Insights 2022.1 Documentation

THE SCIENCE OF WHERE

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Get started

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Basics

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Overview of ArcGIS Insights

ArcGIS Insights is a data analytics workbench that offers spatial and nonspatial analysis capabilities to explore data and deliver powerful results.

Insights is available in three deployment options:

- ArcGIS Insights in ArcGIS Online
- ArcGIS Insights in ArcGIS Enterprise
- ArcGIS Insights desktop

ArcGIS Insights in ArcGIS Online

Insights in ArcGIS Online is a browser-based deployment that is licensed through an ArcGIS Online organization. The Insights in ArcGIS Online deployment allows users to access data from their ArcGIS Online organization and share items with other members of their organization or with the public.

ArcGIS Insights in ArcGIS Enterprise

Insights in ArcGIS Enterprise is a browser-based deployment that is installed and licensed through an ArcGIS Enterprise organization. The Insights in ArcGIS Enterprise deployment includes the same features as Insights in ArcGIS Online, with the added security of hosting your software and data on your own servers, along with access to database connections and a scripting environment.

Use the following resources to set up ArcGIS Insights in ArcGIS Enterprise:

- ArcGIS Enterprise deployment requirements
- Configure ArcGIS Enterprise to support Insights functionality
- Install ArcGIS Insights in ArcGIS Enterprise
- Configure ArcGIS Insights in ArcGIS Enterprise
- Administer ArcGIS Insights in ArcGIS Enterprise

Insights desktop

Insights desktop is installed locally on your Windows or macOS machine. The desktop deployment allows users to take Insights with them and use it without an internet connection. An Insights in ArcGIS Enterprise or Insights in ArcGIS Online account is required to activate Insights desktop.

The following Insights capabilities are only available in Insights desktop when you are connected to the internet and signed in to an Insights in ArcGIS Enterprise or Insights in ArcGIS Online account:

- Sharing pages, models, themes, and workbooks to an organization, groups, or the public.
- Enable location by address using the World Geocoding Service.
- Use Enrich Data.
- Use Buffer/Drive Times with a travel mode.

Feature layers from an ArcGIS organization are available through ArcGIS connections.

The following Insights capabilities are not currently available in Insights desktop:

- Sharing data to an organization, groups, or the public.
- Creating OneDrive and SharePoint connections.

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- Schedule updates to shared pages.

Insights capabilities and deployment options

Most of the capabilities in Insights, such as creating maps, charts, and tables, performing spatial and nonspatial analysis, enabling location, creating relationships, and calculating fields, are available in all Insights deployments. The following capabilities and features are not available in all deployments:

Feature	Insights in ArcGIS Online	Insights in ArcGIS Enterprise	Insights desktop
Create database connections	Not supported	Supported	Supported
Create OneDrive connections	Supported	Supported	Not supported
Create SharePoint connections	Supported	Supported	Not supported
Use the scripting environment	Not supported	Supported	Supported
Share data	Supported	Supported	Not supported
Schedule updates to shared pages	Supported	Supported	Not supported
Save content	Not supported	Not supported	Supported
Access public workbooks, models, datasets, pages, and themes on the home page	Supported	Not supported	Not supported

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Get started

ArcGIS Insights is an analytics workbench that allows you to perform iterative and exploratory data analysis. You can answer questions with data from ArcGIS, Excel spreadsheets, business databases, and more by simply dragging the data to perform analysis.

Get started as an Insights user

If you have an account in an ArcGIS organization and have been granted an Insights license by your administrator, you are ready to start using Insights. As an Insights user, you can access data, perform analysis, and share results.

Start with the basics

Use the following guides to learn the basics of using Insights:

- Sign in to Insights
- Get started with workbooks
- Get started with drag and drop features
- Get started with analysis
- Get started with sharing

Get started as an administrator

Use the following resources to administer your Insights organization:

- Configure ArcGIS Enterprise to support Insights
- Install ArcGIS Insights in ArcGIS Enterprise
- Configure Insights in ArcGIS Enterprise
- Administer Insights in ArcGIS Enterprise

Additional resources

For more information about ArcGIS Insights, see the following:

- What's new
- Frequently asked questions

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Get started with workbooks

Workbooks are used to organize your data and analytical workflows. The following sections give an overview of what you can do with workbooks in Insights.

1. Create a new workbook

When you use Insights, you work in a workbook. A workbook stores connections to your datasets, cards with spatial or nonspatial data, and analysis workflows. Workbooks can be edited, refreshed, and shared with others.

Learn more about workbooks

2. Add data to your page

Adding data is the starting point of any new workbook. Your data can be spatial datasets, nonspatial tables, or a mixture of both. When you open a workbook you can add data from your contents or organization, ArcGIS Living Atlas of the World, files (such as Excel files and shapefiles), and database connections (available in Insights in ArcGIS Enterprise and Insights desktop). Using a combination of spatial and nonspatial data from multiple sources can help you gain a more complete understanding of your data and tell a more interesting story.

Learn more about adding data

3. Create a map card

Spatial data can be displayed as maps in Insights. You can create maps that display multiple datasets, or create multiple maps and do side-by-side comparisons. Using multiple maps and linking the extents is a great way to gain a deeper understanding of your data.

Learn more about creating maps

4. Create a chart card

Charts are a great way to display your data and analyze it nonspatially. Charts are especially helpful when they are paired with a map displaying the same dataset. Both spatial and nonspatial data can be displayed as charts.

Learn more about creating charts

5. Create a summary table

Tables can be used to summarize your categorical data and view statistics such as sum and average. Tables can also be used to group categories, helping you learn even more about your data.

Learn more about creating tables

7. Save the workbook

Once you've created your workbook, you can change the title and save the workbook. The workbook will be available to open at a later date and can also be shared with other members of your organization.

Next steps

Now that you've gathered and implemented the basic components of your workbook, you are ready to perform analysis.

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Get started with drag-and-drop features

Drag-and-drop features in Insights allow you to explore your data and quickly perform common analytical tasks. Use the following sections to get started with the basic drag-and-drop features in Insights.

1. Create new cards

Creating cards is one of the first steps when working in Insights. Have you ever found yourself with a new dataset that you wanted to explore but you didn't know where to start? Try looking for fields that stand out to you and drag them to create a new map, chart, or table. The style of the map or type of chart created will depend on the type of fields you choose, meaning that you always get the optimal display for the data you have.

2. Update cards

Performing quick data visualizations is one of the benefits of Insights. You can drag fields to change the style or add new layers to a map, to add new fields to a chart or table, or to update fields in a chart or table.

3. Perform analysis

Insights makes it possible to perform analysis as it occurs to you. Map cards in Insights include two analysis drop zones for the most popular analysis capabilities: Spatial Aggregation and Spatial Filter. Performing analysis is as easy as dragging a dataset and clicking **Run**.

4. Use selected features

You can create new datasets by dragging selected or filtered data to create a new map. A new result dataset will be created and can be used to make more maps, charts, and tables, or to perform analysis.

Next steps

Use the following resources to learn more:

- Create a map
- Create charts
- Summary tables
- Spatial Aggregation
- Spatial Filter
- Make selections

Meet Drag-N Drop

Drag-N Drop is an expert when it comes to drag-and-drop features in Insights, and she wants to share her knowledge with you! Look for Drag-N Drop throughout the documentation to find tips and tricks on how you can access all of the drag-and-drop features Insights has to offer.

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Get started with analysis

Analysis helps you solve spatial problems and make decisions. Use the following workflow to perform analysis in ArcGIS Insights.

1. Ask and explore

Solving a spatial problem begins with a well-framed question based on your understanding of the problem. Getting the question right is key to deriving meaningful results. Questions that can be answered using spatial analysis include the following:

- How is it distributed?
- How is it related?
- What's nearby?
- How has it changed?

Don't know what questions you want to ask? Not a problem. Insights makes it easy to explore your data so that you can understand patterns and gain insights into your data that will help you ask the questions that matter.

2. Model and compute

ArcGIS Insights offers a suite of analysis capabilities that can be used to manipulate and quantify your data to help you answer your spatial questions. As you perform analysis, your steps are recorded behind the scenes in the Analysis view, making it easy for you to save your model.

3. Examine and interpret

Computers don't perform analysis; people do. Once you have run your analysis and created results, you must examine those results to answer your questions. Have you answered all of your questions? Are there any other questions that you need to ask? As you examine your results, you can interpret what they mean and find your answers.

4. Make decisions

After interpreting the results of the analysis, document your interpretation and decide how to respond. In some cases, you can take action based on your interpretation of the analysis results. You might implement a solution, correct a situation, create an opportunity, or mitigate a circumstance. In other cases, no action is required because your goal was to build knowledge and gain a deeper understanding. Often new questions arise that need to be addressed. These can lead to further analysis.

5. Share results

Once you have answered your question and are satisfied with the analysis, identify the audience that will benefit from your findings and determine who you want to influence. You may want to share your results with other members of your organization or the public. You can communicate your results by sharing pages or creating apps, such as story maps.

Next steps

Now that you have performed your analysis, you are ready to share your work.

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Get started with sharing

Sharing allows you to work collaboratively and communicate your analysis with stakeholders. Use the following sections to get started with sharing content inside and outside your organization.

1. Share your data

Whenever you share content from ArcGIS Insights, you should always start by sharing your data. Sharing your data is a way to give other users access to your results and set up your other content, such as pages and workbooks, to be shared as well. When you share your result datasets from Insights, you create a new feature service that is available to use in Insights or your organization.

2. Share your page

It's easy to share your results with others using shared pages. You can change your map style; create linked maps, charts, and tables; add descriptions; and then share your pages to be viewed by other members of your organization. A shared page can be viewed by all members of your organization, even if they do not have an Insights license. You can also embed the page in a web page or ArcGIS StoryMaps story, where it can be viewed by members of the public.

3. Share your analysis

As you work in Insights, all of the steps in your analysis are recorded in a model. The model can be shared, making it easy to rerun your analysis or give other users access to your workflow. You can add a model to a page and update the datasets being referenced to either rerun the exact analysis, or rerun the analysis with different datasets.

4. Share your workbook

If you want to share your data, pages, and analysis all together, the best way to do it is by sharing your workbook. A shared workbook can be opened in a view-only mode or copied and opened with full editing privileges.

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Sign in to Insights

If you have the proper licences, you can sign in to Insights. Once signed in to Insights, you will have access to data, workbooks, and analytical capabilities that you can use to answer questions and deliver powerful results.

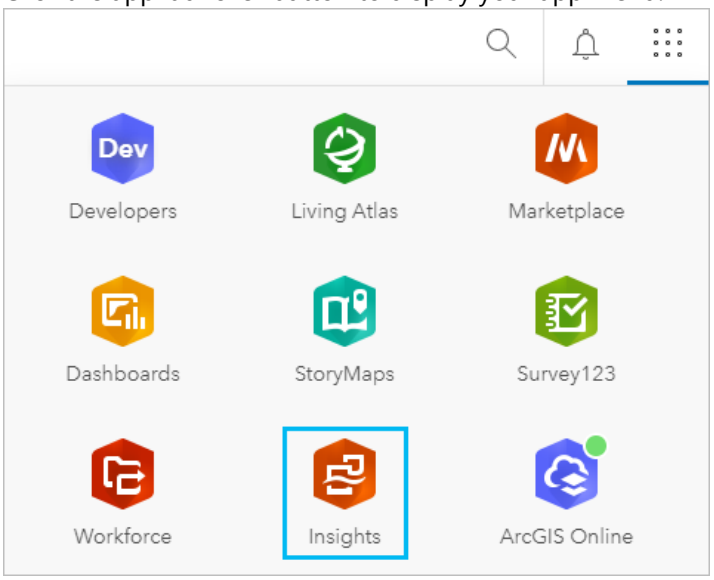
Note:
Insights must be configured and licences granted to access it. For more information on setting up Insights, see the Setup topics.

Sign in to Insights in ArcGIS Enterprise

Insights in ArcGIS Enterprise supports signing in using an ArcGIS account or an Enterprise login.

Complete the following steps to sign in to Insights in ArcGIS Enterprise using an ArcGIS account:

1. Sign in to your Portal for ArcGIS account using your organization's URL (for example, `https://myserver.mycompany.com/portal/home`). If you do not know the URL for your organization, contact your administrator.
2. Click the app launcher button to display your app menu.



3. Click **Insights**.
4. Enter your username and password again, if prompted.

Alternatively, you can sign in directly to Insights in ArcGIS Enterprise by modifying your Portal for ArcGIS URL. For example, `https://myserver.mycompany.com/portal/apps/insights`.

Sign in using Enterprise logins

You can secure your ArcGIS Enterprise portal using Integrated Windows Authentication (IWA), Lightweight Directory Access Protocol (LDAP), public key infrastructure (PKI), or Security Assertion Markup Language (SAML). These authentications will also be used to sign in to Insights in ArcGIS Enterprise.

Complete the following steps to sign in with an account using portal authentication:

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1. Do one of the following:
   - Open the Portal for ArcGIS sign in page using your organization's URL (for example, `https://myserver.mycompany.com/portal/home`).
   - Open the Insights in ArcGIS Enterprise sign in page using your organization's URL (for example, `https://myserver.mycompany.com/portal/apps/insights`).
2. Enter your Enterprise login credentials as follows:
   - For IWA, enter your enterprise account credentials. If you are using a Microsoft Windows computer you may be signed in automatically.
   - For LDAP, enter your username and password, your enterprise account credentials, or select a certificate, depending on your LDAP configuration.
   - For PKI, select a certificate to authenticate your portal, then click **OK**.
   - For SAML enter your enterprise account credentials (for example, Okta or OpenAM).
3. If you signed in to Portal for ArcGIS, open Insights using the app launcher.

Sign out

To sign out of your Insights account, click your profile picture at the top of the page and click **Sign out**. When you are signed out, you will still be able to see some Insights content, such as publicly shared pages. You will be prompted to sign back in to your account if you return to the Insights sign in page or attempt to access an item that is only available in Insights or is not shared publicly.

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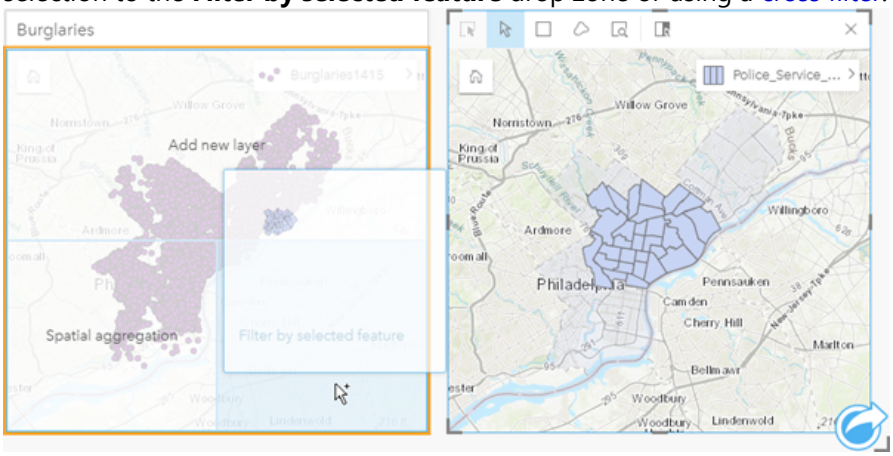
Insightful tips

Using filters

There are several ways to filter your data in Insights, including both attribute and spatial filters. Attribute filters can be found in the data pane and on each map or chart card.

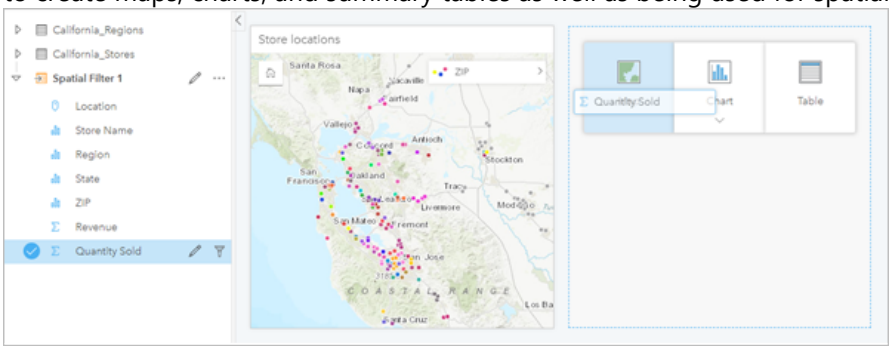
Spatial Filter can be used to filter your data using a spatial relationship with another dataset. Spatial Filter can be accessed using the **Action** button or by dragging a dataset onto a map and dropping it in the **Filter by selected feature** drop zone. You can also filter by a subset of your data by selecting one or more features and dragging the selection to the **Filter by selected feature** drop zone or using a cross filter.



Using result datasets

Result datasets are created when analysis is performed in Insights. Results are temporary datasets signified in the data pane using the **Results** symbol.

You can use result datasets in many of the same ways that you use your original data. Result datasets can be used to create maps, charts, and summary tables as well as being used for spatial and nonspatial analysis.



Boundaries

In Insights in ArcGIS Enterprise, boundaries are datasets provided by Esri and configured by your portal administrator. Boundaries such as world countries, ZIP Codes, and block groups are included.

In Insights in ArcGIS Online, boundaries are specific layers from ArcGIS Living Atlas of the World that include standard geographical districts, such as countries, ZIP Codes, and block groups.

Boundaries are especially useful to use as layers with Spatial Aggregation and Spatial Filter or for geocoding using **Enable location**. You can access these layers using the **Boundaries** tab in the **Add to page** window.

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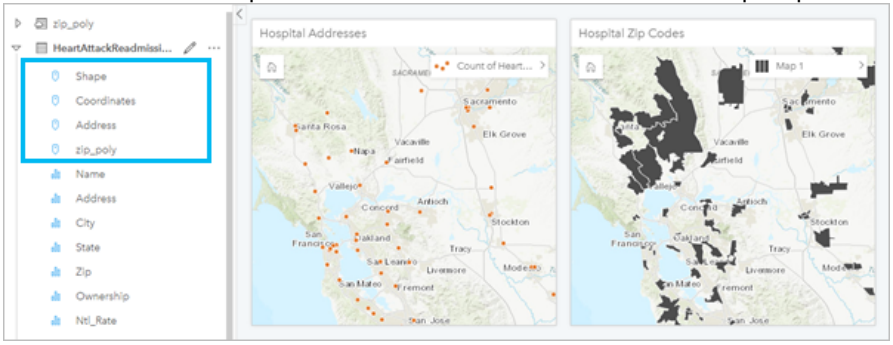
Enabling multiple locations on a dataset

Enable location can be used to geocode datasets using coordinates, addresses, or boundaries. Enabling locations is important in files that do not have a pre-existing location field, but can also be done on datasets that already have a location. For example, a dataset with store locations may also include a field with ZIP Codes. **Enable location** can be used to add a **Geography** location field by matching the ZIP Code field to the ZIP Code boundary layer. The dataset will then have two separate location fields: one will create a map of points, and one will create a map of areas.



Do side-by-side map comparisons

Map cards with several layers can be difficult to work with. Instead, you can create additional maps for side-by-side comparison. This is a departure from traditional GIS that has a single map that holds all of your content.

If you want all of the maps on your page to display the same spatial extent when you zoom and pan, use the **Sync extents** button. It's helpful to have all the maps on your page update to reflect the location and zoom level for your area of interest.

Undo and redo actions

You can improvise your analytics while secure in the knowledge that any action you take in ArcGIS Insights does not change the underlying data and can be undone or redone with the **Undo** and **Redo** buttons at the top of your page.

Note:
If your last action was performed on a previous page and you undo it, the action is undone while your point of focus remains on the current page.

View statistics

Summary statistics are another way to see patterns emerge about the people or objects you measure. For example, if you are viewing pine tree sample data in a map or chart, you may want to see a summary of the numeric values from that field on your map or chart to get a quick view of average height or median age of the trees. The steps vary slightly depending on whether you want to view statistics on a map or chart.

View statistics on a map

A list of statistics is provided on the back of the map card.

1. Click the map to select it.
2. Do one of the following:
   - Click the **Flip card** button to flip the card over and see summary statistics on the back.

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- Click a symbol on the map to view summary information in a pop-up window about a specific feature.

View chart statistics

1. Click the chart that you want to see summary statistics for.
2. Do one of the following:
   - Click the **Chart statistics** button. From **Chart statistics**, check the statistics you want to see on your chart. The chart updates to show the statistics you selected.
   - Click the **Flip card** button to flip the card over and see summary statistics on the back.

Add more data

At any point in your workflow, you can add more datasets to your page with the **Add to page** button above the data pane.

To use data from one page to another, click the dataset from the data pane, and drag the dataset onto the tab of the page you want to use it on. If you haven't created an additional page, you can drag your selected dataset onto the plus-sign (+), and a new page is created and populated with the selected dataset.

Reduce data pane clutter

If you find datasets on your page to be unhelpful to your analysis, remove them from the data pane using the following steps:

1. Click the **Dataset options** button ··· next to the dataset you want to remove.
2. Click **Remove**.
   If there are cards on your page that contain data from the dataset you are about to remove, the following message appears: **Are you sure? You are about to remove <dataset-name> from the page. <#> card(s) will be affected**. If you choose **Yes, Remove**, the dataset and all cards containing data from the dataset are removed.

If your maps or charts are too cluttered with information, target your analysis with filtering. Filtering, along with aggregation, are great ways to step back from your data and see a bigger picture.

Access Esri demographic data

Get access to the latest and most in-depth demographic information for over 100 countries with Enrich Data.

Rename fields or datasets

Sometimes field names or dataset names don't seem to make sense. For example, a field named m_sl contains median sales data. Others who have access to your workbook or presentation may not understand the field name and how it relates to the maps and charts in which it's included.

You can rename the field or dataset with a new alias from the data pane. Renaming a field or dataset does not change the name in the underlying data, only how that field name appears in ArcGIS Insights.

Using the Find answers tab

The **Find answers** tab is a great resource if you are trying to answer a question but do not know which capabilities to use. Similar capabilities are grouped based on which type of question they can answer, making it easy to find the

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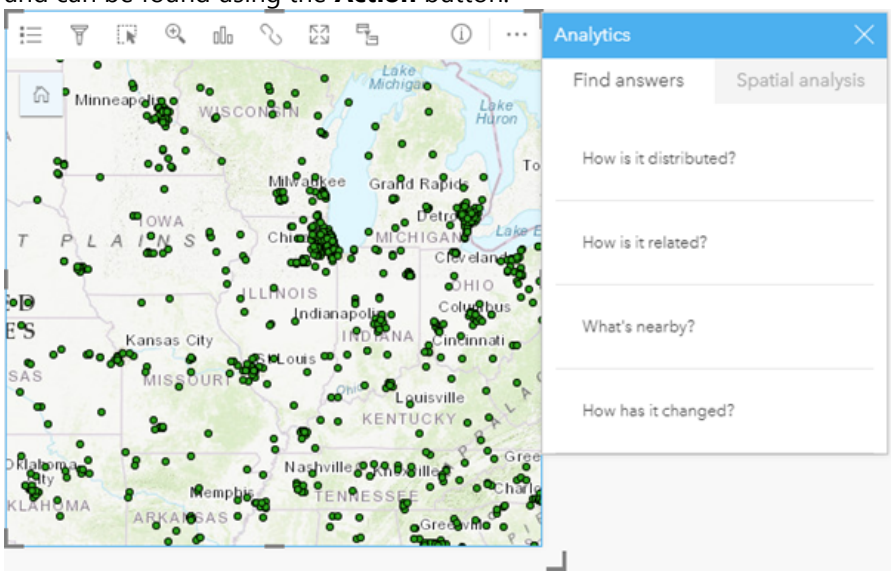
right capability for your analysis. The **Find answers** tab includes both spatial and non-spatial analysis capabilities and can be found using the **Action** button.



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Setup

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ArcGIS Enterprise deployment requirements

A base ArcGIS Enterprise deployment is required to support Insights in ArcGIS Enterprise. The deployment must be licensed with ArcGIS Server Standard, ArcGIS Server Advanced, ArcGIS Server Workgroup Standard, or ArcGIS Server Workgroup Advanced.

Before you set up your ArcGIS Enterprise deployment, check Compatibility with ArcGIS Enterprise to verify supported Insights in ArcGIS Enterprise versions and their compatibility with ArcGIS Enterprise.

Note:
If ArcGIS Web Adaptor for ArcGIS Server is not configured to enable administrative access, ArcGIS Server must be configured to use a CA-signed certificate to support creating database connections.

Some organizations may require a CA-signed SSL certificate for ArcGIS Data Store.

Next steps

After ArcGIS Enterprise is deployed, the next step is to configure the deployment. For more information, see Configure ArcGIS Enterprise to support Insights functionality.

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Configure ArcGIS Enterprise to support Insights functionality

After ArcGIS Enterprise is deployed, you can begin to configure the deployment to support the functionality in Insights. These configuration settings allow Insights users to connect to data warehouses, geocode data, and access all of the analysis capabilities Insights offers.

Configure utility services

Configure utility services required to enable specific functionality in your portal, such as performing analysis that depends on utility services. The table below lists each utility service and the Insights feature it supports.

Option	Description
Geocoding	Allows users to add location to their datasets by specifying an address. For user instructions, see Enable location for your data.
Geometry	Enables the use of dissolved boundaries for Buffer/Drive Times.
Routing	Enables Find Nearest.
GeoEnrichment	Allows users to add demographic information to a location or area using Enrich Data.
Configure travel modes	Allows users to specify a means of transportation, such as walking time or trucking distance, for Buffer/Drive Times.

Note:

- You can configure your portal to use utility services from ArcGIS Online.
- If you are running Insights in a disconnected environment, you must configure the service from a federated or hosting server.

Scheduling

Scheduling is enabled in ArcGIS Enterprise and allows you to schedule updates for Insights reports.

All ArcGIS Enterprise organizations are configured to allow 20 active schedules. All schedule types (Insights reports, ArcGIS Notebooks, and so on) count toward the total.

Configure boundary layers

Configure boundary layers to allow organization members to use feature layers containing boundary information for supported countries in their maps and analyses.

When you configure boundary layers, users can add these layers from the **Boundaries** tab of the **Add to page** window. Boundary layers are another way for users to add location to their data. For user instructions, see the following:

- Add data
- Enable locations for your data

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Configure ArcGIS Living Atlas content

Configure subscriber and premium content from ArcGIS Living Atlas of the World to make this ArcGIS Online collection available in your portal. ArcGIS Living Atlas content that does not require you to sign in to an ArcGIS Online account is available by default.

Batch geocoding

The geocoder in your organization must support batch geocoding to be used to enable location on multiple addresses.

Next steps

After ArcGIS Enterprise is deployed and configured, the next step is to install Insights in ArcGIS Enterprise. For instructions, see Install ArcGIS Insights in ArcGIS Enterprise.

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Install Insights in ArcGIS Enterprise

To install and configure ArcGIS Insights in ArcGIS Enterprise, you need to have elevated privileges in a deployment environment.

At a minimum, to run the installation, you must have installed Portal for ArcGIS and ArcGIS Server, either on the same machine or separately in a distributed environment. A full base ArcGIS Enterprise deployment is required to use Insights in ArcGIS Enterprise.

The setup program detects whether Portal for ArcGIS or ArcGIS Server is installed on your machine and then installs the appropriate Insights feature. On a single-machine deployment, you only need to run the setup once. If your Portal for ArcGIS is configured as highly available, you need to run the setup program on both portal machines. If your ArcGIS Server site is a multimachine site, you need to run the setup program on all of the machines in the ArcGIS Server site.

If neither Portal for ArcGIS nor ArcGIS Server is detected, the program closes.

Windows

Use the following sections to download, install, and uninstall on Windows:

- Download the installation package
- Run the installation program
- Uninstall Insights in ArcGIS Enterprise

Download the installation package

The Insights in ArcGIS Enterprise installation program has two installation features:

- Insights client application on Portal for ArcGIS
- ArcGIS Server component of Insights

Complete the following steps to download the installation package for Windows:

1. Sign in to the My Esri site with your Esri account that is associated with your customer number.
2. Go to **My Organization** and click **Downloads**.
   All the software downloads that are available to you (based on your customer number) are displayed.
3. Locate ArcGIS Insights among the products.
   The latest version of the software is selected by default. See Compatibility with ArcGIS Enterprise to confirm which versions are compatible with your deployment.
4. Change the version number, if necessary, and click **View Downloads**.
5. On the **Download** dialog box, review the information for the version and language. Change the download language, if necessary.
6. On the **Download Components** tab, under the **Product Components** menu, locate **ArcGIS Insights (Windows)**.
7. Click **Download**.
   The installation package is downloaded and saved to your browser's default folder (for example, Downloads).

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To view the help documentation in a supported language other than English, you need to download and install the language pack.

You are now ready to run the installation program.

Run the installation program

Note:
SharePoint, OneDrive, and Jupyter Kernel Gateway connections are enabled by default. You can disable these connections for your organization during the installation process.

You are enrolled in the Esri User Experience Improvement Program by default when you install Insights. You can opt out of the program during the installation.

Complete the following steps to run the installation program on Windows:

1. Browse to the location of the downloaded installation file, and double-click the `setup.exe` file.
2. During the installation, read the license agreement and accept it, or close it if you do not agree with the terms.
3. Optional: On the **Security Settings** dialog, uncheck the boxes to disable SharePoint, OneDrive, and Jupyter Kernel Gateway connections if it's necessary to disable these connections for your organization.
4. Optional: In the **Ready to Install the Program** dialog, uncheck **Click here to participate in the Esri User Experience Improvement Program. (Recommended)** to opt-out of the Esri User Experience Improvement Program. Enrollment in the program is recommended to help improve the user experience.
5. Click **Install**.
   The installation program detects the ArcGIS Enterprise component on your machine—Portal for ArcGIS, ArcGIS Server, or both—and installs the appropriate features.

   Note:
   Portal for ArcGIS and ArcGIS Server will restart automatically as part of the installation process.

If you're working in a distributed environment, repeat the installation until the client is installed on your portal machine (or two machines in a high-availability deployment), and the server component (containing Insights services) is installed on each ArcGIS Server machine in your ArcGIS Server site.

Note:
It is important to run the installation steps on both the portal and server machines when using a distributed environment. If the installations are not run on all machines, Insights will not be installed properly.

The default installation directories are the following:

- `C:\Program Files\ArcGIS\Portal\apps` for the portal client application
- `C:\Program Files\ArcGIS\Server` for the server component

Uninstall Insights in ArcGIS Enterprise

Complete the following steps to uninstall Insights from Windows:

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1. Open **Control Panel** and click **Programs and Features**.
2. From the **Programs** list, choose the Insights in ArcGIS Enterprise version you have installed on your machine.
3. Select **Uninstall/Change** to uninstall Insights in ArcGIS Enterprise.

   Note:
   Portal for ArcGIS and ArcGIS Server will restart automatically as part of the uninstall process.

4. If you are working in a distributed environment, repeat the uninstallation steps on all Portal for ArcGIS and ArcGIS Server machines.

Linux

Use the following sections to download, install, and uninstall on Linux:

- Download the installation package
- Run the installation program
- Uninstall Insights in ArcGIS Enterprise

Download the installation package

The installation package contains the following key files:

- `Insights-<version-number>.portal.tgz`—The Insights web client for your portal
- `Insights-<version-number>.server.tgz`—The required Insights services for your ArcGIS Server site
- `Insights-Setup.sh`—The shell script that runs a silent installation of the web client and services listed above

1. Sign in to the My Esri site with your Esri account that is associated with your customer number.
2. Go to **My Organization** and click **Downloads**.
   All the software downloads that are available to you (based on your customer number) are displayed.
3. Locate ArcGIS Insights among the products.
   The latest version of the software is selected by default. See Compatibility with ArcGIS Enterprise to confirm which versions are compatible with your deployment.
4. Change the version number, if necessary, and click **View Downloads**.
5. On the **Download** dialog box, review the information for the version and language. Change the download language, if necessary.
6. On the **Download Components** tab, under the **Product Components** menu, locate **ArcGIS Insights (Linux)**.
7. Click **Download**.
   The installation package is downloaded and saved to your browser's default folder (for example, Downloads).

To view the help documentation in a supported language other than English, you need to download and install the language pack.

You are now ready to run the installation program.

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Run the installation program

Note:
SharePoint, OneDrive, and Jupyter Kernel Gateway connections are enabled by default. You can disable these connections for your organization during the installation process.

You are enrolled in the Esri User Experience Improvement Program by default when you install Insights. You can opt out of the program during the installation or by updating the settings file after the installation is complete.

Complete the following steps to run the installation program on Linux:

1. Sign in to your machine as a user with administrative privileges.

   Note:
   Installing Insights as a root user is not supported.

2. Use the syntax `./Insights-Setup.sh` to run the default installation. You can also append the following syntax options to customize your installation:
   - `./Insights-Setup.sh -h` — View the options available in the installation. This command will not run the installation program.
   - `./Insights-Setup.sh -e no` (short format) or `./Insights-Setup.sh --esri-user-experience-improvement no` (long format) — Opt out of the Esri User Experience Improvement Program. Enrollment in the program is recommended to help improve the user experience.
   - `./Insights-Setup.sh --SharePoint no` — Disable Microsoft SharePoint connections, if it's necessary for your organization.
   - `./Insights-Setup.sh --OneDrive no` — Disable Microsoft OneDrive connections, if it's necessary for your organization.
   - `./Insights-Setup.sh --KernelGateway no` — Disable Jupyter Kernel Gateway connections, if it's necessary for your organization.

   You can append multiple settings to the default installation. For example, to opt out of the Esri User Experience Improvement Program and disable SharePoint connections, use the following syntax: `./Insights-Setup.sh -e no --SharePoint no`

   Note:
   Portal for ArcGIS and ArcGIS Server will restart automatically as part of the installation process.

If you're working in a distributed environment, repeat the installation until the client is installed on your portal machine (or two machines in a high-availability deployment), and the server component (containing Insights services) is installed on each ArcGIS Server machine in your ArcGIS Server site.

Note:
It is important to run the installation steps on both the portal and server machines when using a distributed environment. If the installations are not run on all machines, Insights will not be installed properly.

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Uninstall Insights in ArcGIS Enterprise

To uninstall Insights, run the following scripts from the command line:

```
$ ./{HOME}/arcgis/portal/uninstall_Insights.sh
$ ./{HOME}/arcgis/server/uninstall_Insights.sh
```

If you are working in a distributed environment, run the uninstallation scripts on all Portal for ArcGIS and ArcGIS Server machines.

When Insights has been successfully uninstalled, you are asked to restart Portal for ArcGIS by running the following script: `$ ./{HOME}/arcgis/portal/startportal.sh`

Upgrade Insights in ArcGIS Enterprise

If you have an earlier version of Insights in ArcGIS Enterprise installed and want to upgrade to the current version, you are not required to uninstall the previous version. Running the ArcGIS Insights installer upgrades the software to the current version. See the detailed steps for more information on installing Insights on Windows and Linux.

If you are upgrading both ArcGIS Enterprise and Insights, it is best practice to complete the ArcGIS Enterprise upgrade first, including the postupgrade steps, before upgrading Insights.

For more information on which Insights versions are supported by your ArcGIS Enterprise deployment, see Compatibility with ArcGIS Enterprise. You may also want to verify the supported database versions.

Upgrade ArcGIS Enterprise 10.7 or earlier

Note:
The following steps are not required to upgrade Insights in ArcGIS Enterprise 2020.2 or higher to Insights in ArcGIS Enterprise 2021.1 or higher. You can upgrade ArcGIS Enterprise 10.7.1 and higher without uninstalling Insights in ArcGIS Enterprise first. Check Compatibility with ArcGIS Enterprise to determine if Insights in ArcGIS Enterprise must also be upgraded.

If you are upgrading ArcGIS Enterprise 10.7 or earlier, you are required to uninstall Insights before completing the upgrade. Complete the following steps to upgrade both Insights and ArcGIS Enterprise:

1. Upgrading ArcGIS Enterprise may require upgrading Insights to a compatible version. Check the compatibility between Insights and ArcGIS Enterprise. You may also want to verify the supported database versions.
2. Uninstall Insights in ArcGIS Enterprise from your Windows or Linux machine.
3. Upgrade ArcGIS Enterprise to the new version, including the postupgrade steps.
4. Install Insights in ArcGIS Enterprise on your Windows or Linux machine (either the same version or the new version).

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Note:
If you are upgrading to ArcGIS Enterprise 10.7 or later from 10.6.1 or earlier, members of your organization may be automatically updated to a compatible user type, or your organization may be licensed for more than one user type for each level. If your organization is licensed for more than one user type, the administrator of the organization must apply the correct user types to each member before they can access Insights. Insights users can have the Creator, GIS Professional, or Insights Analyst user type.

Uninstalling Insights in ArcGIS Enterprise does not affect your saved Insights items, such as workbooks, pages, and database connections.

Allow OS authentication for database connections

Note:
These additional steps are required if you are updating Insights from version 2020.1 or earlier to version 2020.2 or later.

To create database connections using OS authentication if you have an existing Insights in ArcGIS Enterprise installation, complete the following steps after upgrading Insights:

1. Remove the existing SQL Server connector.
2. Restart ArcGIS Server.
3. Add the SQL Server connector.
4. Restart ArcGIS Server.

Once Insights is upgraded and SQL Server is re-registered, the domain administrator must enable OS authentication.

Next steps

After Insights in ArcGIS Enterprise is installed, the next step is to assign the required user types, privileges, and licences to Insights users in your organization. For more information, see Administer Insights in ArcGIS Enterprise.

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Home page

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Home page

The ArcGIS Insights home page can be used to create and manage content, open existing content, and manage your account. The home page is displayed when you sign in to Insights or if you click the **Home** button .

The following tabs are available on the home page:

- **Home**
- **Workbooks**
- **Models**
- **Datasets**
- **Connections**
- **Pages**
- **Themes**
- **Settings**

All of the tabs, except for the **Home** and **Settings** tabs, allow you to create folders and manage items.

Organization members with viewer privileges can also access shared workbooks and pages.

Home

The **Home** tab provides an overview of the items and features that are important to you, as well as statistics on your recent Insights usage. The **Recent workbooks** section lists the most recently created or updated workbooks that you own, giving you quick access to the workbooks that are most relevant to you. The **Favorites** section lists items from your favorites list. All item types, including workbooks, datasets, pages, and themes, can be added to the favorites list using the **Favorite** button ☆. The **Pulse** section displays charts with statistics, such as the number of items you have created or shared recently. The **What's new** section gives an overview of the new and updated features in the current Insights release. More detailed information can be found in What's new.

Workbooks

A workbook is a collection of data, cards, results, and other processes that are performed during analysis. The **Workbooks** tab allows you to open a workbook, import or export a workbook package, or manage existing workbooks.

Hovering over a workbook will give you options to manage your workbook.

Models

Insights model and script items appear in the **Models** tab.

A model is a record of the processes used on an Insights page. Models are created and updated automatically when you perform any analysis or data manipulation actions in an Insights workbook. A model must be shared for the item to appear in the **Models** tab.

A script must be shared to appear in the **Models** tab.

Clicking an item name will open a new workbook and the **Add to page** window with the item selected. One or more datasets should also be added to run the model.

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Datasets

The **Datasets** tab can be used to create, manage, and export datasets that are saved in your organization as feature layer items.

A dataset can be opened in a new workbook by clicking the dataset name.

Connections

The **Connections** tab can be used to create and edit the following connection types:

- Relational database connections
- Microsoft OneDrive connections
- Microsoft SharePoint connections
- Jupyter Kernel Gateway connections

Click the item name to edit the connection settings.

Pages

The **Pages** tab can be used to manage and view shared page items. A page item is a snapshot of the cards that were on an Insights page at the time it was shared. Only shared pages will be saved as items and available from the **Pages** tab.

A page can be opened in the Page Viewer by clicking the page name.

Themes

The **Themes** tab can be used to manage and open shared theme items. A theme saves page settings, including card placement, colors, and fonts, and allows you to apply the settings to other pages. A theme has to be shared for an item to be created.

Clicking a theme name will open a new workbook and the **Add to page** window with the theme selected.

Settings

The **Settings** tab can be used to view and update your profile or manage connector types (available for administrators).

Finding items

Items, such as workbooks, pages, and themes, can be stored in folders and subfolders, added to a favorites list, or shared. Each of these processes affects how items can be found on the tabs on the home page.

Use the following methods to find items:

- Browse through folders and subfolders by clicking the folder cards.
- Search for the item with the search bar.
- Use the filter button to filter the items by owner, date modified, and tags.
- Use the **Favorites** button ★ to view only items on the favorites list.
- Use the **View items** button to show all items from your organization, items created by you, or items shared with you.
- Use the **Sort** button to sort the items alphabetically or by age.

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- Use the **List view** button and **Tile view** button to change how the items are displayed.

Insights viewer home page

The home page for organization members with viewer privileges includes the **Home**, **Workbooks**, **Pages**, and **Settings** tabs.

The **Home** tab provides an overview of the items and features that are important to you, as well as statistics on your recent Insights usage. The **Recent workbooks** section lists the most recently created or updated workbooks that were shared with you, giving you quick access to the workbooks that are most relevant to you. The **Favorites** section shows items that were added to the favorites list using the **Favorite** button. The **Pulse** section displays charts with statistics, such as the number of items you have viewed recently.

The **Workbooks** tab includes the workbooks that were shared with you by other members of your organization. Click on the workbook title to open the workbook in viewer mode.

The **Pages** tab includes the pages that were shared with you by other members of your organization. Click on the page title to open the page in viewer mode.

The **Settings** tab can be used to view and update your profile.

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Create datasets

One of the data sources that can be used in Insights is feature layer items. Feature layers can be created by importing a dataset in Insights, publishing a dataset from ArcGIS Pro, publishing a dataset in your organization, or sharing a dataset from Insights. All feature layer items that you create or that are shared with you will be available to use in Insights, regardless of how they are created.

Feature layers can be accessed from the **Datasets** tab on the home page or added to a workbook from the **Content**, **Groups**, or **Organization** tabs of the **Add to page** window.

Import a file

You can import data from the following sources in Insights:

- Microsoft Excel workbook (`.xlsx`)
- Comma-separated values (CSV) file (`.csv`)
- GeoJSON file (`.json`, `.geojson`, or `.zip`)
- File geodatabase (in a `.zip` file)
- Shapefile (in a `.zip` file)

Use the following steps to create a dataset by importing a file:

1. If a workbook is open in Insights, save your work and click the **Home** button to return to the home page. If you are signing in to or launching Insights, you will be brought to the home page automatically.
2. Click the **Datasets** tab.
3. Click **New dataset**.
   The **New dataset** window appears.
4. Do one of the following:
   - Click **Browse** and open the file you want to use to create a dataset.
   - Drag a file to the **New dataset** window.
5. For files with a `.zip` extension (shapefiles, file geodatabases, and some GeoJSON files), set the **Type** parameter to the correct data format. You can also update the name, tags, and summary for the dataset. Click **Add**.

Note:
Excel files, CSV files, and GeoJSON files (`.json` and `.geojson`) will begin loading automatically once added to the **New dataset** window.

The dataset is added as a feature layer item. You can now move the dataset to a folder, share the dataset, or manage the item details.

Publish from ArcGIS Pro or ArcMap

You can publish a feature layer from ArcGIS Pro or ArcMap to be hosted in your ArcGIS organization. When you publish a hosted feature layer, data is copied from your data source to your organization. The published hosted feature layer references the data in your organization, not the data source.

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An Internet connection is required to publish from ArcGIS Pro or ArcMap to your organization. The speed and bandwidth of your connection affect the time it takes to publish the feature layer.

Follow the steps in the ArcGIS Pro help or ArcMap help to publish a hosted feature layer from these applications.

For more information on hosted feature layers, see Feature layers.

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Create a database connection

A database connection allows you to work with database tables directly in Insights. Database connections can be created to supported databases and additional relational databases that use a Java Database Connectivity (JDBC) driver.

Before you create a database connection, the following prerequisites must be met:

- The appropriate connector must be added before you can create a database connection. For more information, see Required vendor files and Manage connector types.
- You must have the appropriate privileges to the database you want to connect to. If you do not have database privileges, contact the database administrator.
- You must be able to authenticate the connection. For most databases, a username and password are used for authentication. SQL Server and BigQuery use the following alternate authentication methods:
  - SQL Server can use either SQL Server authentication (username and password) or OS authentication. For more information, see Enable OS authentication.
  - BigQuery uses service account authentication. For more information, see Create a service account and private key (https://links.esri.com/create-service-account-private-key).

Create database connections

Database connections are saved as relational database connection items. You can view relational database connection items from the **Connections** tab on the home page or in your ArcGIS Enterprise portal. Connections can be created from the home page or before you add data to your workbook.

Create a connection from the home page

Complete the following steps to create a database connection from the home page:

1. Click the **Connections** tab .
2. Click **New connection** and choose **Database** from the menu.
   The **New connection** window appears.
3. Choose the database type you want to connect to. Only database types available to your organization are listed. For more information, see Manage connector types.
4. Provide the connection properties for your database. Required fields are marked with an asterisk (*).
5. Click **Add**.
   Insights uses the connection properties to try to connect to the database. Once successful, the connection appears on the **Connections** page.

   If Insights can't connect to the database, an error message appears. See Troubleshoot a database connection for more information about the reasons a connection cannot be established.

Each relational database item has a corresponding relational catalog service that resides in the Hosted folder on your portal's hosting server. The service can be updated from the **Connections** tab on the home page. For more information, see Update a database connection.

As the owner of the database connection in Insights in ArcGIS Enterprise, you can share the item with team members so that they can use the data from the database connection in their analysis.

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Create a connection from the Add to page window

Complete the following steps to create a database connection from the **Add to page** window before you add data to your workbook:

1. Open the **Add to page** window using one of the following options:
   - Create a workbook. The **Add to page** window appears when the workbook is created.
   - Click the **Add to page** button above the data pane in an existing workbook.
   - Create a page in an existing workbook. The **Add to page** window appears when the page is created.
2. In the **Add to page** window, choose **Database**.
3. Click **New connection**.
4. Provide the connection properties for your database. Required fields are marked with an asterisk (*).
5. Click **OK**.
   Insights uses the connection properties to try to connect to the database. If connecting to the database is possible, the connection is created, and datasets from the database are listed in the middle pane. You can choose datasets from your new connection to add to your workbook page.

Each relational database item has a corresponding relational catalog service that resides in the Hosted folder on your portal's hosting server. The service can be updated from the **Connections** tab on the home page. For more information, see Update a database connection.

As the owner of the database connection in Insights in ArcGIS Enterprise, you can share the item with team members so that they can use the data from the database connection in their analysis.

Connection properties

Database connections include both required and optional properties. Required properties are marked in the **New connection** window using an asterisk (*).

The following table describes properties that are used for at least one supported database type.

Note:
The properties for connections to additional databases that are not on the list of supported databases are configured in the YAML files (`properties.yml`) used to add the connector type. Therefore, the properties in the **New connection** window for additional databases may not correspond to the properties in this table.

Property	Description	Databases
Name	The alias that will be assigned to the database connection. The **Name** property does not have to correspond to the database name.	Required for all databases.
Type	The database type, for example, Oracle or SQL Server. Only connectors that are available for your organization are listed. For more information, see Manage connector types.	Required for all databases.
Default spatial type	The spatial type used when a location field is added to a database dataset using enable location.	Required for Oracle and PostgreSQL.

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Property	Description	Databases
Connection method	The method for connecting to an Oracle database. The **Connection method** can be **Basic** or **TNS**. The basic method creates a connection using a server name, instance name, and port number. The TNS method creates a connection using a TNS file path and alias.	Required for Oracle.
Server name	The database host name.	Required for Oracle databases using the basic connection method, PostgreSQL, SAP HANA, and SQL Server databases using SQL Server authentication.
Server name (Fully qualified domain name)	The fully qualified domain name from the ArcGIS Server machine for your organization.	Required for SQL Server databases using OS (Windows) authentication.
Instance name	The instance of the database you are connecting to.	Required for Oracle databases using the basic connection method. Optional for SQL Server.
TNS file path	The path where the TNS file is saved on your computer (for example, `C:\oracle\network\admin`). The path does not include the TNS file name (`tnsnames.ora`).	Required for Oracle databases using the TNS connection method.
TNS alias	The alias in the TNS file that defines the database to which you are connecting.	Required for Oracle databases using the TNS connection method.
Port number	The port number for the database you are connecting to.	Required for SAP HANA. Optional for Oracle databases using the basic connection method, PostgreSQL, and SQL Server.
Authentication method	The method of verifying the database connection. The **Authentication method** can be either SQL Server or Windows.	Required for SQL Server.
Project	The project where your BigQuery dataset is stored.	Required for BigQuery.
Account name	The name of the account where the database is saved.	Required for Snowflake.
Domain or username	The domain name or username you are using to authenticate the database connection. For SQL Server connections using Windows authentication, use a domain name. For all other databases and authentication methods, use a username.	Required for Oracle, PostgreSQL, SAP HANA, Snowflake, and SQL Server.
Password	The password that corresponds to the username you are using.	Required for Oracle, PostgreSQL, SAP HANA, Snowflake, and SQL Server databases using SQL Server authentication.

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Property	Description	Databases
Service account email	The email address connected to your Google service account (see https://links.esri.com/create-service-account-private-key).	Required for BigQuery.
Private key	The private key for your Google service account (see https://links.esri.com/create-service-account-private-key).	Required for BigQuery.
Connect using SSL	Enable connecting to a SAP HANA database using Secure Sockets Layer (SSL).	Optional for SAP HANA.
Database name	The name of the database you are connecting to.	Required for SQL Server, PostgreSQL, and Snowflake. Optional for SAP HANA.
Warehouse name	The name of the warehouse you are connecting to.	Required for Snowflake.
Schema name or **Dataset name**	The default schema (Snowflake) or dataset (BigQuery) for the database connection. This schema or dataset is used to store temporary tables created during analysis workflows for read-write connections. If no schema or dataset is selected, or if the user does not have read-write permissions on the schema or dataset, then the database connection will be read-only.	Optional for Snowflake and BigQuery.

Index columns

Insights will create an index on database tables for certain functions using Oracle, SQL Server, or PostgreSQL databases to improve performance. For Oracle and SQL Server databases, indexing can only take place if the user who creates the database connection has the required database privileges. Once the connection is created, indexes will be created on the database tables regardless of who is using them in Insights.

If the user who creates the database connection does not have the necessary privileges, indexing will not take place on the database tables.

The following table describes how indexing will be performed for each database type and the privileges required to create a connection where indexing takes place:

Database	Description	Index type	Required privileges
SAP HANA	Indexing is not completed in Insights for SAP HANA databases.	Not applicable	Not applicable
Oracle	Indexing occurs in the following situations: • A field is calculated on the dataset. • A relationship is created with the dataset. • Enrich Data is used on the dataset. • Location is enabled on the dataset, including through results from spatial analysis. • The data is projected to a different geographic coordinate system. Data will be projected if the coordinate system of the dataset does not match the coordinate system of the basemap.	Nonunique	Connect to and browse contents with data caching. One of the following: • The user is the owner of the table. • The owner of the table granted the CREATE INDEX ON <table name> privilege to the user.

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Database	Description	Index type	Required privileges
SQL Server	Indexing occurs in the following situations: • A filter is applied to the dataset. • A relationship is created with the dataset. • Enrich Data is used on the dataset. • Location is enabled on the dataset, including through results from spatial analysis.	Nonunique	Connect to and browse contents with data caching.
PostgreSQL	Indexing occurs in the following situations: • A filter is applied to the dataset. • A relationship is created with the dataset. • A time series graph is created.	Nonunique	Connect to and browse contents with data caching.
Snowflake	Indexing is not completed in Insights for Snowflake databases.	Not applicable	Not applicable
BigQuery	Indexing is not completed in Insights for BigQuery databases.	Not applicable	Not applicable

Spatial types

The default spatial type is used to determine what spatial type will be used when a location field is added to a database dataset using enable location. The following table describes the default spatial types that are available for each database type:

Database	Supported default spatial types
SAP HANA	• ST_Geometry
Oracle	• Oracle Spatial • Esri Geodatabase
SQL Server	• Geometry
PostgreSQL	• PostGIS Geometry • Esri Geodatabase • None
Snowflake	• Geography
BigQuery	• Geography

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Note:
SDELOB spatial types are not supported.

Next steps

Now that you've created a database connection, you're ready to share the connection with your organization or add data to a workbook.

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Create a OneDrive connection

Note:
The OneDrive connector can be disabled for an Insights in ArcGIS Enterprise organization during the installation process. Contact your administrator if the OneDrive connector is not available. For more information, see Install Insights in ArcGIS Enterprise.

Microsoft OneDrive can be used to store and access your datasets across devices. Microsoft 365 users can create a connection to OneDrive to access your data directly in Insights.

Note:
Insights does not support connections to personal OneDrive accounts. Only OneDrive accounts through Microsoft 365 (OneDrive for Business) are supported. You can access datasets from a personal OneDrive connection using the **Upload file** tab in the Add to page window and browsing to the files through the file explorer.

OneDrive accounts are specific to each individual user. Therefore, OneDrive connections cannot be shared.

The following data sources can be accessed through a connection to OneDrive:

- Microsoft Excel workbooks (`.xlsx`)
- Comma-separated values files (`.csv`)
- Shapefiles (`.zip`)
- GeoJSON files (`.json`, `.geojson`, or GeoJSON in a `.zip` file)

Create a OneDrive connection

Before you can create a connection to OneDrive, your Microsoft 365 administrator must register Insights with Microsoft Azure. Once Insights is registered in Azure, you can create connections to both OneDrive and Microsoft SharePoint.

For information on how to register Insights with Azure, see the Insights connector guide (https://links.esri.com/register-insights-azure).

OneDrive connections can be created from the home page or the **Add to page** window within a workbook.

Home page

Complete the following steps to create a OneDrive connection from the home page:

1. Click the **Connections** tab.
2. Click **New connection** and choose **OneDrive** from the menu.
   The **New connection** window appears.
3. Provide the following required connection properties:
   - **Name**—The alias that will be assigned to the OneDrive connection.
   - **Client ID**—The ID of your OneDrive app in Azure. To find the ID in Azure, browse to **App registrations**, select your OneDrive app, and click **Application (client) ID**.

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- **Organization name**—The name of your organization. You can find the organization name in Azure using your sign in information.

4. Click **Add**.
   Insights uses the connection properties to connect to OneDrive. Once successful, the connection appears on the **Connections** page.

Workbook

Complete the following steps to create a OneDrive connection from the **Add to page** window:

1. Open the **Add to page** window using one of the following options:
   - Create a workbook. The **Add to page** window appears when the workbook is created.
   - Click the **Add to page** button above the data pane in an existing workbook.
   - Create a page in an existing workbook. The **Add to page** window appears when the page is created.
2. In the **Add to page** window, choose **OneDrive**.
3. Click **New connection**.
4. Provide the following required connection properties:
   - **Name**—The alias that will be assigned to the OneDrive connection.
   - **Client ID**—The ID of your OneDrive app in Azure. To find the ID in Azure, browse to **App registrations**, select your OneDrive app, and click **Application (client) ID**.
   - **Organization name**—The name of your organization. You can find the organization name in Azure using your sign in information.
5. Click **OK**.
   Insights uses the connection properties to connect to OneDrive. Once successful, the datasets from the connection are listed in the middle pane. You can choose datasets from your new connection to add to your workbook page.

Edit a OneDrive connection

Complete the following steps to edit a OneDrive connection:

1. On the home page, click the **Connections** tab.
2. Click the name of the OneDrive connection to be edited.
3. To change the name of the OneDrive connection, edit the **Name** parameter.
   The name can also be changed using the **Rename** button.
4. Optionally, change the **Client ID** and **Organization name** parameters.
5. Click **OK** to apply the changes.

Troubleshoot a OneDrive connection

OneDrive connections will fail in browsers using Incognito mode if cookies and pop-ups are disabled. You can fix this error by enabling cookies and pop-ups in your browser.

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Create a SharePoint connection

Note:
The SharePoint connector can be disabled for an Insights in ArcGIS Enterprise organization during the installation process. Contact your administrator if the SharePoint connector is not available. For more information, see Install Insights in ArcGIS Enterprise.

Microsoft SharePoint can be used to store and share datasets in your organization. Microsoft 365 users can create a connection to SharePoint to access your data directly in Insights.

The following data sources can be accessed through a connection to SharePoint:

- Microsoft Excel workbooks (`.xlsx`)
- Comma-separated values files (`.csv`)
- Shapefiles (`.zip`)
- GeoJSON files (`.json`, `.geojson`, or GeoJSON in a `.zip` file)
- SharePoint subsite
- SharePoint document library
- SharePoint list

Note:
Data from a SharePoint connection is copied when added to a workbook. Therefore, updates to the source data will not be reflected in Insights. If an update has occurred in the data, you can add the updated dataset to the workbook and rerun the model.

Create a SharePoint connection

Before you can create a connection to SharePoint, your Microsoft 365 administrator must register Insights with Microsoft Azure. Once Insights is registered in Azure you can create connections to both SharePoint and Microsoft OneDrive.

For information on how to register Insights with Azure, see the Insights connector guide (https://links.esri.com/register-insights-azure).

SharePoint connections can be created from the home page or the **Add to page** window within a workbook.

Home page

Complete the following steps to create a SharePoint connection from the home page:

1. Click the **Connections** tab .
2. Click **New connection** and choose **SharePoint** from the menu.
   The **New connection** window appears.
3. Provide the following required connection properties:
   - **Name**—The alias that will be assigned to the SharePoint connection.

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- **Client ID**—The ID of your SharePoint app in Azure. To find the ID in Azure, browse to **App registrations**, select your SharePoint app, and click **Application (client) ID**.
- **Organization name**—The name of your organization. You can find the organization name in Azure using your sign in information.
- **SharePoint URL**—The URL of your SharePoint site. The URL must be entered using the following format: `https://organization.sharepoint.com/sites/sitename`.

4. Click **Add**.
   Insights uses the connection properties to connect to SharePoint. Once successful, the connection appears on the **Connections** page.

Workbook

Complete the following steps to create a SharePoint connection from the **Add to page** window in a workbook:

1. Open the **Add to page** window using one of the following options:
   - Create a workbook. The **Add to page** window appears when the workbook is created.
   - Click the **Add to page** button above the data pane in an existing workbook.
   - Create a page in an existing workbook. The **Add to page** window appears when the page is created.
2. In the **Add to page** window, choose **SharePoint**.
3. Click **New connection**.
4. Provide the following required connection properties:
   - **Name**—The alias that will be assigned to the SharePoint connection.
   - **Client ID**—The ID of your SharePoint app in Azure. To find the ID in Azure, browse to **App registrations**, select your SharePoint app, and click **Application (client) ID**.
   - **Organization name**—The name of your organization. You can find the organization name in Azure using your sign in information.
   - **SharePoint URL**—The URL of your SharePoint site. The URL must be entered using the following format: `https://organization.sharepoint.com/sites/sitename`.
5. Click **OK**.
   Insights uses the connection properties to connect to SharePoint. Once successful, the datasets from the connection are listed in the middle pane. You can choose datasets from your new connection to add to your workbook page.

Edit a SharePoint connection

Complete the following steps to edit a SharePoint connection:

1. On the home page, click the **Connections** tab.
2. Click the name of the SharePoint connection to be edited.
3. To change the name of the SharePoint connection, edit the **Name** parameter.
   The name can also be changed using the **Rename** button.
4. Optionally, change the **Client ID**, **Organization name**, and **SharePoint URL** parameters.

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5. Click **OK** to apply the changes.

Troubleshoot a SharePoint connection

SharePoint connections will fail in browsers using Incognito mode if cookies and pop-ups are disabled. You can fix this error by enabling cookies and pop-ups in your browser.

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Open a workbook

A workbook is the location where you organize data and do analysis in ArcGIS Insights. Workbooks will contain any results and workflows that are used. A workbook and its corresponding analysis can be shared with other Insights users.

Note:
Simultaneous editing is not supported. If you open the same workbook in two different browser sessions, and changes are saved in one workbook, cards on the page—such as a bar chart or a map—will break. Close the browser session with the broken cards.

A workbook cannot exceed an overall file size of 10 MB. The main contributor to increased file size is embedded images. You can check the workbook size on the item details page.

Create a workbook

To create a workbook in ArcGIS Insights, complete the following steps:

1. Open Insights and sign in to access the home page. If you are already using a workbook, save your work and click the **Home** button to return to the home page.
2. Click the **Workbooks** tab.
3. Click **New workbook**.
   A new workbook is created and the **Add to page** window appears.
4. Use the **Add to page** window to add data, models, and themes to page 1 of your workbook as necessary.

   Tip:
   The data, models, and themes you add are page specific. Each page in your workbook has its own data, allowing you to explore different themes and scenarios on each page. You can drag datasets to add data to a new page, or add new data by clicking the **Add to page** button above the data pane.

5. Name and save your workbook.
6. Visualize your data as maps, charts, and tables and begin your analysis.

A workbook item is created in your organization. If you don't add a name and save your workbook, it will be identified as **Untitled workbook**.

Use existing workbooks

Existing workbooks can be opened within Insights or from your organization. The **Workbooks** page in Insights lists the workbooks that you created, as well as the folders where workbooks could be stored.

To open an existing workbook, find the workbook on the **Workbooks** page and click the item title or double click the item.

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Shared workbooks

The **Workbooks** page lists the workbooks you can access. All accessible workbooks are displayed by default. You can view workbooks that have been shared with you by clicking the **View items** button and choosing **Shared with me**.

Workbooks that have been shared with you are available in a read-only format. You can duplicate a shared workbook to create a new, editable item. The duplicated workbook will be saved in your contents and will list your user account as the author.

Find the correct workbook

The **Workbooks** page is organized with workbooks listed from newest to oldest. The **Favorites** button can be used to view the workbooks on your favorites list. The **View items** button can be used to view your workbooks only, the workbooks that were created by other users in your organization and shared with you, or all of the workbooks accessible to you. The **Sort** button can be used to sort the workbooks from **Newest to oldest**, **Oldest to newest**, **A - Z**, or **Z - A**. A **Search** box and filter button can also be used to find workbooks based on keywords, the owner, the date modified, and tags. You can also use keywords to search for workbooks that are not listed.

Resources

Use the following resources to learn more about workbooks:

- Manage workbooks

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Manage workbooks

After a workbook is created, the settings should be updated, including adding metadata to the item details. Workbooks can also be duplicated, deleted, or refreshed to show updated data.

Workbook options

Workbooks can be managed from the **Workbooks** tab on the home page. For more information on managing workbooks and other items, see Insights items.

Refresh data

Pages and datasets that are compatible with data updates can be refreshed in Insights.* When analysis is performed in Insights, sometimes a copy of the data is created. If the original data is edited, the analysis can be rerun to pick up the latest data by refreshing the page or the dataset. All cards and analysis steps are updated when a dataset is refreshed.

There are two refresh options available in Insights:

- Refresh a page: A page can be refreshed by choosing **Refresh** in the **Share and edit page** menu ▾. The option to refresh a page will only appear when there is at least one dataset on the page that can be refreshed. Refreshing a page will refresh all applicable datasets on the page.

  Tip:

  It is best practice to refresh your pages often if your data is subject to change.

- Refresh a dataset: A dataset can be refreshed by choosing **Refresh** in the **Dataset options** menu ⋯ or by clicking the refresh button in the **Analysis view**. Refreshing a dataset will rerun any analysis steps that use that dataset. Updating a dataset will update associated result layers and cards in your workbook.

*__Refresh__ is available on datasets whose data can be updated, such as database tables and feature layers. Excel files are an example of datasets that cannot be refreshed.

Resources

Use the following resources to learn more about workbooks:

- Open a workbook
- Share a workbook

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Create and use folders

In Insights, items such as data, pages, and workbooks can be organized into folders and subfolders.

Create a folder

Folders can be created to store and organize related workbooks, data, pages, and other items.

Note:
A folder created in your ArcGIS portal will also be available in Insights in ArcGIS Enterprise.

Use the following steps to create a folder in Insights:

1. Click the **Home** button to go to the home page, if necessary.
2. Click one of the tabs in the **Analysis**, **Data**, or **Presentation** categories, such as **Workbooks** or **Datasets**.
3. Click the **New Folder** button.

A folder named **Untitled** is created.

4. Rename the folder.

The folder is created in Insights, as well as in your ArcGIS portal.

Create a subfolder

Subfolders can be added to a folder to further organize your work.

Subfolders are not supported in ArcGIS Enterprise. Items stored in subfolders in Insights in ArcGIS Enterprise are shown in a separate folder in the ArcGIS portal named after the entire folder path (for example, `My folder/My subfolder`).

Note:
There is a 125 character limit on folder names, including the full path name for subfolders. If the pathname reaches 125 characters, you cannot add subfolders.

Use the following steps to create a subfolder:

1. On the home page, click one of the tabs in the **Analysis**, **Data**, or **Presentation** categories, such as **Workbooks** or **Datasets**.
2. Browse to the folder where you want to create the subfolder.
3. Click the **New Folder** button.
   A subfolder named **Untitled** is created.
4. Rename the subfolder.

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Move items to folders

Use the following steps to move an item to a folder:

1. Click the **Home** button to go to the home page, if necessary.
2. Find the item you want to move to a folder using the tabs, search bar, filter, and other sorting options as necessary.
3. Do one of the following:
   - Hover over an item. A list of icons appears for the item.
   - Click multiple items to select them. A list of icons appears above the folders on the page.
4. Click the **Move to folder** button.
5. Browse to or search for the folder or subfolder where you want to store the item. Alternatively, you can create a folder by clicking the **New Folder** button.
6. Select the folder name and click the **Select** button.

The item is moved to the selected folder.

Delete a folder

Folders and subfolders can be deleted in Insights or your ArcGIS portal. Use the following steps to delete the folder or subfolder in Insights:

Caution:
When you delete a folder, all the content, including items and subfolders, are also deleted.

1. On the home page, click one of the tabs in the **Analysis**, **Data**, or **Presentation** categories, such as **Workbooks** or **Datasets**.
2. Click the **Delete** button on the folder or subfolder you want to delete.

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Create, share, and edit items

Content that you create or share in Insights is saved as an item. Items can be viewed or opened from the home page and include item details that provide information about the item.

Item types

The following item types can be created in Insights:

- Feature Layer
- Relational Database Connection
- Insights Page
- Insights Model
- Insights Workbook
- Insights Theme
- Insights Script

In addition, workbook packages can be uploaded in ArcGIS Online and ArcGIS Enterprise to create an Insights workbook package item. Workbook package items cannot be accessed or managed from the Insights home page. You can download a workbook package item from its item details page and import the package in Insights.

Note:
Insights workbook package items are supported in ArcGIS Enterprise 10.9.1.

Manage items

Items can be managed from the tabs, such as **Workbooks** or **Pages**, on the home page. You can access the home page by signing in to Insights or clicking the **Home** button in a workbook. The following options are available for Insights items:

Option	Description
Schedule	Create or edit scheduled updates to shared pages. **Schedule** is available for page items in Insights in ArcGIS Enterprise and Insights in ArcGIS Online. For more information, see Schedule updates for shared pages.
Details	View or change the item details, including the description, content status, tags, and license information.
Rename	Change the name of the item.
Share	Share the item or change the shared settings. For more information, see Share your work.
Favorite	Make an item a favorite. Favorite items can be viewed using the **Favorites** button ★ under the search bar and in the Favorites list on the home page.
Export	Export a dataset or a workbook package. **Export** is only available for feature layer items and workbooks.

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Option	Description
Duplicate	Create a copy of the item. **Duplicate** is only available for workbook items. **Tip:** Workbooks that have been shared with you can only be opened in read-only mode. You can duplicate a shared workbook to gain full access to the data and analysis. Any changes made to the duplicated workbook are not reflected in the original workbook.
Move to folder	Move the item to a folder.
Sign in or **Sign out**	Sign in or sign out of an ArcGIS connection (available in Insights desktop).
Delete	Delete the item. Items can be deleted by the item owner or any member of the organization with Administrator privileges. **Note:** The **Delete** button is disabled if delete protection is enabled for the item.

You can share, move, or delete multiple items from the same folder. When you select multiple items, the **Share** button **Move to folder** button and **Delete** button appear above your folders. Using these buttons will apply the action to all of the selected items.

Item details

Item details provide important information about the item, including a description, the owner, and the status. Item details can be viewed using the **Details** button for the item. Item details can be edited by the item owner or any member of the organization with Administrator privileges by clicking the information in the details.

The following details are available for Insights items:

Item detail	Description
Description	The description of an item is empty by default and needs to be added manually by the item owner or an administrator. The description should include a summary of the item as well as other item-specific information, such as data source.
Content status	Items can be designated as authoritative or deprecated, which makes it easier for others to find authoritative items while discouraging the use of items that are out of date. The **Authoritative** and **Deprecated** badges are used to identify items to members of the organization. The item owner or a member of the organization with administrative privileges can mark an item as deprecated. Only users with administrative privileges can mark an item as authoritative or change its status from authoritative.
Layers	Lists the names of each layer in a feature layer, along with the option to export the data or open in a workbook. This detail is only available on feature layer items.
Owner	The owner of an item is the person responsible for the item, including updating the item details. By default, the owner is the person who created the item.
Shared with	This detail indicates who can see or use the item. The shared status can be **No one**, **Shared to group**, **Organization**, or **Everyone**.
Tags	Tags help people find your items when they initiate a search. The tags you specify should correspond to keywords you think people will use to search for your item.

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Item detail	Description
License	Your item may contain data from different agencies or individuals. Use this item to credit the data providers.

Change item ownership

By default, the owner of an item is the person who created it. The ownership of an item can be changed by a member of the organization with Administrator privileges.

Complete the following steps to change the owner of an item:

1. Use the **Home** button to go to the home page, if necessary. If you're signing in to Insights, the home page opens automatically.
2. Use the tabs, search bar, filter, and other sorting options to find the item with the ownership you want to change.
3. Hover over the item and click the **Details** button.
   The item details appears.
4. Under **Owner**, click the user name.
5. Select the new owner's name and click **Change**.
   The item's ownership is updated.

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Add data

Your data is the basis of everything you do in Insights. You can add data to your workbook page from various data sources, allowing you to quickly find the data you need for your analysis.

Add data from the home page

The **Datasets** tab on the home page gives you access to the feature layers that you created or that were shared with you by members of your organization. Clicking the title of a dataset opens the dataset in a new workbook. You can use the search bar, filter, **Favorites** list ★, **View items** button, and **Sort** button to help you find the items you want to add to a page.

Add to page window

The **Add to page** window organizes your data to make it available in your workbook.

Insights in ArcGIS Enterprise

The following data tabs and data sources are available in Insights in ArcGIS Enterprise:

- **Living Atlas**—Feature layers curated by ArcGIS Online and configured for your ArcGIS Enterprise organization.
- **ArcGIS public**—Feature layers shared publicly from ArcGIS Online users outside of your organization.
- **Upload file**—Excel workbooks, CSV files, shapefiles, and GeoJSON files that are added directly to your workbook.
- ArcGIS organization—Data from your ArcGIS Enterprise organization. The following data sources are available from your ArcGIS connection:
  - **My content**—Feature layers created by you.
  - **My groups**—Feature layers created by you or another member of your organization and shared to a group of which you are a member.
  - **My organization**—Feature layers created by you or another member of your organization and shared to your organization.
  - **Boundaries**—Standard boundary feature layers that have been configured for your organization.
- **Databases**—Database connections and their associated spatial and nonspatial tables.
- **SharePoint**—Datasets stored in Microsoft SharePoint.
- **OneDrive**—Datasets stored in Microsoft OneDrive.

Note:
The OneDrive and SharePoint connectors can be disabled for an Insights in ArcGIS Enterprise organization during the installation process. Contact your administrator if the connectors are not available. For more information, see Install Insights in ArcGIS Enterprise.

Add data to your workbook

Data can be added to your workbook from ArcGIS Living Atlas, ArcGIS Online, uploaded files, your ArcGIS organization, database connections, SharePoint, and OneDrive.

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ArcGIS Living Atlas

Note:
Living Atlas is not available for Insights in ArcGIS Enterprise organizations where the server cannot access ArcGIS Online (for example, in a disconnected environment).

To add data from the **Living Atlas** tab, complete the following steps:

1. Open the **Add to page** window using one of the following options:
   - Create a workbook. The **Add to page** window appears when the workbook is created.
   - Click the **Add to page** button above the data pane in an existing workbook.
   - Create a page in an existing workbook. The **Add to page** window appears when the page is created.
2. Click the **Living Atlas** tab.
3. Find the feature layer you want to add, using the search bar and sorting tools, if necessary.
4. Select the dataset.
   The dataset appears in the **Selected data** pane. If there is more than one layer or table associated to the selected dataset, all of the layers or tables will be listed.
5. Optionally, deselect any datasets, layers, or tables that you do not want to add to the workbook.
6. Click **Add**.

ArcGIS public

Note:
ArcGIS public is not available for Insights in ArcGIS Enterprise organizations where the server cannot access ArcGIS Online (for example, in a disconnected environment).

To add data from the **ArcGIS public** tab, complete the following steps:

1. Open the **Add to page** window using one of the following options:
   - Create a workbook. The **Add to page** window appears when the workbook is created.
   - Click the **Add to page** button above the data pane in an existing workbook.
   - Create a page in an existing workbook. The **Add to page** window appears when the page is created.
2. Click the **ArcGIS public** tab.
3. Optionally, use the drop-down menu to change from **Public content** to **Public groups**, then select a group from which to add content.
4. Find the feature layer you want to add, using the search bar and sorting tools, if necessary.
5. Select the dataset.
   The dataset appears in the **Selected data** pane. If there is more than one layer or table associated to the selected dataset, all of the layers or tables will be listed.
6. Optionally, deselect any datasets, layers, or tables that you do not want to add to the workbook.
7. Click **Add**.

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Upload file

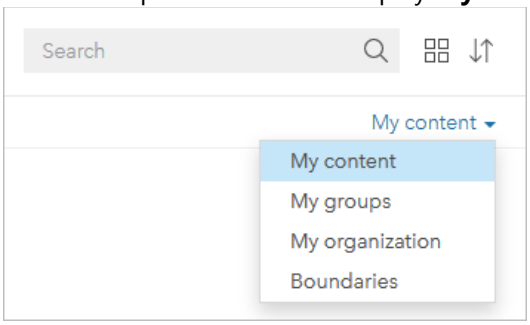
To add data from the **Upload file** tab, complete the following steps:

1. Open the **Add to page** window using one of the following options:
   - Create a workbook. The **Add to page** window appears when the workbook is created.
   - Click the **Add to page** button above the data pane in an existing workbook.
   - Create a page in an existing workbook. The **Add to page** window appears when the page is created.
2. Click the **Upload file** tab.
3. Browse to add files using the **Browse my computer** button or drag files into the window.
   The dataset appears in the **Selected data** pane. If there is more than one layer or table associated to the selected dataset, all of the layers or tables will be listed.
4. Optionally, deselect any datasets, layers, or tables that you do not want to add to the workbook.
5. Click **Add**.

ArcGIS organization

To add data from your ArcGIS organization, complete the following steps:

1. Open the **Add to page** window using one of the following options:
   - Create a workbook. The **Add to page** window appears when the workbook is created.
   - Click the **Add to page** button above the data pane in an existing workbook.
   - Create a page in an existing workbook. The **Add to page** window appears when the page is created.
2. Click the tab for your ArcGIS connection, if necessary. Data from the last data source you used is displayed by default.
3. Use the drop-down menu to display **My content**, **My groups**, **My organization**, or **Boundaries**, if necessary.



Tip:

If you are unsure where to find your dataset, choose **My organization**. All datasets from your content, groups, and boundaries are also available in **My organization**.

4. If you selected **My groups**, click the group with which the data is shared.
5. Find the feature layer you want to add, using the search bar and sorting tools, if necessary.
6. Select the dataset.

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The dataset appears in the **Selected data** pane. If there is more than one layer or table associated to the selected dataset, all of the layers or tables will be listed.

7. Optionally, deselect any datasets, layers, or tables that you do not want to add to the workbook.
8. Click **Add**.

Databases

To add data from the **Databases** tab, complete the following steps:

1. Open the **Add to page** window using one of the following options:
   - Create a workbook. The **Add to page** window appears when the workbook is created.
   - Click the **Add to page** button above the data pane in an existing workbook.
   - Create a page in an existing workbook. The **Add to page** window appears when the page is created.
2. Click the **Databases** tab.
3. Click the database connection from which you want to add data. You can also create a connection, if necessary.
4. Find the table you want to add, using the search bar and sorting tools, if necessary.
5. Select the table.
   The dataset appears in the **Selected data** pane. If there is more than one layer or table associated to the selected dataset, all of the layers or tables will be listed.
6. Optionally, deselect any datasets, layers, or tables that you do not want to add to the workbook.
7. Click **Add**.

SharePoint

To add data from the **SharePoint** tab, complete the following steps:

1. Open the **Add to page** window using one of the following options:
   - Create a workbook. The **Add to page** window appears when the workbook is created.
   - Click the **Add to page** button above the data pane in an existing workbook.
   - Create a page in an existing workbook. The **Add to page** window appears when the page is created.
2. Click the **SharePoint** tab.
3. Click the SharePoint connection from which you want to add data. You can also create a connection, if necessary.
4. Find the dataset you want to add, using the search bar and sorting tools, if necessary.
5. Select the dataset.
   The dataset appears in the **Selected data** pane. If there is more than one layer or table associated to the selected dataset, all of the layers or tables will be listed.
6. Optionally, deselect any datasets, layers, or tables that you do not want to add to the workbook.
7. Click **Add**.

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OneDrive

To add data from the **OneDrive** tab, complete the following steps:

1. Open the **Add to page** window using one of the following options:
   - Create a workbook. The **Add to page** window appears when the workbook is created.
   - Click the **Add to page** button above the data pane in an existing workbook.
   - Create a page in an existing workbook. The **Add to page** window appears when the page is created.
2. Click the **OneDrive** tab.
3. Click the OneDrive connection from which you want to add data. You can also create a connection, if necessary.
4. Find the dataset you want to add, using the search bar and sorting tools, if necessary.
5. Select the dataset.
   The dataset appears in the **Selected data** pane. If there is more than one layer or table associated to the selected dataset, all of the layers or tables will be listed.
6. Optionally, deselect any datasets, layers, or tables that you do not want to add to the workbook.
7. Click **Add**.

Data types

Several data types can be added to a workbook, including feature layers, files, and database datasets.

Feature layers

Feature layers in your organization are categorized in the **Add to page** window to make them easier for you to find. Depending on who created the layers, how they are shared, and which deployment you are using, you can find feature layers in **My content**, **My groups**, **My organization**, **Living Atlas**, and **Boundaries**.

Some feature layers in the **Add to page** window, such as layers from ArcGIS Living Atlas, may include badges that give you information about the layer. The badges indicate authoritative content, deprecated content, ArcGIS Living Atlas layers, layers shared through a distributed collaboration, subscriber content, premium content, and content purchased through ArcGIS Marketplace.

Feature layers can be either hosted or remote. Hosted feature layers are identified with the dataset icon in the data pane, whereas remote feature layers are identified with the remote dataset icon.

A map is created automatically when you add a feature layer to your workbook.

Files

Datasets can be added directly to your workbook using the **Upload file** tab. A file is saved only in the current workbook and must be added again to use it in a separate workbook. If a file will be used frequently, you can import the file on the home page to create a feature layer so that the data will be available in **My content** for all workbooks you create.

The following file formats are supported:

- Microsoft Excel workbook (`.xlsx`)
- Comma-separated values (CSV) file (`.csv`)

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- Shapefile in a compressed (`.zip`) folder
- File geodatabase in a compressed (`.zip`) folder (Insights desktop only)
- GeoJSON (`.json`, `.geojson`, or GeoJSON files in a compressed [`.zip`] folder)

Note:
Each compressed folder can contain more than one file. However, all files in a compressed folder must be the same format (for example, all shapefiles or all GeoJSON files).

CSV files only support one table per sheet. If your CSV file contains multiple tables per sheet, you should convert it to an Excel workbook or move the extra tables to their own sheets.

Excel and CSV files are added as nonspatial tables. To use your Excel and CSV files as spatial data, you must enable location.

Files are identified with the dataset icon in the data pane.

No cards are created when you add data from a file. You can create charts and tables with all file types. Maps can be created with shapefiles or with Excel and CSV files that have location enabled.

Note:
If you use Insights in ArcGIS Enterprise with a PKI authentication and your files fail to upload, it may mean that the value of the `uploadReadAheadSize` property needs to be increased on your IIS web server.

OneDrive and SharePoint

Files can also be added from the OneDrive and SharePoint tabs. Connections must be created to OneDrive and SharePoint before data can be accessed.

Databases

Connections can be made to PostgreSQL, SQL Server, Oracle, and SAP HANA databases so that you can access database tables from directly within Insights. Database tables can be spatial or nonspatial. Spatial tables load with the location field symbol .

Database tables are identified with the database dataset icon in the data pane.

No cards are created when you add datasets from a database connection. You can create charts and tables with any database tables, or create maps if the table has a location field. You can also enable location in a table without a location field.

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Note:
To ensure the accurate and consistent analysis of spatial data from database connections, Insights requires that spatial tables have either a primary key or a unique index. An exclamation mark next to the location icon indicates that neither a primary key nor a unique index is detected. You can choose which fields will be used as the location or the ID fields by clicking the location field icon and choosing from the list of spatial and nonspatial fields.

If an ID field is not specified either automatically or manually, the table will be added to Insights as a nonspatial dataset. Only one spatial field is supported for each spatial table from a database connection, where features must meet the following requirements:

- Features must have a valid geometry or geography (null or invalid features are not supported).
- Features must have a spatial reference identifier (SRID).
- All features in the field must have the same SRID.
- All features in the field must have the same geometry type.

View data sources

Data sources can be viewed for the datasets on the page using the analysis view. The following information is stored and provided for a dataset:

- Feature layers (including hosted and remote feature layers, public data from ArcGIS Online, and data from ArcGIS Living Atlas)—Feature layer name and dataset name
- Files—File name and dataset or table name
- Database tables—Database connection name and table name
- OneDrive and SharePoint—Connection name, path, and table name

Note:
The original data source is not stored for a result dataset that has been copied to the workbook or copied to a different page.

The data source cannot be viewed for files uploaded to a workbook at Insights 2021.2 or earlier.

Use the following steps to view the source of a dataset:

1. Click the **Analysis view** button in the workbook toolbar.
2. In the analysis view, click the input dataset whose source you want to see.

   Note:
   You must perform one or more analytical processes that create a card or result dataset to see an input dataset in the analysis view. For example, creating a map card or joining two datasets are two processes that will make a dataset appear in the analysis view.

3. Click the **Information** button .

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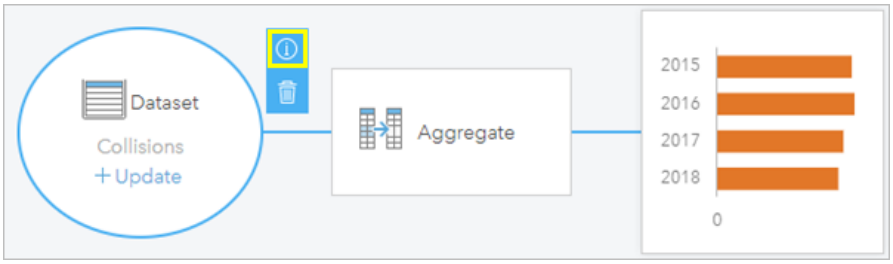
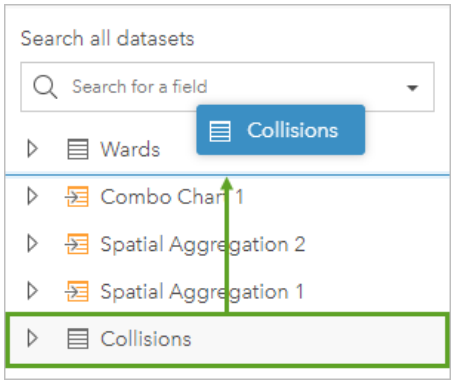


The **Information** pane appears showing the source of the dataset.

Reorder datasets in the data pane

Datasets are listed in the data pane based on the order in which they are added. You can change the order of the datasets by dragging a dataset to a different position in the data pane.



You can also move a dataset by clicking the **Dataset options** button ··· and choosing **Move up** or **Move down** from the menu, or by selecting the dataset and using the `Shift+Up arrow` or `Shift+Down arrow` keyboard commands.

Remove a dataset

Use the following steps to remove a dataset from the data pane:

1. Click the **Dataset options** button ··· next to the dataset you want to remove.
2. Click **Remove**.
   If there are cards on your page that contain data from the dataset you are about to remove, the following message appears: **Are you sure? You are about to remove <dataset-name> from the page. <#> card(s) will be affected**. If you choose **Yes, Remove**, the dataset and all cards containing data from the dataset are removed.

Resources

The following resources may be helpful for adding data in Insights:

- Supported data
- Create datasets
- Prepare your Excel and CSV data
- Create a database connection

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Update a database connection

Note:
You cannot edit database properties through Insights. If you need to change the properties of your database, you must do so within the database itself, then update the connection properties in Insights.

A database connection will be broken if the database properties, such as the database name or port number, are changed. You can restore the connection by editing the connection properties.

All connection properties can be updated, except **Type**. For example, changing to SAP HANA from Microsoft SQL Server is not supported. For a complete list of connection properties, see Create a database connection.

If you attempt to add data from a database with a broken connection, the message **Something went wrong. Check to see if the connection properties need to be updated** will appear. The connection properties may need to be updated, or there may be other reasons that the connection is failing. For more information, see Troubleshoot a database connection.

Edit connection properties

Complete the following steps to edit a database connection:

1. If a workbook is open in Insights, save your work and click the **Home** button to return to the home page. If you are signing in to Insights you will be brought to the home page automatically.
2. Click the **Connections** tab.
3. Click the name of the database connection you want to edit. You can only edit database connections that you created. Users with Administrator privileges can update database connections created by other members of the organization.
   The **Edit connection** window opens.
4. Update the connection details. All details can be changed except **Type**.
5. Enter the password for the database, if it was not already updated. The password must be entered before the edits can be saved.
6. Click **Save**.

See also

See the following topics to learn more about database connections:

- Create a database connection
- Troubleshoot a database connection
- Share a database connection

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Data pane

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Data pane

The Insights data pane is used to organize and manage your data.

Above the data pane

The following buttons are available above the data pane:

Button	Description
Add to page	Add items (data, models, themes, and scripts) to your page.
Map	Create a map.
Chart	Create a chart.
Table	Create a table.
Create relationships	Create attribute and spatial joins between datasets.

Manage datasets and fields

You can use the data pane to manage datasets and fields, including changing field and dataset aliases, changing field types, and applying dataset filters.

A search bar is available to search for fields in the datasets listed in the data pane. You can search all datasets or search in a specific dataset.

Use the following resources to learn more about datasets and fields:

- Dataset types: feature layers, database tables, result datasets, function datasets, and scripts
- Search for fields
- Field types
- Display field
- Calculate geometry
- Rename fields and datasets
- Dataset filter

Dataset options

The **Dataset options** button ··· is available for all dataset types in the data pane, as well as scripts. The button is used to display menu options, such as enabling location on the dataset, viewing the data table, and exporting or sharing the dataset. For scripts, the **Dataset options** menu can be used to open, run, download, share, or remove the script.

Use the following resources to learn more about the **Dataset options** menu:

- Enable location
- View data table
- Advanced filter
- Remove dataset
- Refresh dataset

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- Export datasets
- Share data
- Copy dataset to workbook
- Hide and show fields
- Move datasets up or down

For more information about the **Dataset options** menu for scripts, see Use the scripting environment.

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Create relationships to join datasets

Relationships are used to join attributes from two or more datasets based on common fields or locations. Relationships can be used to add attributes from a reference table to another dataset, to combine attributes from two datasets to enable different types of analysis, and to enable location in nonspatial tables.

To create a relationship in ArcGIS Insights, you must add two or more supported datasets with common fields to your page.

About relationships

Insights allows you to join data from two or more datasets using a common field or location in the **Create Relationships** window. For example, you can associate a dataset of sales transactions with a dataset containing store information by identifying a common field (for example, store number). The common field identifies which rows from each dataset will be joined to each other, and the relationship type determines which rows are kept in the joined dataset.

The four types of relationships you can use to join your datasets are as follows:

- Inner
- All (full outer join)
- Left (left outer join)
- Right (right outer join)

Note:
Spatial joins (joins made using location fields) will be created using Intersects as the spatial relationship. However, you can still choose Inner, All, Left, or Right as the relationship type.

The joined dataset is displayed as a result dataset in the data pane. The joined dataset allows you to expand your analysis by using the data from all of the joined datasets as a single layer.

In the context of a joined dataset, cardinality refers to the relationships between datasets. In the **Create Relationships** window, take the time to consider the cardinality between the datasets, which can be one-to-one, many-to-one, or many-to-many. Cardinality does not affect the type of relationship you create, but it does have implications for the fields you might want to aggregate in the joined dataset, or the field you choose to show on your map.

Insights also suggests a common field when you choose the datasets you want to join. If no field is suggested, you can select the fields you want to use for the relationship.

Supported data

The following data types can be used to create relationships:

- Hosted feature layers
- Files added to your workbook
- Datasets from a database connection
- Result datasets from spatial analysis, including results from unsupported data types

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Definition queries in feature services are not supported for creating relationships. Data in your workbook that is not supported for relationships will be disabled in the **Create Relationships** window.

Note:
Relationships cannot be created with remote feature layers, such as ArcGIS Living Atlas layers.

Database datasets must be from the same database and instance to be compatible for joining. Other datasets must be stored in the same data store to be joined.

If your datasets are not compatible with joining or are stored in separate data stores, you can copy the datasets to your workbook and use the copied datasets to create the relationship.

Create a relationship

To learn how to create a relationship to join datasets, you can complete the steps below, or follow a sample use case to walk you through the process, including descriptions and results for each type of relationship.

1. Click the **Create Relationships** button above the data pane.
   The **Create Relationships** window appears and displays a list of datasets for your current page under **My Data**.
2. Under **My Data**, click one or more datasets you want to join.

   Note:
   If you plan to use the Left or Right relationship types, make sure the dataset that should be on the left or the right is in the desired place. The dataset you choose first will appear on the left after you add it to the page.

   Tip:
   It's best practice to place the dataset that has the finest level of detail (the most granular) on the left. For the sample use case described below, the StoreTransactions dataset should be on the left.

   When you select the first dataset, the view updates to show only those datasets that are eligible for a relationship.

   Insights analyzes the datasets you added and suggests a field to use for the join based on the type of data the field contains and the name of the field. If a field is suggested, thumbnails that represent each dataset are joined using a line, and the suggested field appears on each thumbnail.

3. Do one of the following:
   - If the suggested field is acceptable, and you want to use the default relationship type (Inner), proceed to the final step.
   - If you want to use a different field, add another field to join, or choose a different type of relationship, proceed to the next step.
   - If a common field could not be detected, a line appears between your dataset thumbnails, and the **Create Relationship** window opens where you can choose the common fields. Proceed to step 5.

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4. To edit relationship properties, such as choosing a different field, adding other fields to join, or changing the relationship type, click the **Edit relationship** button on the relationship line that connects the dataset thumbnails.
5. Choose a different field in one or more datasets, or choose a different relationship type and close or click outside of the relationship properties dialog box.
6. Optional: If the relationship requires a composite key, you can add additional fields using the **Add fields** button under **Choose Fields**.
   For example, if you are joining CityName to CityName, you might also have to specify county, state, and country because values in CityName are duplicated in the dataset.
7. Do one of the following:
   - Click **Finish** (at the lower right) to proceed with the relationship.
   - Click **Cancel** to undo the current relationship.

   When you click **Finish**, the **Create Relationships** window closes. A new result dataset with the joined data is added to the data pane.

Sample use case

This section describes a sample use case that shows how you can create a relationship between two datasets to answer specific questions, and how each relationship type affects the data in the joined dataset.

The questions are as follows:

- What is sales revenue by store?
- Where is my highest grossing store located in the city?

There are two datasets on the workbook page that can help answer this question. The first is the following Excel table showing store transactions from three stores:

OrderID	StoreID	TotalAmount	PaymentMethod
1204	1	$91.48	Credit
1295	1	$103.86	Credit
1316	3	$97.81	Debit
1406	2	$103.24	Credit
1421	2	$44.95	Cash
1426	2	$153.71	Debit
1454	3	$168.95	Credit

The StoreTransactions dataset alone could provide a summary of TotalAmount by StoreID (if you change StoreID to a string field, and create a bar chart), but a report showing TotalAmount by a store name is preferred for the sake of clarity when it's time to share the analysis results with teams across the organization.

In addition, the StoreTransactions dataset cannot show the store locations on a map.

The second is a feature layer showing the following six store locations:

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StoreID	StoreName
1	Baskets and Cases
2	Toys! Toys! Toys!
3	Robert's Plants
4	Aisha's Bookstore and Coffee Shop
5	Gadgets and Gizmos
6	Sally's Hardware and Construction

These datasets track data at two different levels of detail. The first dataset tracks data at the transaction level, which is a more detailed level than the second table, which tracks data at the store level.

As a result, you see duplicate records (rows) in the StoreID column in StoreTransactions, while StoreLocations has only unique records in its StoreID column. There are many transactions per store. This is what's referred to as a many-to-one relationship, a particular type of cardinality between the datasets.

Looking at the data, it's apparent that StoreID is the best field to use to create a relationship between these two datasets.

To answer the questions for this use case, you need to do the following:

1. Consider the effect that each relationship type has on the resulting joined dataset.
2. Follow the instructions in Create a relationship (above) to create the relationship that works best for the input datasets.
3. Visualize the joined data to answer the questions.
   a. Using the StoreName and TotalAmount fields from the joined dataset, create a bar chart or a summary table to aggregate the fields. Sales are aggregated by each store name.
   b. Create a graduated symbol map using the TotalAmount field.

Relationship types

The relationship type you use, along with the common field you choose, determines the records that you keep in the joined dataset. The following subsections provide a look at what the joined dataset looks like by relationship type.

Inner relationship type

If you used the default relationship type while following the steps in Create a relationship (above), the joined dataset uses the Inner relationship type.

Inner keeps only the records that match both datasets. Null records are not added.

OrderID	StoreID	TotalAmount	PaymentMethod	StoreID	StoreName
1204	1	$91.48	Credit	1	Baskets and Cases
1295	1	$103.86	Credit	1	Baskets and Cases
1316	3	$97.81	Debit	3	Robert's Plants
1406	2	$103.24	Credit	2	Toys! Toys! Toys!

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OrderID	StoreID	TotalAmount	PaymentMethod	StoreID	StoreName
1421	2	$44.95	Cash	2	Toys! Toys! Toys!
1426	2	$153.71	Debit	2	Toys! Toys! Toys!
1454	3	$168.95	Credit	3	Robert's Plants

The records that were excluded were records for StoreID 4 through 6 from the StoreLocations dataset.

Using the default relationship type is a good choice to help answer the sample use case questions above. The Inner relationship type provides data that will not show null values when you visualize your data.

All relationship type

The All relation type (full outer join) keeps all records from both datasets and treats records containing no matches as null values.

OrderID	StoreID	TotalAmount	PaymentMethod	StoreID	StoreName
1204	1	$91.48	Credit	1	Baskets and Cases
1295	1	$103.86	Credit	1	Baskets and Cases
1316	3	$97.81	Debit	3	Robert's Plants
1406	2	$103.24	Credit	2	Toys! Toys! Toys!
1421	2	$44.95	Cash	2	Toys! Toys! Toys!
1426	2	$153.71	Debit	2	Toys! Toys! Toys!
1454	3	$168.95	Credit	3	Robert's Plants
				5	Gadgets and Gizmos
				6	Sally's Hardware and Construction
				4	Aisha's Bookstore and Coffee Shop

The resulting dataset contains null values in the columns originating from the left dataset (StoreTransactions) for records corresponding to StoreIDs 4, 5, and 6 from the right dataset (StoreLocations). This is because there are no matching records for those store IDs in the left dataset.

Left relationship type

When using the Left relationship type (left outer join), you must ensure that the dataset you want to retain the records from is on the left side of the **Create Relationships** window by selecting this dataset first. See Create a relationship for more information.

Records that match those from the dataset on the left (StoreTransactions) are retained, along with matching records from the dataset on the right (StoreLocations). If no match on the right is found, the right side contains null values.

OrderID	StoreID	TotalAmount	PaymentMethod	StoreID	StoreName
1204	1	$91.48	Credit	1	Baskets and Cases
1295	1	$103.86	Credit	1	Baskets and Cases
1316	3	$97.81	Debit	3	Robert's Plants

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OrderID	StoreID	TotalAmount	PaymentMethod	StoreID	StoreName
1406	2	$103.24	Credit	2	Toys! Toys! Toys!
1421	2	$44.95	Cash	2	Toys! Toys! Toys!
1426	2	$153.71	Debit	2	Toys! Toys! Toys!
1454	3	$168.95	Credit	3	Robert's Plants

This joined dataset looks exactly like the Inner relationship type. To answer the sample use case questions, you can use either the Left or Inner relationship type to create a relationship between the two tables, and then create a bar chart, which won't show null values.

If the left side (StoreTransactions) contained a record for StoreID 7, which is not in the StoreLocations dataset on the right, a Left join would have null records on the right.

OrderID	StoreID	TotalAmount	PaymentMethod	StoreID	StoreName
1204	1	$91.48	Credit	1	Baskets and Cases
1295	1	$103.86	Credit	1	Baskets and Cases
1316	3	$97.81	Debit	3	Robert's Plants
1406	2	$103.24	Credit	2	Toys! Toys! Toys!
1421	2	$44.95	Cash	2	Toys! Toys! Toys!
1426	2	$153.71	Debit	2	Toys! Toys! Toys!
1454	3	$168.95	Credit	3	Robert's Plants
1502	7	$112.65	Cash		

Right relationship type

When using the Right relationship type (right outer join), you must ensure that the dataset you want to retain the records from is on the right side of the **Create Relationships** window by selecting the left dataset first, and the right dataset next. See Create a relationship for more information.

Records that match those from the dataset on the right (StoreLocations) are retained, along with matching records from the dataset on the left (StoreTransactions). If no match on the left is found, the left side contains null values.

OrderID	StoreID	TotalAmount	PaymentMethod	StoreID	StoreName
1204	1	$91.48	Credit	1	Baskets and Cases
1295	1	$103.86	Credit	1	Baskets and Cases
1316	3	$97.81	Debit	3	Robert's Plants
1406	2	$103.24	Credit	2	Toys! Toys! Toys!
1421	2	$44.95	Cash	2	Toys! Toys! Toys!
1426	2	$153.71	Debit	2	Toys! Toys! Toys!
1454	3	$168.95	Credit	3	Robert's Plants
				5	Gadgets and Gizmos
				6	Sally's Hardware and Construction

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OrderID	StoreID	TotalAmount	PaymentMethod	StoreID	StoreName
				4	Aisha's Bookstore and Coffee Shop

The resulting bar chart from the above right-joined dataset would contain null values.

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Search for fields

The search bar in the data pane can be used to filter datasets to show only fields that match the search value. Fields that are returned from the search can be selected and used to create maps, charts, and tables. You can also use the search to apply a dataset filter, rename a field, change the field type, or hide a field.

Note:
Multiple fields can be selected from the same dataset. If a field is selected from a second dataset, the previous selections will be cleared.

Search for fields in all datasets

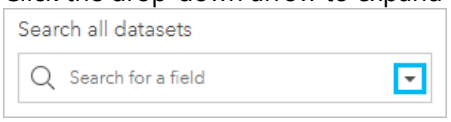
The search box is used for all datasets in the data pane by default. To search for a field, begin typing in the search box. The datasets expands to display all matching fields. If no fields in the dataset match your search, the message **No matching fields** appears.

Search for fields within a dataset

If you do not want to see the search results for all datasets in the data pane, you can choose a single dataset to search.

Use the following steps to search for fields within a specific dataset:

1. Click the drop-down arrow to expand the menu for the search bar.



2. Choose a dataset from the menu.
   The dataset is listed above the search bar.

   Note:
   Only one dataset can be chosen at a time. Selecting a different dataset from the menu will replace the previous selection. You can remove the selected dataset by clicking the clear button × next to the dataset name above the search bar.

3. Start typing a field name in the search bar.
   The matching field names for the chosen dataset appear. All other datasets in the data pane are unavailable. If no fields match your search, the message **No matching fields** appears.
4. Select the field you want to use to create a map, chart, or table. If necessary, you can search for more fields from the same dataset to create a visualization.

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Field types

Field types are assigned to every field in a dataset in ArcGIS Insights based on the type of data in the field. Insights identifies field types using icons that indicate the default behavior of each field from your dataset in visualizations. The field type also determines the default statistic type applied to each field in a visualization.

While the table below lists the default visualization for each field type, you can change to a different visualization depending on the data selected in the card.

Tip:

There are times when you may want to specify a different type of field. You can change a field type in the data pane.

Role	Behavior	Default visualization	Default statistic type (for aggregations)
Location	Allows you to plot data on a map as points, lines, and areas, and perform spatial analysis. Can be used as unique categories in charts and tables.	• 1 location: Location map • 2 locations: Link map	Count
String	Groups data as bars, slices, or lines in charts. Groups data as a category column in summary tables. Appears as unique symbols on maps. Can be calculated as a count along the statistics axis of charts, or statistics columns in summary tables.	Default chart: Bar chart *Default map: Unique values map	Count
Number	Determines the height, length, or size of bars, columns, slices, and bubbles in charts. Determines the size of the graduated circles in graduated symbol maps.	Default chart: • 1 number: Histogram • 2 numbers: Scatter plot *Default map: Graduated symbol map	Sum
Rate/ Ratio	Determines the height, length, or size of bars, columns, slices, and bubbles in charts. Grouped ranges of rate/ratios determine the level of shading for features shown in maps.	Default chart: • 1 rate/ratio: Histogram • 2 rate/ratios: Scatter plot *Default map: Choropleth map	Sum in charts None in choropleth maps

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Role	Behavior	Default visualization	Default statistic type (for aggregations)
Date/Time	Displays a series of data points graphed in chronological order. Insights automatically divides date/time fields into subfields that can be used as string fields in other visualizations. Date/time subfields include the following: • Year • Quarter • Month • Day of month • Day of week • Hour • Minute • Second **Note:** The subfields created in Insights are dependent on the input data. If the input includes date only, the time subfields will not be provided. If the input includes time only, the date subfields will not be provided.	Default chart: Time series graph Default map: Not applicable	Count
Subtype	Displays data from an assigned subtype. Subtype fields are treated as strings when used to create maps, charts, and tables.	Default chart: Bar chart *Default map: Unique values map	Count
Coded value domain	Displays descriptions from an assigned coded value domain. Coded value domain fields are treated as strings when used to create maps, charts, and tables.	Default chart: Bar chart *Default map: Unique values map **Note:** Multidomain fields are not supported in all map and chart visualizations. For more information, see Domains and subtypes.	Count

*To create a map using a string, number, or rate/ratio, your dataset must contain one location field. See Enable location for your dataset.

Change a field type

The types of visualizations that can be created using data from a given field are dependent on the field type. In some situations, the type assigned to the field is not the optimal type for the analysis you want to perform or the visualizations you want to create. The following examples are situations where a field type may need to be changed:

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- A field containing discrete numbers (for example, district codes, ZIP codes, years, or ages) is added as a number field type. These discrete numbers are more accurately represented as categories in some situations. Therefore, the field type can be changed from **Number** to **String**.

  Note:
  Whether a field type should be changed is often dependent on the specific data and type of analysis you want to perform. In this example, age could realistically be analyzed as either a number or a string. For example, ages as a number could be used to create a histogram showing the distribution of ages in the data, whereas ages as a string could be used to create a bar chart showing the average amount of spending on entertainment for each age in the data.

- A field containing percentages, rate, ratios, or proportions (for example, population density, crime rate, or average grades) is added as a number field type. These numbers are more accurately represented as rate/ratios, particularly when creating a map of the field since numbers and rate/ratios have different default map types (graduated symbol maps for number fields and choropleth maps for rate/ratio fields). Therefore, the field type can be changed from **Number** to **Rate/Ratio**.
- A CSV file contains fields with date or time information. Since CSV files do not support date/time formatting, the fields are added as string fields. Some visualizations and functionality (for example, time series charts and subfields) are available only for date/time fields. Therefore, the field type can be changed from **String** to **Date/Time**.

Changing a field type in Insights does not change the underlying data and will only be reflected in the workbook where the field type was changed.

The following table describes the compatible field type changes available in Insights:

Original field type	Compatible field types
Number	A number field can be changed to the following field types: • String • Rate/Ratio
Rate/Ratio	A rate/ratio field can be changed to the following field types: • Number • String

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Original field type	Compatible field types
String	A string field can be changed to a date/time field. The string field must be formatted in a recognized format that fits the following specifications: • The same format must be used for all entries in a field. • Dates can be entered in any standard order. • Standard date separators, including hyphen (-) and slash (/) are accepted. • A space is required between the time and AM or PM. The following list includes examples of some of the formats that are accepted: • `YY-MM-DD hh:mm:ss.SSS am` • `MM DD YY hh:mm:ss` • `YY/MM/DD hh:mm:ss pm` • `MM-DD-YY` • `hh:mm` The following values are accepted for each element of the formats: • `MM`: Month (1-12 or three letter abbreviation) • `DD`: Day (1-31) • `YYYY`: Year (four digit or two digit) • `hh`: Hour (12 hour or 24 hour) • `mm`: Minute (0-59) • `ss`: Second (0-59) • `SSS`: Milliseconds (0-999) • `AM/PM`: AM or PM (not case sensitive) A string field that was originally a number or rate/ratio field can be changed to a number or rate/ratio type.
Date/Time	A date/time field cannot be changed.
Location	A location field cannot be changed.
Subtype	A subtype field cannot be changed.
Coded value domain	A coded value domain field cannot be changed.

Use the following steps to change a field type:

1. From your dataset in the data pane, click the field type icon.
   A menu lists the compatible field types.
2. Choose the field type from the list.

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New visualization will reflect the field's new type. However, existing visualizations using the field as its previous type will not update.

Location field

Location fields are a part of all spatial datasets, including points, lines, and areas. A dataset must have a location field to create a map. A location field can be added to a nonspatial dataset using Enable location.

Calculations for length or area and perimeter can be added as location subfields for line and area features, respectively. The subfields are added as number fields, so they can be used to create maps, charts, and tables. For more information, see Calculate geometry.

String field

String fields are assigned to fields that include text values. Data in string fields is often referred to as categorical values and is qualitative or descriptive in nature. In some circumstances numbers can be assigned a string field and treated as categorical values. Examples where numbers can be treated as strings include age or ZIP Code. To change a number to a string field, click the number field button next to the field and choose **String** from the menu.

String fields can be used to make unique values maps, tables, and several charts, such as bar charts, treemaps, and box plots. String fields can also be used as a **Color by** or **Subgroup** parameter in other charts, such as scatter plots and stacked bar charts.

Number field

Number fields are assigned to fields that include numerical values. Data in number fields will often show measurements and is quantitative in nature.

Number fields can be used to make proportional symbol and choropleth maps, tables, and charts such as scatter plots and histograms.

Note:
Certain visualizations, such as histograms and KPI cards, may be required to display rounded integers as their labels rather than decimals for some datasets. The rounded integers are for display only, and the decimal values are used for all calculations.

Rate/Ratio field

Rate/Ratio fields are assigned when a field is created using Calculate Ratio or Calculate % Change. If a dataset with a potential rate/ratio field is added to Insights, it will likely be added as a number field. You can change a number field to a rate/ratio field by clicking the number field button next to the field and choosing **Rate/Ratio** from the menu.

Date/Time field

A date/time field is assigned to datasets with date or time fields. Date/Time fields can also be calculated using the date functions in the data table or by changing a field from a string type to a date/time type.

Insights uses Coordinated Universal Time (UTC) and does not currently read time zones directly from data fields. Insights will always return date/time fields in feature layers as UTC, which may cause the fields to appear converted to UTC in Insights. In all other instances, date/time fields are assumed to be in UTC. Therefore, the date/time values returned in Insights will be identical to the input values.

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Note:
Date/Time fields are only available in Insights if standardized SQL queries are enabled on the ArcGIS Server.

Date/Time fields are not available for datasets stored outside of the hosted data store, such as ArcGIS Living Atlas of the World datasets and map image layers.

Date/Time fields in Insights are given subfields, such as `Year` and `Month`. The subfields are all added as string fields, so they can be used to create maps (if there is a location field in the dataset), charts, and tables.

Note:
Subfields are not created for date/time fields in map services or remote feature layers, such as ArcGIS Living Atlas datasets.

Date/Time fields can be used to create time series graphs and tables, but they cannot be used to style a map.

Excel files

When a Microsoft Excel table with a date field is loaded into Insights, the field should automatically be assigned as a date/time field. If the date field is added with a different type, try some of these troubleshooting techniques:

- If using a CSV file, try saving the file as an Excel workbook. Excel workbooks have more formatting options than CSV files. Alternatively, you can convert a string field to a date/time field after the data is loaded in Insights.
- Check that the field is formatted as a date in Excel.
- Check that the data is in an Excel table.

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Enable locations for your data

If your dataset does not contain a location field, you can enable location with these location types: coordinates, addresses, geographies, or standard boundaries. After you enable location, a new location field is added to your dataset. With a location field, you can create maps and perform spatial analysis with your data.

Note:
The following limitations exist for Google BigQuery, Snowflake, and database platforms that are not supported out-of-the-box:

- Enable location is not supported for read-only connections.
- Google BigQuery and Snowflake only support spatial reference 4326 (GCS WGS 1984). Therefore, only spatial reference 4326 is supported when enabling location with coordinates. Other database platforms may support additional spatial reference systems.

Coordinates

Use the **Coordinates** location type if your dataset contains X,Y coordinates. ArcGIS Insights can usually detect the X (longitude) and Y (latitude) fields in your dataset. You can override the suggested fields, and specify other fields.

For example, if your data contains two sets of coordinates, you might want to specify which coordinates you want to add location to. The default spatial reference is World Geodetic System (WGS) 1984 (4326). You can specify a different spatial reference. If you are unsure of which coordinate system to use, check with the person who created the spreadsheet or collected the data.

If your latitude (Y) values fall between -90 and 90 and the longitude (X) values fall between -180 and 180, use WGS84. If your latitude and longitude values are in meters and have 6, 7, or 8 digits before (to the left of) the decimal point, use Web Mercator.

Complete the following steps to enable location by coordinates:

1. From the data pane, click the **Dataset options** button ⋯.
2. Click **Enable location**.
   The **Enable location** pane appears with the **Coordinates** tab enabled by default. Depending on your dataset, the **X (Longitude)**, **Y (Latitude)**, and **Spatial reference** parameters may be updated with default values.
3. For the **X (Longitude)** and **Y (Latitude)** parameters, use the menu to choose the correct coordinate fields, if necessary.
4. For the **Spatial reference** parameter, use the menu to search for and add the correct spatial reference for your dataset, if necessary.
5. Check the **Repeat identical features** check box if you want all features to be enabled as individual features. If the box is unchecked, then identical features will be aggregated.
6. Click **Run**.

A new location field called **Coordinates** is added to the dataset.

Address

Use the **Address** location type to create point features based on addresses in your dataset.

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You can choose a less descriptive field, such as PostalCode if you want to see each postal code as a point on a map. For area features, it's best practice to enable location by geography or standard boundaries.

Note:
Your portal must be configured to allow batch geocoding and you must have the Geocoding privilege to enable location by address (a transaction called geocoding).

Complete the following steps to enable location by address:

1. From the data pane, click the **Dataset options** button ⋯.
2. Click **Enable location**.
   The **Enable location** pane appears with the **Coordinates** tab enabled by default.
3. Click the **Address** tab.
4. For **Geocoding service**, the ArcGIS World Geocoding Service is selected by default. If your organization uses custom locators, you can use the menu to select the correct locator.
5. For **Country, region, or territory**, use the drop down menu to choose the location where the geocoder should search for addresses.
6. For **Address Fields**, choose a format:
   - **Multiple** (default)—The address information is separated across multiple fields. The following table is an example of a multiple field address:

StreetNumber	StreetName	City	State
380	New York St.	Redlands	CA

   - **One**—The address information is contained in a single field. The following table is an example of a single field address:

StreetAddress
380 New York St., Redlands, CA

7. Match the fields that correspond to the address field or fields in your dataset.
8. Check the **Repeat identical features** check box if you want all features to be enabled as individual features. If the box is unchecked, then identical features will be aggregated.
9. Click **Run**.

A new location field called **Address** is added to the dataset.

Geography

Use the **Geography** tab to enable location for area features, such as neighborhoods or police districts. The area layer must be available in the data pane on the current page before you can use it to enable location by geography.

When you enable location by **Geography**, a join is performed behind the scenes between the current dataset and a custom or standard boundary layer from the data pane that you specify.

Complete the following steps to enable location by geography:

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1. From the data pane, click the **Dataset options** button ⋯.
2. Click **Enable location**.
   The **Enable location** pane appears with the **Coordinates** tab enabled by default.
3. Click the **Geography** tab.
4. For **Location fields**, use the menu to choose the field you want to use to enable location (for example, `Branch name`).
5. For **Matching geography level**, use the menu to choose a dataset with existing locations that match the selected location fields (for example, **Branches**).

   Note:
   Values in **Matching geography level** are based on the existing layers in the data pane. If no geography levels are listed, you must add data that contains a location field or enable location using the Standard boundaries tab.

   The estimated match accuracy between the fields is indicated with a sliding scale that ranges between **No match** and **Best**.
6. Click **Run**.

A new location field named after the geography layer is added to the dataset.

Standard boundaries

Use the **Standard boundaries** tab to enable location for standard area features, such as states or countries, using layers from ArcGIS Living Atlas or your organization's boundary layers.

Note:
Your organization must be configured to use ArcGIS Living Atlas or boundary layers to enable location using standard boundaries. For Insights desktop users, you must be signed in to an ArcGIS organization with access to ArcGIS Living Atlas or boundary layers. For more information, see Configure ArcGIS Enterprise to support Insights functionality.

When you enable location using **Standard boundaries**, a join is performed behind the scenes between the current dataset and a standard boundary layer that you specify.

Complete the following steps to enable location by standard boundaries:

1. From the data pane, click the **Dataset options** button ⋯.
2. Click **Enable location**.
   The **Enable location** pane appears with the **Coordinates** tab enabled by default.
3. Click the **Standard boundaries** tab.
4. For **Location fields**, use the menu to choose the field you want to use to enable location (for example, `Country`).
5. For **Standard boundaries**, use the menu to choose a dataset from ArcGIS Living Atlas or your organization's boundary layers (for example, **World Countries (Generalized)**).

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6. For **Matching geography level**, use the menu to choose a layer with existing locations that match the selected location fields (for example, **country_gen_trim**).
   The estimated match accuracy between the fields is indicated with a sliding scale that ranges between **No match** and **Best**.
7. Check **Add boundaries to workbook** to add the selected boundary layer to the data pane.
8. Click **Run**.

A new location field named after the standard boundary layer is added to the dataset.

Identical features

Identical point features will be aggregated into a single feature by default when enabling location by coordinates or address. To keep all point features without aggregating, check the **Repeat identical features** parameter in the **Enable location** pane.

Features with location enabled by geography will always be aggregated.

Repeat identical features

If **Repeat identical features** is checked, every entry in the dataset will be displayed individually on a map, including features in the exact same location. A map created with the location field will display the features using Location (Single symbol).

Repeat identical features should be used for datasets with separate features that have the same location, where each feature is known to have a separate location, or in situations where you need to perform analysis on the raw data, rather than the aggregated data.

Example

An analyst wants to determine the return on investment (ROI) for colleges in the United States. Since the ROI is not based on counts, the raw data is required to perform the calculation using Calculate Ratio. Therefore, the location of the colleges should be added with **Repeat identical features** enabled.

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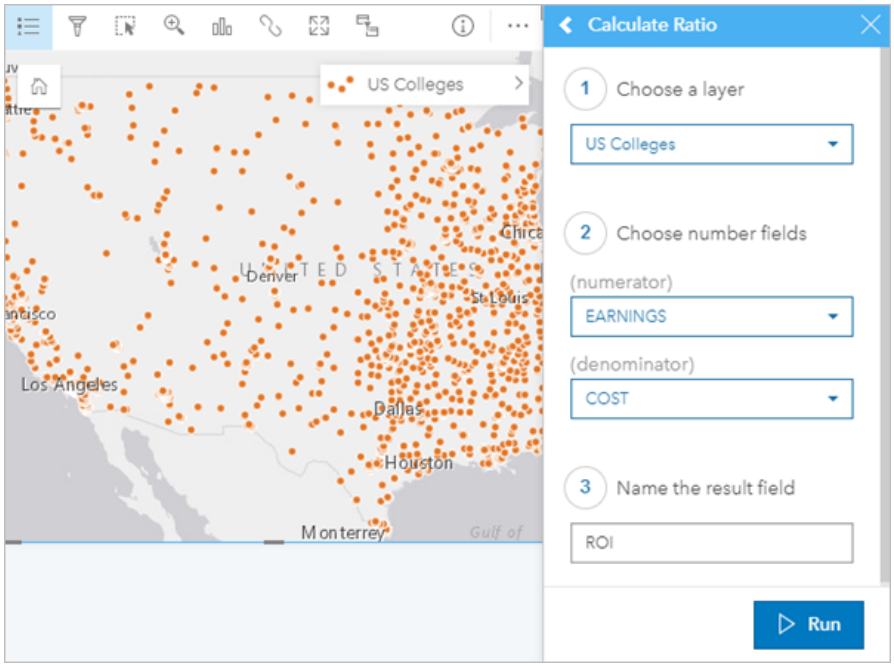

Aggregate features

If **Repeat identical features** is not checked, the features located in the same location (either identical coordinates or identical addresses) will be aggregated into a single point. A map created with the location field will display the count of features in each location using Counts and amounts (Size). A map created with a number or rate/ratio field will display the sum of the aggregated points by default, with the options to change the statistic to minimum, maximum, or average. The **Flip card** button can be used to view the aggregated statistics.

Aggregating features should be used when features located in the same place need to be combined to display a count or summary of the data, or when the locations will be used to create a link map, a map with pie chart symbols, or a map with column chart symbols.

Note:

Identical features will not be aggregated when they are used to create nonspatial visualizations, like charts and tables. Therefore, you may see different count values between your maps and other cards when you enable location with **Repeat identical features** unchecked. The count of features on maps with pie chart symbols or column chart symbols may not correspond exactly to the counts in the map legend because repeated features at a single location are counted once for the overall count on the map, but counted separately in the legend.

Example

A retail supplier collects monthly data on the orders made for each store. Enabling location on the data by aggregating the features allows the data analyst to quickly compare each location using maps with the count of orders, total revenue, and other aggregated statistics.

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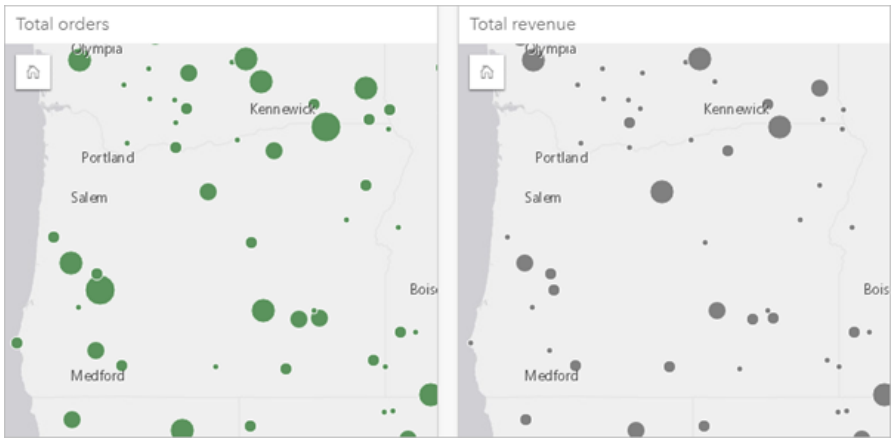

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Calculate geometry

Feature geometries can be calculated for line and polygon features. For lines, the length of each feature is calculated. For polygons, the area and perimeter are calculated. The properties can be calculated in meters, kilometers, feet, or miles.

Your dataset must have a location field before you can calculate geometries. You can add a location field to your dataset using Enable Location.

Calculate geometry for your dataset

Use the following steps to calculate geometry:

1. Expand the dataset for which you will calculate feature size.
2. Click the location field button .
3. Click **Select unit** and choose a unit from the menu. The units include meters, kilometers, feet, and miles.
4. Click **Add length** for line features or **Add area and perimeter** for area features.

The geometry subfields are added below the location field.

Use geometry fields

Geometry subfields function as number fields, meaning they can be used to style map features, added as numeric variables on charts, or summarized on summary tables. Geometry can also be used to normalize your data by area when you create a choropleth map.

You can also rename a geometry field or use it to apply a dataset filter.

Export datasets with geometry fields

You can export compatible datasets to CSV, shapefile, or GeoJSON formats. If you export a dataset with geometry fields, a compressed folder is created containing the files in the format you selected. If your folder contains two files, the first file will contain the fields from the original dataset and the second file will contain the geometry fields. The ObjectID field can be used to join the two datasets.

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Change dataset properties

Dataset properties can be updated in the data pane without affecting the underlying data. Dataset properties that can be updated include dataset and field aliases and hiding unnecessary fields from the dataset.

Change the alias for a field or a dataset

An alias is an alternative name for a field—a more user-friendly description of the content of the field. Unlike true names, aliases do not have to adhere to the limitations of the database, so they can contain special characters such as spaces. By specifying an alias, you can give names to fields that are more descriptive than their actual field name.

When you specify different aliases the underlying data is not changed, only how that field or dataset appears in ArcGIS Insights.

Change a dataset alias

1. From the data pane, click the **Rename dataset** button next to the dataset alias you want to change.
2. Type the new alias.
3. Hit Enter or Return on your keyboard.

Change a field alias

Fields can be renamed from the data pane or the data table. Use the following steps to rename a field from the data pane:

1. From the data pane, hover over the field alias you want to change.
2. Click the **Rename field** button .
3. Type the new name.
4. Hit Enter or Return on your keyboard.

Use the following steps to rename a field from the data table:

1. From the data pane, click the **Dataset options** button ··· next to the dataset whose data table you want to display.
2. Select **View data table** from the menu.
3. Click the field name to highlight the field and enable editing.
4. Type the new name.
5. Hit Enter or Return on your keyboard.

Hide or show fields in your dataset

If your dataset contains numerous fields, and you don't have any use for one or more fields, you can hide them from view.

1. From the data pane, choose one or more fields you want to hide in your dataset.
2. From the data pane, click **Dataset options** ··· next to the dataset alias you want to change.
3. Click **Hide selected fields**.

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If you want to show those fields again, click **Dataset options** ⋯, and choose **Show hidden fields**.

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Copy a dataset to your workbook

Copying a dataset to your workbook allows you to create a workbook version of datasets from your ArcGIS organization, a database connection, or other data sources. Copied datasets are functionally equivalent to datasets created from files or hosted feature layers. A copied dataset is only available in the workbook where it was copied, unless it is shared to create a hosted feature layer.

Complete the following steps to copy a dataset:

1. Add a dataset to your workbook, if necessary.
2. Click the **Dataset options** button ··· for the dataset in the data pane.
3. Click **Copy to workbook**.

A copy of the dataset is added to the data pane. The dataset is named in the format **Dataset Name 1**.

Why copy a dataset?

Tables from database connections and remote feature layers do not have the full functionality of a file, hosted feature layer, or copied dataset. Copying the data to your workbook allows you to take full advantage of all features available in Insights, regardless of your data type.

Copying your data is recommended in the following situations:

- When using a remote feature layer for any of the unsupported functions.
- When creating a relationship between incompatible datasets, such as datasets stored in different database types or data stores.
- When using a map image layer to create a visualization that requires aggregation and the maximum record count is exceeded.
- When converting strings to date/time fields with database tables from Snowflake, Google BigQuery, or any databases that are not on the list of supported databases for Insights.

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Export data

Exporting data allows you to save your Insights datasets outside of Insights in commonly used file formats. Exported data can be shared with colleagues or used in other products, such as ArcGIS Pro or Microsoft Excel.

Only feature layers can be exported. You can export data from a feature layer if one of the following is true:

- You own the features.
- You have administrator privileges.
- You are not the feature layer owner or the administrator, but the owner or administrator has shared the dataset with you and configured the dataset to allow others to export the data.

Note:
Export will be disabled for users who are not the owner or an administrator in the following situations:

- Enable location was run on the dataset.
- The dataset includes one or more calculated fields.
- The dataset includes calculated geometries.
- The dataset is the result of a join.

Exporting data is disabled for feature layers that are accessed through a distributed collaboration.

Data from an individual card can also be exported. For more information, see View the back of a card.

Export a dataset

Datasets can be exported from the data pane or from the home page.

Data pane

Use the following steps to export a dataset from the data pane:

1. From the data pane, next to the dataset you want to export, click the **Dataset options** button ⋯.
2. Click **Export**.
   A menu with export formats is displayed.

   Note:
   If **Export** is disabled, the dataset you have selected is not compatible with exporting.

3. Choose the export format.

The dataset is exported in the selected format and saved in your browser's default download location.

Note:
It may take several minutes for the download to appear in your browser, depending on the size of your dataset.

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Home page

Use the following steps to export a dataset from the home page:

1. From the home page, click the **Datasets** tab.
2. Find the dataset you want to export. Use the search bar, filter button, **View items** button, and **Sort** button, if necessary.
3. Hover over the dataset and click the **Export** button.
4. Click the export format from the menu.

The dataset is exported in the selected format and saved in your browser's default download location.

Note:
It may take several minutes for the download to appear in your browser, depending on the size of your dataset.

Export formats

Feature layers can be exported to the following formats:

- Shapefile
- Comma-separated values (CSV) files
- GeoJSON

All file formats will be exported in a compressed folder (`.zip`).

Feature services with multiple layers

A feature service can contain multiple feature layers. If a dataset with multiple layers is exported to a CSV file or GeoJSON, each layer will appear in a separate file and the collection will be saved in a compressed folder.

If a feature service is owned by another member of your organization, **Allow others to export to different formats** must be set on each feature layer that you want to export. Only the feature layers with export enabled will be included in the exported file.

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Resources

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What's new

ArcGIS Insights 2022.1 includes enhancements to reference tables, new options for enabling location, updates to workbook and page settings, plus other enhancements and updates throughout the software.

Note:
Insights 2022.1 has two separate versions for ArcGIS Enterprise. Insights in ArcGIS Enterprise 2022.1 is compatible with ArcGIS Enterprise 10.8.1 and Insights in ArcGIS Enterprise 2022.1.1 is compatible with ArcGIS Enterprise 10.9 and ArcGIS Enterprise 10.9.1. The two Insights in ArcGIS Enterprise versions have equivalent functionality.

For more information on version compatibility, see Compatibility with ArcGIS Enterprise.

Reference table

Reference tables now support conditional formatting, sparklines, and additional table formatting options. Conditional formatting options include rule based formatting and data bars. Sparklines can be line, column, or win/loss visualizations. Table formatting options include new preset colors. For more information, see Create a reference table.

Filters

The temporal filter widget now supports a slider configuration for both dates and times. The widget layout can also be expanded so the calendar or slider is always visible on the page.

The results from Temporal Decomposition and Forecast now support cross filters. Cross filters allow you to filter the data on a card using selections on a different card.

Data sources

TNS connections are now supported for Oracle databases. A TNS connection can be created using the TNS file and alias. For more information, see Create a database connection.

You can now enable location on a dataset using standard boundaries from ArcGIS Living Atlas or configured boundary layers without adding the boundary to your workbook first. For more information, see Enable locations for your data.

Analysis

The Enrich Data tool has a new, streamlined data browser. The data browser is used to select demographic and landscape data to add to your dataset.

Centrality values can now be viewed in a reference table for link maps and link charts. The table includes the entity (field), node (feature), and centrality values for the map or chart.

Weighted centralities are now available for link maps and link charts. Weights can be applied to closeness, betweenness, and eigenvector centralities. For more information, see Link analysis.

Page settings

The page options now include settings to update card backgrounds and borders for all cards on a page. The settings can also be applied to all pages in the workbook. For more information, see Customize your page.

Insights workbooks now support uploading image files to use as the workbook banner. For more information, see Customize your banner and logo.

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Languages

Bulgarian is now a supported language for the Insights app. For a full list of supported languages, see Set language.

Resources

You can now access resources for learning more about Insights by clicking the **Help** button and choosing **Insights resources**. The resources include help documentation, tutorials, training, blogs, and more.

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Frequently asked questions

Listed below are common questions about ArcGIS Insights.

General

- Is Insights available in ArcGIS Online?
- How is Insights licensed?
- What is required to install ArcGIS Insights in ArcGIS Enterprise?
- What is required to install Insights desktop?
- Can I customize Insights using an API?
- Can I use my Insights analysis in other ArcGIS applications?

Sharing

- Are shared pages live?
- Can I share individual cards?
- Who can see my shared pages?

Data

- Which types of data can be used in Insights?
- Which databases can I connect to from Insights?
- Can I connect directly to a geodatabase from Insights?

Visualization

- Can I use custom symbology?
- Can I use a custom color ramp?

Is Insights available in ArcGIS Online?

Yes, Insights is available through both ArcGIS Online and ArcGIS Enterprise.

For more information, see Overview of ArcGIS Insights.

How is Insights licensed?

Insights is a premium app that requires a specific licence to be applied to your account by the administrator of your organization. Talk to your account manager about licenses for Insights.

For more information on Insights licenses, see Administer Insights in ArcGIS Enterprise and Licensing.

What is required to install ArcGIS Insights in ArcGIS Enterprise?

To use Insights in ArcGIS Enterprise, you must have a base ArcGIS Enterprise deployment that is compatible with a supported Insights version.

For more information, see Install ArcGIS Insights in ArcGIS Enterprise.

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What is required to install Insights desktop?

Insights desktop is available to all existing Insights in ArcGIS Enterprise and Insights in ArcGIS Online users and can be installed on Windows and macOS computers.

Can I customize Insights using an Application Programming Interface (API)?

No, Insights does not currently support customization using an API. However, Insights in ArcGIS Enterprise and Insights desktop do support Python and R scripting, which allows you to expand the capabilities available in Insights.

For more information, see Scripting in Insights.

Can I use my Insights analysis in other ArcGIS applications?

Insights creates several different types of outputs, both automatically when performing analysis and through sharing. Most item types created in Insights can only be opened or used within Insights. Feature layers created from sharing data can be used in other applications, such as Map Viewer Classic or ArcGIS Pro. Publicly shared pages can be embedded in web sites and Esri Story Maps.

For more information, see Share your work.

Are shared pages live?

Shared pages include a snapshot of the data at the time the shared page was created. Therefore, you must update the shared page to view updates to your datasets or analysis.

There are some exceptions when the data on a shared page will be live, including when a cross filter is applied. For more information, see Share a page.

Can I share individual cards?

No, individual map, chart, and table cards cannot be shared. However, you can share the model used to create a card or share a page with a single card and display the page using an `<iframe>`. When a page is embedded with an `<iframe>` only the cards are displayed.

Who can see my shared pages?

The visibility of your shared pages depends on the settings used when sharing. For Insights in ArcGIS Enterprise deployments, other factors in your setup, such as firewalls and disconnected environments, will also affect visibility.

For more information, see Share a page.

Which types of data can be used in Insights?

Insights supports data from several sources, including feature layers, files, and database datasets.

For a full list of data sources, see Supported data.

Which databases can I connect to from Insights?

You can connect directly to Google BigQuery, Microsoft SQL Server, Oracle, PostgreSQL, SAP HANA, and Snowflake databases from Insights in ArcGIS Enterprise and Insights desktop. You can also use additional configurations to add connectors for databases that are not supported out of the box. For more information, see Supported databases.

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Can I connect directly to a geodatabase from Insights?

You can connect to a supported Microsoft SQL Server, Oracle, PostgreSQL, or SAP HANA database containing an enterprise geodatabase from Insights in ArcGIS Enterprise and Insights desktop. Geodatabase support enables you to browse and add geodatabase user tables to your Insights workbook.

For more information, see Supported databases.

Can I use custom symbology?

The only way to add custom symbology in Insights is to add data that has already been saved with custom symbology. One way to do that is to apply your custom symbology in ArcGIS Pro, and publish the data to your ArcGIS organization as a feature service.

If you have map or chart cards that are styled by unique symbols, you can change the colors of the individual symbols from the **Layer options** pane. For more information, see Create a map or Create a chart.

Can I use a custom color ramp?

Insights does not currently support loading custom symbology, including color ramps.

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Keyboard navigation and accessibility

Esri is committed to creating accessible technology and working to improve our products for people with disabilities and situational limitations. Insights supports both keyboard navigation and screen readers. Keyboard navigation can also map to other types of assistive technology or navigation interfaces.

Keyboard shortcuts

Keyboard shortcuts are keys or combinations of keys that provide an alternative way to execute a command that would typically be performed with a mouse. The following table describes the keyboard shortcuts and their associated functions that can be used to navigate the Insights user interface.

Keyboard shortcut	Function
`Tab` **Note:** The **Accessibility** setting must have **Press Tab to highlight each item on a webpage** selected to use tab navigation in Safari browsers.	Navigate between sections. For example, move between cards on the page.
`Shift+Tab`	Navigate backward between sections within a component.
Arrow keys	Navigate within a section, including tabs, menu items, and drop-down options.
`Shift+Arrow keys`	Move the focus between cards.
`Enter` or `Space`	Apply a selection on the highlighted page component. For example, select an item, expand a menu, select an option button, or check a check box.
`Esc`	Close the dialog box, menu, or window.
`Home` or `End`	Navigate to the first or last item in a container.
`Page Down` or `Page Up`	Scroll to the top or bottom of the page.
`f`	Bring a card forward on your page. **Note:** If a text box is active, such as a title, axis label, or text and media card, you must use `Esc+f` to deactivate the text box and move the card forward.
`b`	Send a card backward on your page. **Note:** If a text box is active, such as a title, axis label, or text and media card, you must use `Esc+b` to deactivate the text box and move the card backward.
`Shift+Up arrow` or `Shift+Down arrow`	Move a selected dataset up or down in the data pane.

Screen readers

Insights supports the following screen readers:

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- Microsoft Narrator
- VoiceOver
- JAWS

Note:
It is best practice to use the screen reader that is built into your operating system (Narrator for Windows or VoiceOver for macOS).

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Data

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Supported data

The following data sources are supported in Insights:

- Available hosted or registered feature layers from your content, groups, or organization
- Feature layers from ArcGIS Living Atlas of the World
- Microsoft Excel files (`.xlsx`)
- Comma-separated value files (`.csv`)
- Shapefiles (`.zip`)
- GeoJSON files (`.json`, `.geojson`, or GeoJSON files in a `.zip` file)
- Map image layers
- Connections to Google BigQuery, Microsoft SQL Server, Oracle, PostgreSQL, SAP HANA, and Snowflake databases. The following data types are supported:
  - Spatial tables
  - Nonspatial tables
  - Relational database views
- Connections to enterprise geodatabases
- Connections to Microsoft OneDrive. The following data types are supported:
  - Microsoft Excel files (`.xlsx`)
  - Comma-separated value files (`.csv`)
  - Shapefiles (`.zip`)
  - GeoJSON files (`.json`, `.geojson`, or GeoJSON files in a `.zip` file)
- Connections to Microsoft SharePoint. The following data types are supported:
  - Microsoft Excel files (`.xlsx`)
  - Comma-separated value files (`.csv`)
  - Shapefiles (`.zip`)
  - GeoJSON files (`.json`, `.geojson`, or GeoJSON files in a `.zip` file)
  - SharePoint subsites
  - SharePoint document libraries
  - SharePoint lists

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Note:
Compressed files must use UTF-8 or CP437 character encoding.

Map image layers require that the **Feature Access** capability be enabled to support statistics. If statistics are not supported, you cannot use many Insights features, including creating charts. See Troubleshoot a map image layer for tips on how to enure that statistics are supported when you publish a map image layer.

Map image layers must also have standardized query enabled. To enable standardized query, the layer must be shared as a dynamic service, rather than a tile layer.

Insights does not support the following:

- Multipoint geometries
- Multipatch geometries
- Feature layers from ArcGIS Online and ArcGIS Enterprise with a definition expression or feature layers that use an ArcGIS Arcade expression
- Query layers
- Feature layers with tracking enabled
- Datasets and enterprise geodatabases registered as versioned. You should unregister a dataset as versioned before using it in Insights.

Resources

Use the following resources to learn more about data in Insights:

- Add data
- Create datasets
- Supported databases
- Create a database connection
- Feature layers

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Feature layers

Feature layers are web-based datasets that contain a group of similar geographic features (for example, buildings, parcels, cities, roads, and earthquake epicenters). Features can be points, lines, or polygons (areas) and are used in Insights to create maps, charts, and tables; perform spatial and nonspatial analysis; create filters; and share results. The feature layers you use in Insights can be either hosted in your organization or accessed remotely.

In Insights, feature layers are available from the **Datasets** tab on the home page or from the **Living Atlas**, **ArcGIS public**, and ArcGIS organization tabs from the Add to page window.

Hosted feature layers

Hosted feature layers are feature layers that are stored within your organization's data store. These are layers that have been created in or published to your organization by you or members of your organization.

Remote feature layers

Remote feature layers are stored outside of your organization's data store. One commonly used example of remote feature layers is ArcGIS Living Atlas layers, which can be used by Insights but are hosted by ArcGIS Online. Datasets from the spatiotemporal big data store are also treated as remote layers.

Remote feature layers do not support all the functionality in Insights. You can copy a remote feature layer to your workbook to access all functionality of a hosted feature layer. The following functions are not supported for remote feature layers:

- Create a relationship
- Share a dataset
- Use domains or subtypes

The following additional functions are not supported for remote feature layers that are accessed through a proxy (such as subscriber content from ArcGIS Living Atlas), layers accessed from an ArcGIS Enterprise deployment that does not have Insights installed, and layers whose hosting portal cannot be determined:

- Apply an advanced filter
- Filter by top or bottom n values
- Apply a cross filter
- Apply a predefined filter
- Create a binned map
- Create a binned scatter plot
- Create a chart using median or percentile as the statistic
- Display R2 values for a scatter plot matrix
- Use date/time subfields
- Normalize a choropleth map or graduated symbols map using the **Divide by** parameter

Troubleshoot feature layers

Use the following tips to troubleshoot errors with feature layers:

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- The message **SSL connector error** appears for remote feature layers secured using a Secure Sockets Layer (SSL) when a certificate authority (CA) is missing.

  For Insights in ArcGIS Enterprise, the CA must be imported to ArcGIS Server. For more information, see the Configure ArcGIS Server with an existing CA-signed certificate topic in the ArcGIS Server help documentation.
- The message **This feature layer cannot be shared** appears when sharing a dataset results in an error opening the ArcGIS Server workspace. This error can occur when the ArcGIS Data Store license is out of date. The error can be resolved by updating the ArcGIS Data Store license and resharing the dataset.
- The message **This layer is not fully supported. This remote feature layer does not support pagination, which is required for most Insights functionality** appears when certain remote feature layers, such as remote feature layers accessed through a proxy, are not configured to support pagination. This error may indicate that the feature layer is hosted on ArcGIS Server 10.6 or lower, and that the server should be upgraded for the feature layer to become fully supported. If the feature layer is hosted on ArcGIS Server 10.7 or later, then pagination can be configured for the layer.

Resources

Use the following resources to learn more about feature layers in Insights:

- Create datasets
- Copy a dataset
- Add data

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Domains and subtypes

Domains and subtypes are components of feature layers and feature classes that can be used to constrain or define fields in your datasets. ArcGIS Insights supports using datasets and fields that have a domain or subtype defined.

Note:
Domains and subtypes cannot be created or assigned to fields in Insights. You can create and assign domains and subtypes to your datasets in other ArcGIS products, such as ArcGIS Pro, ArcGIS Online, and ArcGIS Enterprise. The data can then be used in Insights.

Domains

Domains are used to describe the values accepted in a field. Only values or ranges of values that have been deemed valid can be used as input in a field where a domain is applied. Therefore, domains are an important resource for maintaining data integrity, especially when data is being collected in the field by many workers.

There are two types of domains that can be assigned to a field: coded value domains and range domains.

Coded value domains

Coded value domains specify a valid set of values that can be used in the field. A coded value domain consists of codes that will be saved in the dataset and user-friendly descriptions that correspond to each code, similar to a reference table. For example, an electrical utility provides a map of outages. To maintain consistent information and style on the map, the `Status` field has a domain applied with the accepted status values. The following table is an example of the codes and descriptions that could be applied to the `Status` field:

Code	Description
A	Out of service
B	Dispatched
C	Planned outage

Range domains

Range domains are available for numbers and dates and specify the minimum and maximum values accepted in the field. Data entries outside the range will not be accepted in the field. For example, a public works department must do annual inspections for all the fire hydrants in the city. The normal pressure range for the hydrants is between 50 and 120 psi. A range domain can be created with a minimum value of 50 and a maximum value of 120. The domain can then be applied to the `Pressure` field so only values within that range can be entered. Any hydrants that do not have pressure values in that range will fail the inspection.

Subtypes

Subtypes are a set of features that share the same attributes. Each subtype is defined to provide other fields with the correct attribute information, including domains and default values. Subtypes are most useful in situations in which the attributes in your data are linked to other attributes. For example, street subtypes could include residential, arterial, and highway. Each of these subtypes could also have an associated default speed limit.

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Case study

A database table with city-owned water pipes has a `Type` field that accepts two subtypes: main and service pipe. Each subtype defines a set of rules for the `Materials` field and the `Diameter (in.)` field. The `Status` field has a separate domain that is not linked to either subtype.

Type	Materials	Diameter (in.)	Status	
Subtype 1: Main	Coded value domain 1 • Code: PVC • Description: PVC (Polyvinyl chloride) • Code: I • Description: Ductile Iron • Code: S • Description: Steel		Range domain 1 • Minimum: 29.5 • Maximum: 90.5 Default value: 29.5	Coded value domain 3 • Code: IS • Description: In service • Code: L • Description: Leaking • Code: IR • Description: In repair • Code: IC • Description: In construction • Code: NU • Description: Not in use
Subtype 2: Service pipe	Coded value domain 2 • Code: PEX • Description: PEX (Cross-linked polyethylene) • Code: PERT • Description: PE-RT (Polyethylene of Raised Temperature) • Code: PVC • Description: PVC (Polyvinyl chloride)		Range domain 2 • Minimum: 0.75 • Maximum: 1 Default value: 1	

A new subdivision in the city requires new water mains and service pipes, and a GIS analyst in the public works department is tasked with adding the new features to the dataset.

The first feature added is the new water main, using the `Main` subtype in the `Type` field. The `Main` subtype is connected to a coded value domain in the `Materials` field and a range domain in the `Diameter (in.)` field. The new water main is made of steel with a diameter of 50 inches, so the analyst updates the `Materials` field to `Steel` and changes the `Diameter (in.)` field to `50` from the default value of 29.5.

Tip:

While the database stores the data using the code from the coded value domain, the analyst only sees the description.

The final field, `Status`, is also a coded value domain. However, this domain was applied to the field, not to the subtype. Therefore, the same options are available regardless of which subtype is chosen for the `Type` field. The analyst updates the `Status` field to `In construction`, since the work on the water main is not yet completed.

The next feature the analyst adds to the dataset is a new service pipe connecting one of the newly built houses to the water main. The new feature uses the `Service pipe` subtype in the `Type` field. The service pipes are made from

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1-inch PEX pipe, so the analyst updates the `Materials` field to `PEX (Cross-linked polyethylene)` and keeps the `Diameter (in.)` field set to the default value of `1`. Since the service pipe has already been installed but is not yet providing water to the new house, the `Status` field is updated to `Not in use`.

Once the water for the subdivision is turned on, the `Status` field for all new water mains and service pipes will be updated to `In service`.

Supported data types

Feature layers and tables from supported enterprise geodatabase tables that have domains and subtypes defined can be used in ArcGIS Insights. Since domains and subtypes cannot be created in Insights, you will have to create and apply the domains and subtypes in a different software, such as ArcGIS Pro, before the data is used in Insights.

Feature layers

Domains can be created and applied to a field in a feature class in ArcGIS Pro and published to your organization as a hosted feature layer. Attribute lists and ranges can also be created directly within your ArcGIS Enterprise organization.

Subtypes can be created and applied to a field in a feature class in ArcGIS Pro and published to your organization as a hosted feature layer. Subtypes cannot be defined directly within your ArcGIS Enterprise organization.

Enterprise geodatabase tables

Domains and subtypes can be created and applied to fields in tables in supported enterprise geodatabase versions. You can then create a connection to the database to use the data in Insights in ArcGIS Enterprise.

Limitations

Insights does not support using fields with domains or subtypes for the following capabilities:

- Calculating a field
- Applying an advanced filter
- Creating a relationship using the description from a coded value domain*

Multidomain fields (in other words, fields with different domains based on the subtype) are not supported for the following capabilities:

- Single-category charts, such as donut charts and bubble charts. Charts that support multiple-category fields, such as bar charts, do support multidomain fields.
- The **Color by** field in scatter plots.
- Maps with categorical fields (unique values maps, maps with column chart symbols, and maps with pie chart symbols).
- The **Type** field for links in link charts and link maps.
- Nodes in link charts.

Domains and subtypes are not supported for remote feature layers. If a remote layer contains domains or subtypes, you can copy the layer to your workbook to use the domain and subtype fields.

*Coded value domains use the codes stored in the dataset rather than descriptions to create a relationship. Therefore, the second dataset used in the relationship should have a field matching the field type and values of the codes, rather than the descriptions.

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Prepare Excel and CSV data

ArcGIS Insights allows you to add tabular data from a Microsoft Excel spreadsheet or comma-separate value (CSV) file.

For Excel files, one dataset is added for each sheet, Excel table, or named range. Each Excel table or named range will be added as a separate dataset in Insights, including tables and named ranges on the same sheet.

For CSV files, one dataset is added for each sheet. CSV files do not support multiple tables per sheet. If your CSV file contains multiple tables per sheet, you should convert it to an Excel workbook or move the tables to their own sheets.

Note:
Commas must be used as the delimiters in CSV files. Other delimiters, such as tabs and semicolons, are not currently supported.

Supported Excel versions and file formats

The following versions and formats are supported:

- Microsoft Excel 2007 and later
- `.xlsx` or `.csv` files only
- Pivot tables are not supported

Excel and CSV formatting best practices

Use the following guidelines to format your data in an Excel or CSV file:

- Assign a header name to each column. Tables without headers will be assigned the column label as the header (A, B, C, and so on).
- Remove unnecessary text and empty rows above your headers.
- Remove empty rows between headings and the first row of data.
- Remove or split all merged columns or rows, including merged headers.
- Do not include multilevel headers.
- Remove calculated columns or rows. New fields can be calculated after the data is added to Insights.
- Remove rows that provide an aggregated total (for example, GrandTotal). Otherwise, the aggregated total is imported as a data record that will lead to inaccurate analysis results.
- Format data from Excel workbooks in Excel tables. An Excel table will help ensure your data is loaded into Insights correctly.
- Include the header row in all Excel tables and named ranges.
- Provide a name for each sheet, Excel table, and named range. The sheet name and table name are used as the default dataset names in Insights.
- Apply the appropriate cell formatting to columns to ensure that Insights appropriately recognizes numbers, percentages, strings, and date/time fields.
- Ensure all the data in a column is a single type. For example, do not mix string and date values in a single column.

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Tip:

Use find and replace to search for and remove values like No Data from number and date fields.

- Ensure all dates in a column use a single format and the format is supported in Excel.

Limitations

The following limitations apply to Excel and CSV files:

- #VALUE! errors in calculated fields are assigned null values when added to Insights.
- CSV files do not support date or time formatting. If you have date or time fields in a CSV file, the fields will be added to Insights as a string field. You can change the field type from **String** to **Date/Time** from the data pane.

Next steps

Now that you have prepared your Excel and CSV data, you are ready to use it in Insights. The following resources will help you to get started:

- Add data to your page
- Enable locations
- Analysis capabilities

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Configure redirect URIs

In Insights in ArcGIS Enterprise and Insights desktop, shared pages and packaged workbooks with secured data may fail because of an invalid URI.

Shared pages will fail because of an invalid URI when the following criteria are met:

- The page contains a secured remote feature layer.
- Cross filters are applied to cards containing the secured data.

Packaged workbooks will fail because of an invalid URI when the following criteria are met:

- The workbook contains a secured remote feature layer.
- Cross filters are applied to cards containing the secured data.
- The **Reference data** method is used to package the workbook.

An ArcGIS administrator can add redirect URIs to prevent shared pages and workbook packages from failing.

Add a redirect URI

Complete the following steps to add a redirect URI:

1. For the portal where the data originates, sign in to the ArcGIS Portal Directory as an administrator. The URL for the ArcGIS Portal Directory is in the format `https://webadaptorhost.domain.com/webadaptorname/portaladmin`.
2. From the Portal Administrator Directory, click **Security** > **OAuth** > **Get App Info**.
3. For **App ID**, type `arcgisInsights`.
4. Change the **Format** setting to JSON.
5. Click **Get App Info**.
6. Copy the JSON output.
7. Return to the **OAuth** page.
8. Click **Update App Info**.
9. Change the **Format** setting to JSON and paste the copied text in the **App Info** text box.
10. Add the information for the primary connection into the `redirectURIs` array. Use the following code as an example:

```
{
        "appId":"arcgisInsights",
        "redirectURIs":["https://dataonlyconnection.domain.com",
                        "https://primaryconnection.domain.com"]
}
```

11. Click **Update App**.

The page can now be shared or the workbook can be packaged successfully.

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Databases

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Supported data types from databases

The following tables list data types for each supported database, and how each type maps to Esri field types. Field types listed as not supported will not appear in your database tables in Insights.

Google BigQuery data types

Note:
BigQuery only supports GEOGRAPHY data types using spatial reference 4326 (World Geodetic System 1984).

BigQuery data type	Esri field type
STRING	esriFieldTypeString
BYTES	Not supported
INTEGER	esriFieldTypeInteger
FLOAT	esriFieldTypeDouble
NUMERIC	esriFieldTypeDouble
BOOLEAN	Not supported
RECORD	Not supported
TIMESTAMP	esriFieldTypeDate
DATE	esriFieldTypeDate
TIME	esriFieldTypeDate
DATETIME	esriFieldTypeDate
ARRAY	Not supported
STRUCT	Not supported
GEOGRAPHY	esriFieldTypeGeometry
REPEATED COLUMNS	Not supported
BIGNUMERIC	esriFieldTypeDouble

Microsoft SQL Server data types

Microsoft SQL Server data type	Esri field type
bigint	esriFieldTypeDouble
binary	esriFieldTypeString
bit	Not supported
char	esriFieldTypeString
date	esriFieldTypeDate
datetime	esriFieldTypeDate
datetime2	esriFieldTypeDate
datetimeoffset	Not supported

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Microsoft SQL Server data type	Esri field type
decimal	esriFieldTypeDouble
float	esriFieldTypeDouble
geography	esriFieldTypeGeometry
geometry	esriFieldTypeGeometry
image	Not supported
int	esriFieldTypeInteger
money	esriFieldTypeDouble
nchar	esriFieldTypeString
ntext	Not supported
numeric	esriFieldTypeDouble
nvarchar	esriFieldTypeString
real	esriFieldTypeSingle
smalldatetime	esriFieldTypeDate
smallint	esriFieldTypeSmallInteger
smallmoney	esriFieldTypeDouble
text	Not supported
time	esriFieldTypeDate
timestamp	Not supported
tinyint	esriFieldTypeSmallInteger
udt	Not supported
uniqueidentifier	esriFieldTypeString
varbinary	Not supported
varchar	esriFieldTypeString
xml	Not supported

Oracle data types

Oracle data type	Esri field type
Any types	Not supported
BFILE	Not supported
BINARY_DOUBLE	esriFieldTypeDouble
BINARY_FLOAT	esriFieldTypeDouble
BLOB	Not supported
CHAR	esriFieldTypeString
CLOB	Not supported

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Oracle data type	Esri field type
DATE	esriFieldTypeDate
INTERVAL DAY TO SECOND	Not supported
INTERVAL YEAR TO MONTH	Not supported
LONG	Not supported
LONG RAW	Not supported
Media types	Not supported
NCHAR	esriFieldTypeString
NCLOB	Not supported
NUMBER	One of the following, based on precision and scale: • esriFieldTypeSmallInteger (precision: 1–4, scale: 0) • esriFieldTypeInteger (precision: 5–9, scale: 0) • esriFieldTypeSingle (precision: 1–6, scale: 1–6) • esriFieldTypeDouble (precision: 7+, scale: 7+ or precision: 10+, scale: 0+)
NVARCHAR2	esriFieldTypeString
RAW	Not supported
ROWID	esriFieldTypeString
SDO_GEOMETRY	esriFieldTypeGeometry
SDO_GEORASTER	Not supported
SDO_TOPO_GEOMETRY	Not supported
ST_GEOMETRY	esriFieldTypeGeometry **Note:** ST_GEOMETRY data types require external procedures to be configured before they can be used in Insights.
TIMESTAMP	esriFieldTypeDate
TIMESTAMP WITH LOCALTIME ZONE	Not supported
TIMESTAMP WITH TIMEZONE	Not supported
URI types	Not supported
UROWID	esriFieldTypeString
VARCHAR2	esriFieldTypeString
XML types	Not supported
User-defined types	Not supported

PostgreSQL data types

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PostgreSQL data type	Esri field type
BIGINT	esriFieldTypeDouble
BIGSERIAL	esriFieldTypeDouble
BIT	Not supported
BIT VARYING	Not supported
BOOLEAN	Not supported
BOX	Not supported
BYTEA	Not supported
CHARACTER	esriFieldTypeString
CHARACTER VARYING	esriFieldTypeString
CIDR	Not supported
CIRCLE	Not supported
DATE	esriFieldTypeDate
DOUBLE PRECISION	esriFieldTypeDouble
INET	Not supported
INTEGER	esriFieldTypeInteger
INTERVAL	Not supported
JSON	Not supported
JSONB	Not supported
LINE	Not supported
LSEG	Not supported
MACADDR	Not supported
MONEY	esriFieldTypeDouble
NUMERIC	esriFieldTypeDouble
PATH	Not supported
PG_LSN	Not supported
POINT	esriFieldTypeGeometry
POLYGON	esriFieldTypeGeometry
REAL	esriFieldTypeSingle
SMALLINT	esriFieldTypeSmallInteger
SMALLSERIAL	esriFieldTypeSmallInteger
SERIAL	esriFieldTypeInteger
TEXT	esriFieldTypeString
TIME (without time zone)	esriFieldTypeDate

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PostgreSQL data type	Esri field type
TIME (with time zone)	Not supported
TIMESTAMP (without time zone)	esriFieldTypeDate
TIMESTAMP (with time zone)	Not supported
TSQUERY	Not supported
TSVECTOR	Not supported
TXID_SNAPSHOT	Not supported
UUID	Not supported
XML	Not supported

SAP HANA data types

SAP HANA data type	Esri field type
ALPHANUM	esriFieldTypeString
BIGINT	esriFieldTypeDouble
BINTEXT	Not supported
BLOB	Not supported
BOOLEAN	Not supported
CLOB	Not supported
DATE	esriFieldTypeDate
DECIMAL	esriFieldTypeDouble
DOUBLE	esriFieldTypeDouble
INTEGER	esriFieldTypeInteger
NCLOB	Not supported
NVARCHAR	esriFieldTypeString
REAL	esriFieldTypeSingle
SECONDDATE	esriFieldTypeDate
SHORTTEXT	esriFieldTypeString
SMALLDECIMAL	esriFieldTypeDouble
SMALLINT	esriFieldTypeSmallInteger
ST_GEOMETRY	esriFieldTypeGeometry
ST_POINT	esriFieldTypeGeometry
TEXT	Not supported
TIME	esriFieldTypeDate
TIMESTAMP	esriFieldTypeDate
TINYINT	esriFieldTypeSmallInteger

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SAP HANA data type	Esri field type
VARBINARY	Not supported
VARCHAR	esriFieldTypeString

Snowflake data types

Note:
Snowflake only supports GEOGRAPHY data types using spatial reference 4326 (World Geodetic System 1984).

Snowflake data type	Esri field type
ARRAY	Not supported
BIGINT	esriFieldTypeInteger
BOOLEAN	Not supported
BINARY	Not supported
CHAR	esriFieldTypeString
CHARACTER	esriFieldTypeString
DATE	esriFieldTypeDate
DATETIME	esriFieldTypeDate
DECIMAL	esriFieldTypeDouble
DOUBLE	esriFieldTypeDouble
DOUBLE PRECISION	esriFieldTypeDouble
FLOAT	esriFieldTypeDouble
FLOAT4	esriFieldTypeDouble
FLOAT8	esriFieldTypeDouble
GEOGRAPHY	esriFieldTypeGeometry
INT	esriFieldTypeInteger
INTEGER	esriFieldTypeInteger
NUMBER	esriFieldTypeDouble
NUMERIC	esriFieldTypeDouble
OBJECT	Not supported
REAL	esriFieldTypeSingle
SMALLINT	esriFieldTypeSmallInteger
STRING	esriFieldTypeString
TEXT	esriFieldTypeString
TIME	esriFieldTypeDate
TIMESTAMP	esriFieldTypeDate
TIMESTAMP_NTZ	esriFieldTypeDate

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Snowflake data type	Esri field type
TIMESTAMP_LTZ	Not supported
TIMESTAMP_TZ	Not supported
VARBINARY	Not supported
VARCHAR	esriFieldTypeString
VARIANT	Not supported

Resources

For more information about databases and Insights, see the following:

- Supported databases
- Create a database connection

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Understanding data in relational databases

Relational databases

Data in relational databases is stored in tables. Each table is a set of rows and columns. Each column has a type, and many databases support one or more native spatial data types.

The data type determines the following:

- Which values can be stored in a column
- Which operations can be performed on the data in that column
- How the data is physically stored in the database

ArcGIS Insights supports direct access to specific data types from a list of supported database management systems. When accessing a database table directly through an add data workflow, Insights filters out any unsupported data types.

Note:
Database tables accessed through Insights are read-only and cannot be edited. This includes cases in which a dataset has been shared with others in your organization as a feature layer, and edits are being attempted in a client application other than Insights.

Tip:
When using data from a database causes an error, detailed information is added to the ArcGIS Server logs on your portal's hosting server site. Work with your ArcGIS Server administrator to diagnose and resolve any issues.

Connecting to a database

Before you can use data from a database in Insights, you must create a database connection. Before you create a database connection, certain prerequisites must be met.

The process of establishing a database connection in Insights in ArcGIS Enterprise creates a Relational Database Connection item in the portal's **Content** tab and the **Connections** tab on the Insights home page. This item can subsequently be shared with others. Sharing a database connection item only shares the ability to browse the contents of the database. The credentials used when establishing the connection are never exposed to those with whom the item has been shared.

If an issue arises while creating a database connection, see Troubleshoot a database connection.

Caution:
If you're having trouble using a database connection that previously worked in Insights, you may need to update the connection. Deleting the database connection will render any dependent datasets inoperable. You should only delete a relational database connection when you are sure no datasets are dependent, or you purposefully want to disable upstream datasets.

While database connections update to reflect the current state of the database, datasets reflect the schema of the table or view at the time of dataset creation. Datasets created from a database connection are dependent on the schema, naming conventions, and existing spatial data objects (geometry types and spatial reference identifiers) of

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the database. Renaming or deleting tables and views referenced by a dataset will break the dataset. Likewise, field names and data types must remain static for a dataset to be functional.

Geodatabases

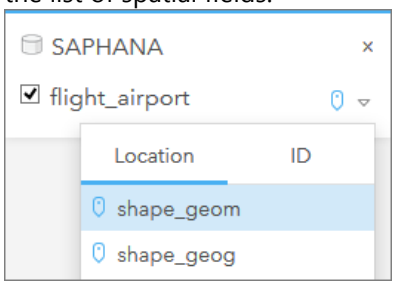
Insights allows you to create a connection to a supported Microsoft SQL Server, Oracle, SAP HANA, or PostgreSQL database that has a non-versioned enterprise geodatabase defined. If the geodatabase is versioned, the data must be unregistered as versioned to work in Insights. Currently, only geodatabase user tables not created under the sde user schema can be viewed and accessed from Insights. Insights does not work directly with file and personal geodatabases.

Spatial datasets

Database tables do not need to be spatially enabled to be used in Insights. A spatially enabled table contains a field that Insights interprets as a location field. When a location field is detected in a table, Insights makes a number of assumptions described in the following sections.

Single spatial column

Insights only supports one spatial column per database table. You can choose which spatial field will be used as the location field by clicking the location field icon next to the table name under **Selected Data** and choosing from the list of spatial fields.



Supported geometry types

The databases Insights supports are compliant with the Open Geospatial Consortium (OGC) and International Organization for Standardization (ISO) standard for simple feature access. The following table lists supported OGC/ISO geometry types, along with how they are interpreted in Insights:

OGC/ISO	Geometry Type
`POINT`	Point
`LINESTRING` `MULTILINESTRING`	Line
`POLYGON` `MULTIPOLYGON`	Area

Insights does not enforce the OGC/ISO standards. When an unsupported geometry type is encountered, an error will occur.

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Same geometry type

It is expected that all geometries in a spatial column share the same geometry type; for example, all point, all line, or all area. The geometry type for a dataset is determined by querying the first row in the table where the spatial column is not a null value.

Insights does not check for the same geometry. Unexpected results or errors may occur if rows in the dataset fail to meet this expectation.

Same spatial reference

It is expected that all geometries in a spatial column share a common spatial reference identifier (SRID). The spatial reference of the dataset is determined by querying the first row in the table where the spatial column is not a null value.

Insights does not check for the same spatial reference. Unexpected results or errors may occur if rows in the database fail to meet this expectation.

Project on the fly

Insights displays spatial data in the spatial reference system of your default basemap. This is for display and query purposes only; the underlying data is not altered. If the underlying geographic coordinate systems of the two spatial reference systems are incompatible, alignment and accuracy problems may be observed. To ensure fast performance and accurate display of spatial data, the spatial reference system of your spatial datasets should match the spatial reference system of the default basemap.

Note:
If your data is from a SAP HANA database and it is not possible for the spatial reference system of your spatial datasets to match the spatial reference system of the default basemap, it is recommended that unbounded SRIDs be used for your spatial datasets. Unbounded SRIDs will ensure that your spatial data can be displayed even if the extent of your organization's default basemap exceeds the extent of the spatial reference system of your spatial data.

Spatial operations

When performing spatial aggregation or spatial filtering using two datasets from a database connection, the spatial data in both datasets must have the same spatial reference system. For SQL Server database connections, the data must also have the same data type (geography or geometry).

Coordinate dimensionality

Coordinate dimensionality is defined by the x-, y-, z-, and m-coordinates for each vertex in a geometry. Insights ignores any z- and m-coordinates returned from the database.

Optimizing database content for performance

Properly configured and tuned databases always perform best. The following represent some considerations database administrators should make for ensuring an optimal user experience in Insights:

- Up-to-date database statistics

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Database statistics are used by the database management system optimizer to choose the optimal execution plan for the query being executed. Up-to-date statistics will help maintain query performance.

- Primary key constraints

  A primary key constraint uniquely identifies each row in a database table. Although not a requirement, it is recommended that a primary key be defined on database tables. Further, a single integer type field is recommend for a primary key.

- Use both attribute and spatial indexes

  If your database platform supports it, index any fields used for querying or rendering your data.

- Common spatial reference

  If possible, keep all data in a common spatial reference, and ideally, use the same projection as your organization's default basemap. This will avoid on-the-fly projection calculations when drawing data on a map and will prevent errors during spatial analysis.

- Simplified data

  Use the most simplified or generalized version of spatial data that will satisfy the visualization and analysis requirements of your organization. Simplified data has fewer vertices and line segments than complex datasets, meaning it will draw faster and analysis results will be returned sooner.

- Spatial joins at ETL time

  Spatial joins at run time can be expensive. Because spatial data does not change often, it's worth it to pay the price of performing spatial joins on data in the database once, and, at run time, performing attribute joins to achieve the same results.

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Unique identifiers

Each row in a database table must be uniquely identifiable to be used in Insights. The following logic is used to determine which columns are used to identify uniqueness:

- Search for a primary key. If one is found, use the columns that define the primary key.
- Search for an index that is flagged as unique. If one is found, use the columns that define the index.

Tip:

Unexpected results may occur if a unique index is used and null values are included in the selected columns. It is best practice to define a primary key for all tables. If it is not possible to define a primary key, the columns that participate in a unique index should be flagged in the database as `not null`.

If the above criteria are not met, a warning icon appears when the table is selected to add to a workbook, and a unique identifier must be applied. A unique identifier is a field or a combination of fields that uniquely identifies every row in your data. If a single field is used, the field must contain only unique values and cannot contain null values. If multiple fields are used, the individual fields do not require only unique values, but the combination of the rows must always be unique.

A unique identifier can be created using string or integer columns. Date, float, and double columns cannot be chosen as the unique identifier.

Examples

The following table contains sales data for a retail chain. The table includes a store number, the state where the store is located, and the total amount in sales. Two of the fields, **Store number** and **Total sales**, contain all unique vales and no nulls. The other field, **State**, does not contain unique values. In this case, the **Store number** field should be used as the unique identifier, since each store is only listed once and you know the store number will always be unique for each store.

Store number	State	Total sales
1001	Colorado	1,583,296.29
1002	Colorado	1,938,495.84
1003	Wyoming	1,439,752.57
1004	Montana	2,583,485.83
1005	Montana	928,573.67

If a single field does not fit the requirements for a unique identifier, or if you are not confident that the values in the field will always remain unique, you can combine multiple fields to create unique entries. The following table includes the number of items in stock at each store. Unlike in the previous example, the **Store number** field is not unique, because there are multiple items in stock per store. The **Item ID** field is also not unique. The **Quantity** field is currently unique, but the number of items in stock at a store is likely to change and will not always be unique, so that field should not be used as an identifier. A better identifier would be a combination of the **Store number** and **Item ID** fields, since each item is only listed once per store.

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Store number	Item ID	Quantity
1001	123456	20
1001	234567	5
1001	345678	16
1002	123456	11
1002	234567	0
1002	345678	21

Choose a unique identifier

Complete the following steps to apply a unique identifier from the database table:

1. Click the warning icon ⚠.
   The **Choose a unique identifier** window appears. The window displays the nonspatial fields in the database table that do not contain null values, as well as the field type.
2. Do one of the following:
   - If you know which column or combination of columns is best to create a unique identifier, select the fields.
   - If you do not know which column or combination of columns is best to create a unique identifier, click the **Analyze** button to scan the table for columns that contain all unique values. Columns containing unique values are indicated using the following icon: ⚿
   - If the table does not have columns that can be used as a unique identifier, or if you do not want to create a unique identifier from the existing fields, you can choose **Copy the database table and create a primary key**.
3. Click **Apply**.

Create a primary key

Some database tables do not include columns that can be used as a unique identifier. Therefore, a primary key must be created before the table can be used in Insights. For those tables, you must select **Copy the database table and create a primary key**.

Insights does not edit the data in your database tables, including adding a primary key column. A copy of the database table is created before the primary key is applied. The location of the copied database table depends on the permissions for the database connection. For read-write connections, the copied table is stored in the database. For read-only connections, the table is copied and stored in the Insights workbook. Datasets copied to a workbook will have the same functionality as hosted feature layers or uploaded files.

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Database data caching

Data caching allows ArcGIS Insights to create and manage tables in your managed database to improve query performance. The user that creates the database connection must have been granted all required database privileges for data caching to be triggered.

Note:
Data caching is not performed for Google BigQuery, Snowflake, or database platforms that are not supported out of the box.

Data caching is only used for the Spatial Aggregation and Spatial Filter capabilities.

Data will only be cached if all the following conditions are met:

- Both datasets originate from the same database connection.
- The spatial data from both datasets is stored using the same spatial data type.
- The spatial data from both datasets is stored using the same spatial reference system.

Data caching table location and naming

Data caching tables are always created under your default schema and are named using the following prefixes:

Database	Table name prefix
Microsoft SQL Server, PostgreSQL, and SAP HANA	`$IN_` Example: `$IN_0xmneL7PT7e4uuE4eL4z7w`
Oracle	`T$IN_` Example: `T$IN_A3GZAW7ZRMQNLJP3IRCQAQ`
Other database platforms	Not applicable

Note:
Data caching tables are intended for internal use and are never visible through database connections in Insights.

Data caching table life cycle

Data caching tables are tied to Insights datasets and workbooks. A single dataset may refer to one or more data caching tables. Data caching tables are fully managed by Insights and are deleted after one of the following actions takes place:

- The workbook is deleted.
- All referring datasets are removed and the workbook is reopened.
- A referring dataset is refreshed.*

*In this case, a new data caching table containing the refreshed data will be created.

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Troubleshoot a database connection

When creating a new database connection or trying to access an existing database connection, ArcGIS Insights may not be able to establish a connection to the database.

When a connection problem occurs, one of the following messages appears:

- **Invalid credentials. Ensure the username and password provided for this connection are correct** indicates that an incorrect username or password was entered.
- **Invalid host. Ensure server name provided for this connection is valid and that the host is accessible** indicates that an incorrect server name or port number was entered.
- **Invalid database name. Ensure database name provided for this connection is valid** indicates that an incorrect database name or instance name was entered.
- **Insufficient privileges. Ensure the user has appropriate privileges on this database** indicates that the database user requires additional privileges before a connection can be created between Insights and the database.
- **Something went wrong. Verify your connection properties, or click here to troubleshoot this** is used for SAP HANA only. This error message indicates that one of the required parameters is incorrect.
- **Required library was not found. Ensure the database installation contains the required library. Click here for more information** is used when an Oracle or PostgreSQL database is missing a required library. For Oracle, the required library is `st_shapelib.dll` on Windows or `libst_shapelib.so` on Linux or Unix. For PostgreSQL, the required library is `st_geometry.dll` on Windows or `st_geometry.so` on Linux.
- **Data connection issue. Check if connection properties need updating and that all required vendor files are uploaded** indicates that one or more of the database connection properties have changed (for example, if the **Warehouse name** is missing or incorrect in a connection to Snowflake), or the vendor file is missing. Contact your database administrator to determine which properties require updates, or your ArcGIS administrator to determine if the vendor file is missing or requires updates.
- **We couldn't connect to the database** indicates that the error could not be identified. The most common cause of this error is invalid credentials for connections to Google BigQuery (**Project** or **Private key**) or Snowflake (**Username**, **Password**, or **Warehouse name**).
- **SSL certificate error. Refer to the help documentation for more information** indicates that a certificate authority (CA) is missing from the operating system. This error can occur when using Insights desktop on macOS to connect to SAP HANA Cloud (**Connect using SSL** is selected) or Snowflake. For information on importing a CA to your operating system, see the macOS help documentation.
- **The required connector type is not available. Contact an ArcGIS administrator to add or update the connector** indicates that the database cannot be accessed because the connector is out of date or was deleted. The ArcGIS administrator can resolve issues with an outdated connector by deleting the connector then readding it with the latest files.

The following list provides common causes of database connection problems that can be investigated:

- The connection properties, such as **Username**, **Password**, and **Port number** are invalid. Verify that the connection properties for the database connection are correct. If changes are required for an existing database connection, you can edit these properties by updating the database connection.
- You don't have the database privileges required to create the connection.

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- Database vendor files are not present or the connector was not added correctly. See Manage connector types for more information.
- The vendor files are out of date or unsupported. If an unsupported vendor file is used, the database connection may be made successfully, but newer functionality in Insights cannot be used. For example, certain spatial analysis capabilities may run without completing. For information on the latest certified vendor files, see Required vendor files.
- The database is not configured to accept connections. Some databases require additional configuration to allow remote clients to connect. For example, for Microsoft SQL Server databases, you must enable the server network protocol to accept connections over the network.
- Connections have been blocked. Database administrators can prevent users from connecting to a database while they perform certain database maintenance tasks, such as backup and recovery, and upgrades.

Caution:

If you're having trouble using a database connection that previously worked in Insights, you may need to update the connection. Deleting the database connection will render any dependent datasets inoperable. You should only delete a relational database connection when you are sure no datasets are dependent, or you purposefully want to disable upstream datasets.

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Visualize

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Maps

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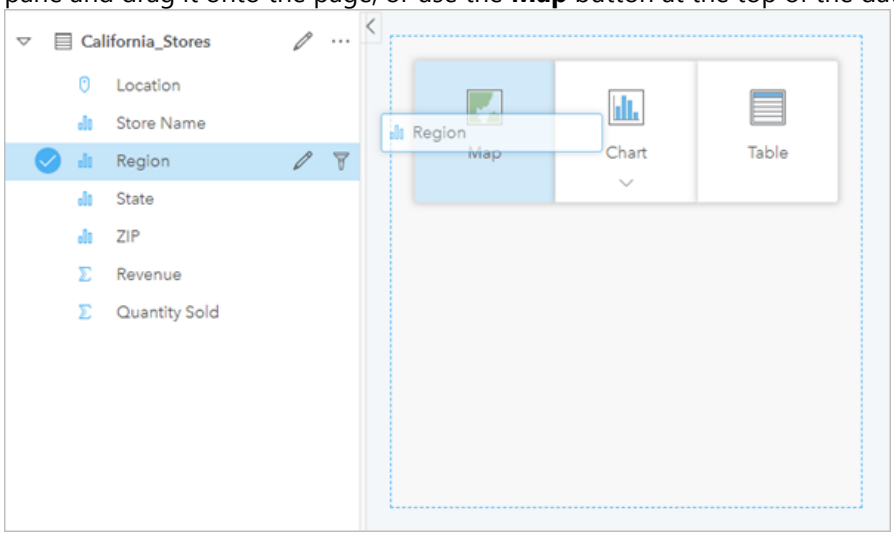
Create a map

To create a map, you must have added data to your page. A map is created by default when you add data from a feature layer, including layers from ArcGIS Living Atlas of the World. If the dataset you added doesn't contain a Location field, you must enable location before you can create a map.

To create interactive maps, select a location, string, number, or rate/ratio field, or a complete dataset, from the data pane and drag it onto the page, or use the **Map** button at the top of the data pane.



Drag a layer or field to the Map drop zone to create a map. You can also create a map by selecting a field and clicking Map above the data pane.

Tip:

You can copy a map card onto another page by dragging it to the **New page** tab + or an already created page. If you want to copy the map onto the same page, use `Ctrl+C` to copy and `Ctrl+V` to paste.

The field type that you select determines the type of map you create. You can also switch to a map from an existing chart or table. The type of map you switch to depends on the data inputs from the existing card. For example, a bar chart switches to a category map. A histogram switches to a graduated symbol map.

To learn more about the data requirements for each map type, as well as examples and information on properties you can change and interact with, see the individual map topics, such as unique values maps and link maps.

After you have a map on your page, you can begin exploring your data using spatial analysis or change the style of your map.

A warning icon ⚠ indicates that the map is not displaying all of the features from the dataset. The warning will be displayed for maps with more than 100,000 features within the map extent. Click on the icon to display the number of features being rendered. The complete dataset will still be used for spatial analysis, provided there are no filters or selections, even if the full dataset is not being rendered.

Tip:

If you are using a point dataset, switching to a binned map will allow you to display all of the data.

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Map types

There are several types of maps that can be created using ArcGIS Insights. Insights uses smart mapping to create the best type of map for the data you want to visualize, so you know you are always getting the best type of map for the field that you are mapping.

The table below indicates the inputs for each map, related visualizations you can switch to using the **Visualization type** button , and questions the map can help you answer.

Visualization	Data types	Related visualization types	Questions it can help you answer
Binned map	Point data (required) and number or rate/ratio field (optional).	• Heat map • Location map • Summary table • Reference table • KPI • Histogram • Bar chart • Column chart • Treemap • Bubble chart • Line graph • Box plot • Donut chart	Where is it located? How is it distributed? Where are high values? Where are low values?
Choropleth map	Number or rate/ratio field.	• Graduated symbol map • Summary table • Reference table • KPI • Histogram • Box plot	How is it distributed?

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Visualization	Data types	Related visualization types	Questions it can help you answer
Column chart symbols	Multipart features and a string field.	• Unique values maps • Pie chart symbols • Summary table • Reference table • Bar chart • Stacked bar chart • Column chart • Stacked column chart • Treemap • Heat chart • Chord diagram • Data clock • Link chart • Line graph	Where is it located? How is it distributed (by category)?
Heat map	Point data.	• Binned map • Location map • Summary table • Reference table • KPI • Histogram • Box plot	How is it distributed?

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Visualization	Data types	Related visualization types	Questions it can help you answer
Link map	Two location fields.	• Summary table • Reference table • Bar chart • Stacked bar chart • Column chart • Stacked column chart • Treemap • Heat chart • Chord diagram • Data clock • Link chart • Line graph	How is it related?
Location map	One location field.	• Binned map • Heat map • Summary table • Reference table • Bar chart • Column chart • Treemap • Bubble chart • Line graph • Donut chart	Where is it located? How is it distributed?

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Visualization	Data types	Related visualization types	Questions it can help you answer
Pie chart symbols	Multipart features and a string field.	• Unique values maps • Column chart symbols • Summary table • Reference table • Bar chart • Stacked bar chart • Column chart • Stacked column chart • Treemap • Heat chart • Chord diagram • Data clock • Link chart • Line graph	Where is it located? How is it distributed (by category)?
Graduated symbol map	One number field.	• Choropleth map • Summary table • Reference table • KPI • Histogram • Box plot	Where is it located? How is it distributed? Where are high values? Where are low values?

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Visualization	Data types	Related visualization types	Questions it can help you answer
Unique values map	One string field.	• Summary table • Reference table • KPI • Bar chart • Column chart • Treemap • Bubble chart • Line graph • Donut chart	Where is it located? How is it distributed (by category)?

Change a basemap

The default basemap used for your map cards will be the same as the default basemap in your ArcGIS Enterprise organization. You can change the basemap for your map cards using the **Basemaps** menu button on the page toolbar.

Note:
If a map card is activated then changing the basemap will update only the active card. If no map cards are active then all of the maps will have their basemap changed. A map card is active when you see the map toolbar and the **Action** button.

Add or remove a layer

Maps represent data from different datasets as separate layers. A new layer can be added to the map by dragging a field from a different dataset to the **Add new layer** drop zone on an existing map.

A layer can be deleted from a map by expanding the **Layer options** pane › and clicking the **Delete** button. You can also temporarily turn off a layer on a map by clicking the layer symbol next to the layer name in the legend.

Use the map toolbar

Every map has a toolbar that can be used to find more information or manipulate the data or card.

Tool	Description
Layer options	The **Layer options** button can be used to show or hide the name and symbol of datasets being displayed on the map. The **Layer options** pane gives access to the legend, symbology, and appearance for the layer. **Note:** Hidden layers will remain hidden if the page is shared.
Card filter	The **Card filter** button can be used to remove any unwanted data from your chart. Filters can be applied to all string, number, rate/ratio, and date/time fields. A card filter does not affect other cards using the same dataset. For more information, see Filter data.

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Tool	Description
Selection tools	Selections can be used to highlight important features. Selections on one card are reflected on any other card using the same data. The following selection tools are available on map cards: • **Select** • **Box select** • **Lasso** • **Zoom to selection** • **Invert selection** For more information, see Make selections.
Zoom tools	The **Zoom tools** can be used to change the extent of your data. The following **Zoom tools** can be used on map cards: • **Zoom in** • **Zoom out** • **Zoom to selection** • **Set default extent** • **Clear default extent** • **Zoom to layer** **Tip:** You can also zoom using Shift + click + drag. For more information, see Navigate maps.
Visualization type	The **Visualization type** drop-down menu shows all available card types. The drop-down list can be used to quickly change your card to a summary table or chart. The availability of visualizations depends on what type of data is being displayed on your card.
Sync extents	The **Sync extents** button can be used to display all maps at the same extent and zoom level.
Maximize	The **Maximize** button is used to enlarge the card. Other cards on the page will be reduced to thumbnails. The card can be returned to its previous size using the **Restore down** button.
Enable cross filters	The **Enable cross filters** button is used to allow filters to be created on the card using selections on other cards. Cross filters can be removed using the **Disable cross filters** button. For more information, see Filter data.
Flip card	The **Flip card** button flips the card to display information about the layers on your map, such as the count of features, the timestamp for when the data was last updated, and the references for the basemap. There is also a space for you to describe the analysis on the card.
Delete	The **Delete** button removes the card from your page. If you did not intend to delete your card, you can retrieve it using the **Undo** button.

Change the layer options

The **Layer options** pane can be accessed by clicking the arrow › in the layer list. The options in the **Layer options** pane are dependent on the type of data being mapped.

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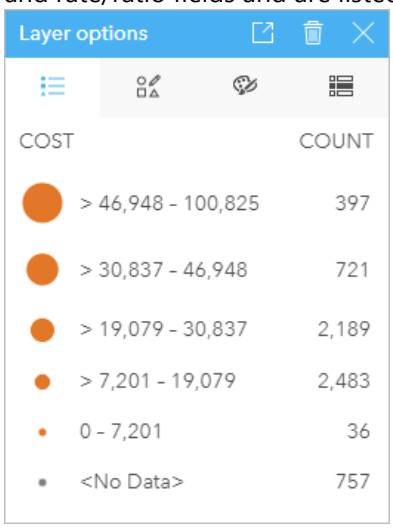
Legend tab

Each layer includes a legend, which can be found on the **Legend** tab of the **Layer options** pane. For layers styled by the **Counts and amounts (Size)**, **Counts and amounts (Color)**, **Types (Unique symbols)**, and **Bins** symbol types, the legend will be interactive, meaning any selections you make in the legend will be reflected on the map. Each entry in the legend also includes a count of features and may include category or range values, depending on the **Symbol type**. Null values (called **<No Data>** in the legend) are displayed with a gray symbol for string, number, and rate/ratio fields and are listed last in the **Legend** tab.



The Legend tab of the Layer options pane displays the symbols and count for features in the layer. This legend is displaying classified graduated symbols from the COST field.

The **Legend** tab can be used to change the color of individual categories for maps symbolized by Types (Unique symbols) or for **<No Data>** values. To change the color associated with a category, click the symbol and choose a color from the palette or enter a hex value.

The map legend can be added to the page as a separate card. To create a legend, click the **Pop out legend** button on the **Legend** tab.

Symbology tab

The **Symbology** tab is used to change the field and type of symbols being used to style your map.

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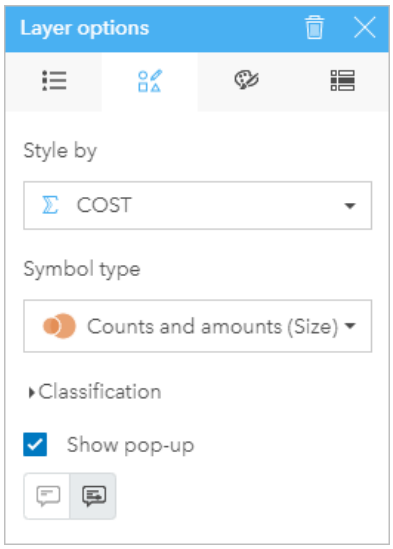

The Symbology tab of the Layer options pane allows you to choose the field and symbol type used to style your layer. The Classification parameter is only available when using Counts and amounts (Size) or Counts and amounts (Color) for the Symbol type parameter.

The following table summarizes all of the potential parameters for all types of data.

Parameter	Description
Style by	The **Style by** parameter depicts which field is being used to display the data on the map. This property is available for all features with location, string, number, or rate/ratio field types.
Symbol type	The **Symbol type** parameter determines how the points, lines, or areas appear on the map. **Symbol type** options depend on the type of features and field type being mapped. This property is available for all features.
Classification type	**Classification type** is the method of grouping numeric data into ranges. The classification methods include **Natural breaks**, **Equal interval**, **Quantile**, **Standard deviation**, **Unclassed**, and **Manual**. This property is available when using the **Counts and amounts (Color)** or **Counts and amounts (Size)** symbol type.
Show pop-up	The **Show pop-up** parameter determines if pop-ups are displayed when you hover over a feature, and what information is included in the pop-ups.

Style by

The **Style by** parameter depicts which field is being used to display the data on the map. You can use the drop-down menu to change the **Style by** parameter to a different field. You can also select a field from the layer being mapped in the data pane and drag the layer to the map to change the style.

If the mapped dataset had location enabled without the Repeat identical features parameter checked or was created through spatial aggregation, the **Style by** parameter will have statistic options including sum, minimum, maximum, and average.

Any field with a location, string, number, or rate/ratio field type can be used to style a layer. Date/Time fields cannot be styled on a map.

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Symbol type

Symbol types determine how symbols are rendered on your map. Options in the **Symbol type** parameter reflect the supported map renderers in Insights. Smart mapping defines how symbol types are shown on a map based on the type of field you are showing. The following table lists smart mapping symbol types supported by Insights, as well as the applicable field types, and the maps they produce:

Symbol type	Features	Description
Counts and amounts (Color)	Feature types: Points, lines, and areas Field types: Number and rate/ratio	The **Counts and amounts (Color)** symbol type uses graduated colors to style numeric values. The color ramp used can be either sequential or diverging: • Sequential—A single color that ranges from light to dark is used to display data. Usually the data that has a more neutral meaning will be light, while higher values or values with more meaning will be dark. • Diverging—Two colors are used to display data with important meaning at both the low and high extremes. The colors have dark shades at the lower and upper extremes and neutral colors in the middle. Using **Counts and amounts (Color)** as the symbol type results in a choropleth map. This is the default symbol type for rate/ratio fields.
Counts and amounts (Size)	Feature types: Points, lines, and areas Field types: Number and rate/ratio	The **Counts and amounts (Size)** symbol type uses graduated symbols to style numeric values. The symbol size will reflect the size of the numbers, with the smallest numbers being styled with the smallest symbols and the largest numbers being styled with the largest symbols. Using **Counts and amounts (Size)** as the symbol type results in a graduated symbol map. This is the default symbol type for number fields.
Types (Unique symbols)	Field types: Location, string, number, and rate/ratio	The **Types (Unique symbols)** symbol type uses a different color for every unique value in the field being symbolized. It is most common to use **Types (Unique symbols)** when mapping categorical data (string fields) with relatively few unique field values. Using **Types (Unique symbols)** as the symbol type results in a unique values map. This is the default symbol type for string fields.
Location (Single symbol)	Feature types: Points, lines, and areas Field types: Location	The **Location (Single symbol)** symbol type uses uniform symbols for all features. Styling features by location only helps you to focus on the distribution of features, rather than field values. Using **Location (Single symbol)** as the symbol type results in a location map. This is the default symbol type for location fields.
Bins	Feature types: Points Field types: Location and number	The **Bins** symbol type uses points in the layer to calculate and display the relative density of points on the map as a set of polygonal bins. Binned maps are styled by graduated colors. The color ramp used can be either sequential or diverging.

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Symbol type	Features	Description
Heat map	Feature types: Points Field types: Location, string, number, and rate/ratio	The Heat map symbol type uses points in the layer to calculate and display the relative density of points on the map as smoothly varying sets of colors ranging from cool (low density of points) to hot (many points).

While smart mapping symbol types provide effective maps right away, sometimes you may want your map to use a predefined symbol type from an ArcGIS dataset (for example, an ArcGIS feature layer that shows crime incidents as point data in red). If your dataset originated from Portal for ArcGIS, you'll see the **Original** symbol type. This option allows you to revert to the original symbol settings for symbol color, shape, size, and transparency.

Classification

When you map numeric data using Counts and amounts (Size) or Counts and amounts (Color), numbers are automatically grouped into classes using the natural breaks classification method. Classification allocates observations into each class and uses graduated symbol size or color to represent the classes.

Classification method	Description
Natural breaks	Classes are based on natural groupings inherent in the data. This is the default classification. The default number of bins is 5.
Equal interval	Divides the range of attribute values into equal-sized subranges. The default number of bins is 5.
Quantile	Divides the attributes into bins with equal numbers of features. The default number of bins is 5.
Standard deviation	Classifies a feature based on how much the feature's attributes vary from the mean. The number of bins used will depend on your data.
Unclassed	Numeric data is displayed on a continuous scale, rather than in discrete classes. There are no bins used in the **Unclassed** method.
Manual	Manually add class breaks that are appropriate for your data. There are no bins used in the **Manual** method.

Divide by calculates a rate/ratio by dividing the number field you used to style your map by the number field you select from the list. This allows you to calculate a rate/ratio on the fly if your dataset doesn't already contain normalized data.

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Note:

- If you used a rate/ratio field, **Divide by** is not available because the field is already identified as a normalized field.
- An error will occur if an aggregated field is used to normalize database data using the **Divide by** property. Normalizing an aggregated field from a database dataset will also cause an error.

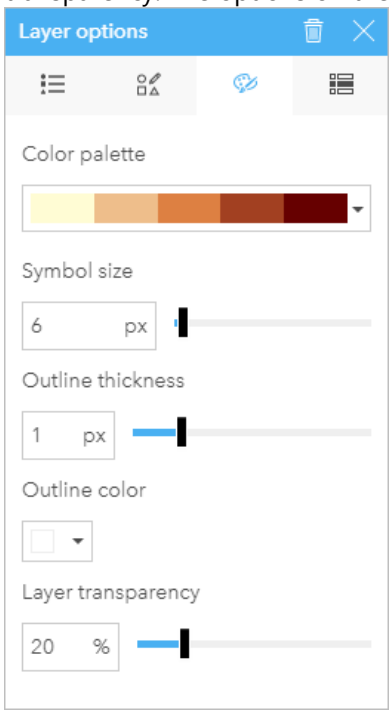
Show pop-up

The **Show pop-up** parameter allows you to enable or disable pop-ups when hovering over features on a map. If pop-ups are enabled, there is an additional option to view the pop-ups with statistics (for example, minimum, maximum, and average values) or without statistics (display field and feature value only).

Show pop-up is available on all map types except heat maps. The **With statistics** button and **Without statistics** button are available for all map types except location maps and heat maps.

Appearance tab

After you choose your data and symbol type, you can adjust the style properties, such as color, shape, and transparency. The options on the **Appearance** tab will vary based on the symbol type and type of features.



The Appearance tab includes parameters that can be used to customize the symbols for your layer. The parameter options are dependent on the choices for the Style by and Symbol type parameters on the Symbology tab.

Attributes tab

The **Attributes** tab is used to view a list of attributes and values for one or more features selected in the layer. The **Attributes** tab will only list simple attributes for selected features in the current layer.

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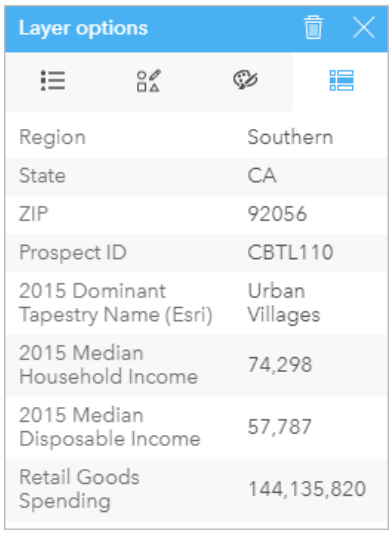

The Attributes tab displays attributes for selected features in the current layer.

Copy a map

A map card can be duplicated on a page by activating the card (a card is active when the **Action** button is visible) and using `Ctrl+C` to copy the card and `Ctrl+V` to paste it on the page.

A map card can be copied to a different page by dragging the card to the **New page** tab or to an existing page. When a map is copied to a new page, the dataset will also be copied, if necessary, along with all of the processes used to create the map. The dataset will not be copied if it already exists on the new page unless one of the datasets contains a dataset filter, a calculated field, or a location field created by enabling location.

Next steps

Use the following resources to learn more about maps:

- Binned maps
- Choropleth maps
- Maps with column chart symbols
- Heat maps
- Link maps
- Location maps
- Maps with pie chart symbols
- Graduated symbol maps
- Unique values maps

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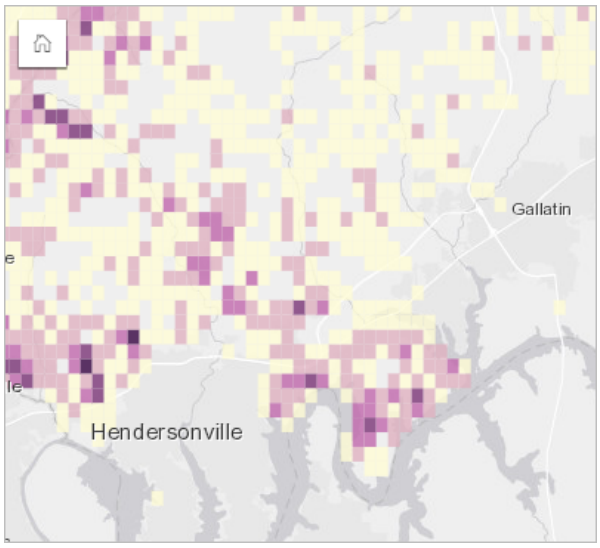
Create and use a binned map

Binned maps provide a quick representation of how your data is distributed. Features contained in each bin are summarized using a statistic type, such as sum or average. This map visualization is helpful for datasets with a large number of points or densely located points.

Example

A municipal water service and operations center is preparing for an extensive upgrade to its fleet and automated equipment. The initiative will require three years to complete and will require prioritizing regions with the highest demand. An analyst can visualize service requests using bins to quickly determine where more requests or greater water loss is occurring.



Deep purple areas in the above map indicate more service requests, while lighter yellow areas indicate fewer service requests.

Create a binned map

To create a binned map, complete the following steps:

1. Drag a point dataset to the page and onto the **Map** drop zone.

   Note:
   You can also create a map by selecting a field and clicking the **Map** button above the data pane.

2. Expand the legend to display the Layer options pane.
3. Browse to the **Symbology** tab.
4. Change **Symbol type** to **Bins**.

Usage notes

The Layer options pane can be used to view the classification of the bins, adjust the bin size, and change the style of the bins.

Use the **Legend** tab to view the classification values of the binned map and make selections based on the bins.

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Use the **Symbology** tab to do the following:

- Choose a different field or statistic type to style your map using the **Style by** parameter. Available statistic types include sum, minimum, maximum, and average.

  Tip:

  Bins always use one of the statistic types when your map is styled by a number field.

- Change the **Symbol type** setting to a different map style, such as a heat map.
- Set the size of the bins by adjusting the **Resolution** value. The default **Resolution** is 50.
- Specify the **Transition value** setting. If the number of point features in the map extent is less than the transition value, the map will display the point features. If the number of points in the map extent is greater than or equal to the transition value, the map will be styled with bins. The default **Transition value** is 2,000.

Use the **Appearance** tab to change the symbol style properties, such as the color palette, bin outline thickness and color, and layer transparency.

Use the **Attributes** tab to view details for features that are selected on the map.

Limitations

Binned maps are not available for certain remote feature layers. If your remote feature layer does not support binned maps, you can copy the layer to your workbook and create a binned map using the copy.

Zoom tools and selection tools are not available for binned maps with over 100,000 features on shared pages.

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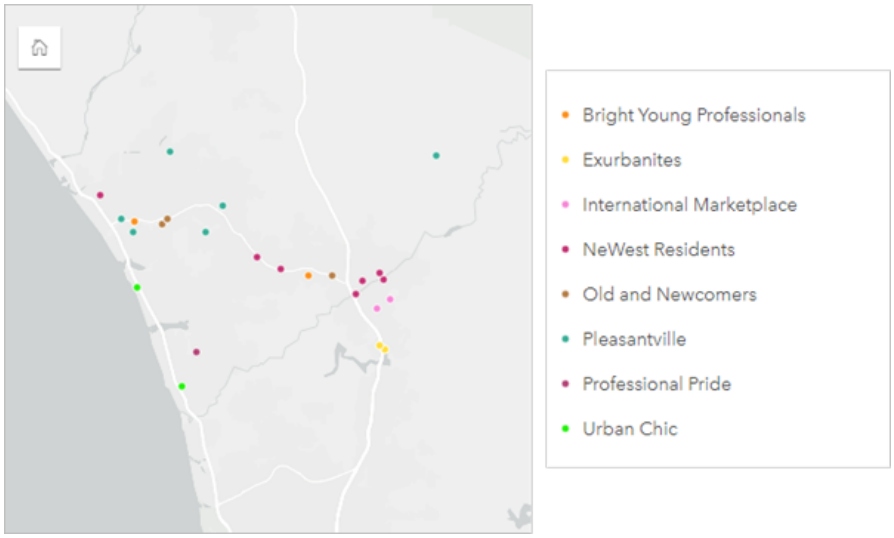
Create and use a unique values map

Unique values maps use unique symbols to style distinct categories in your map, so you can see where point, line, and area features are located and what type they are, such as tree species or restaurant types. Unique values maps help you answer questions, such as: Where is it located? How is it distributed?

Unique values maps can handle up to 100 unique categories, applying a unique color to each. Categories exceeding 100 are put into an **Others** category.

Example

A small retail chain wants to expand throughout the region and is looking at prospective sites for new stores. The marketers know that the dominant demographic group that shops at the store is young people under 30, especially students and recent graduates. A unique values map can be used to symbolize each prospect by the dominant Tapestry Segment in the area where the potential new store site is located.



The above map shows where each prospect is located and uses a unique color to indicate the Tapestry Segment that categorizes each prospect.

Tip:

Group related bar charts or time series charts with the same field you used to style your unique values map. That way, your interactions among the unique values map, bar chart, and line chart will show you simultaneous categorical, temporal, and spatial patterns.

Create a unique values map

To create a unique values map, complete the following steps:

1. Expand a dataset in the data pane so that the fields are visible.
2. Select a string field .

Tip:

You can search for fields using the search bar in the data pane.

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3. Drag the field to the page and drop it on the **Map** drop zone. A unique values map will be created using **Types (Unique symbols)** as the **Symbol type**.

   Note:
   The **Types (Unique symbols)** smart mapping symbol type is applied by default when you create a map using a string field.

You can also create a unique values map from an existing chart that was created using only a string field, such as a bar chart, donut chart, or bubble chart.

Tip:

Drag a different string field from the same dataset onto your map. Your map will update to show a unique values map using the new field.

Usage notes

Click the **Flip card** button to turn the map card over. The back of the card includes the count of each category and a text box for a description of the map.

The Layer options pane is accessible from the layer legend and can be used to view the unique values being mapped, change the style of the map, and view information about selected features.

Use the **Legend** tab to view the values of the unique values map and make selections based on the values. To change the color associated with a category, click the symbol and choose a color from the palette or enter a hex value.

Use the **Symbology** tab to change the field displayed on the map or switch to a different type of map.

Use the **Appearance** tab to change the symbol style properties, such as size, outline thickness and color, and layer transparency.

Use the **Attributes** tab to view details for features selected on the map.

Use the **Visualization type** button to switch directly between a unique values map and other visualizations, such as a summary table, donut chart, bubble chart, or line graph.

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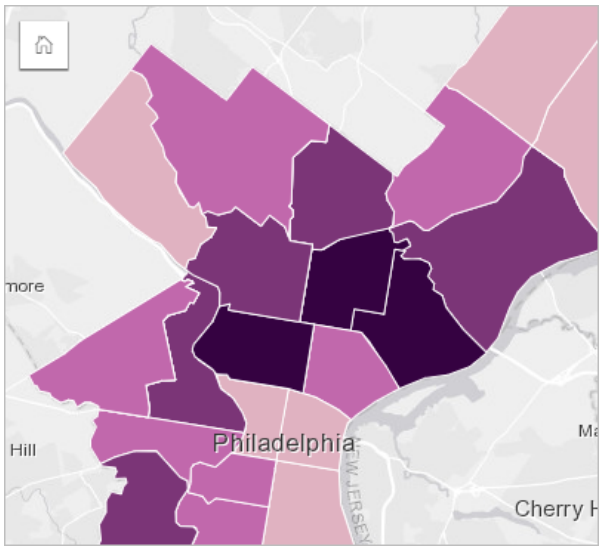
Create and use a choropleth map

Choropleth maps use the **Counts and amounts (Color)** smart mapping symbol type to show normalized data as shaded points, lines, or areas. Choropleth maps help answer questions about your data, such as: How do rates or percentages compare by geographic feature?

Example

A crime analyst is researching crime frequencies across the city and the correlation between crime and other social issues, such as high unemployment rates. City officials will use the results to implement new social programming across the city in an effort to reduce crime. A choropleth map can be used to visualize the unemployment rates in police districts across the city and compare them to crime rates.



Darker areas in the above map indicate high levels of unemployment, while lighter areas indicate low levels of unemployment.

Create a choropleth map

A choropleth map is automatically created when a rate/ratio field is used to create a map. A numeric field can also be used to create a choropleth map by switching **Symbol type** from **Counts and amounts (Size)** to **Counts and amounts (Color)**. Numeric data should then be normalized using the **Divide by** parameter when used to create a choropleth map.

To create a choropleth map with a rate, ratio, or proportion, use the following steps:

1. Expand a dataset in the data pane so that the fields are visible.
2. Select a rate/ratio field A/B.

> **Tip:**
>
> If you have rate/ratio values in a number field ∑, you can change the field type by clicking the field icon and choosing **Rate/Ratio**.
>
> You can search for fields using the search bar in the data pane.

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3. Drag the field to the page and onto the **Map** drop zone. A choropleth map will be created using **Counts and amounts (Color)** as the **Symbol type** setting.

Note:
The **Counts and amounts (Color)** smart mapping symbol type is applied by default when you create a map using a rate/ratio field. You can also apply **Counts and amounts (Color)** to maps created using a number field.

To create a choropleth map using normalization, complete the following steps:

1. Expand a dataset in the data pane so that the fields are visible.
2. Select a number field. The number should be a total, such as number of crimes or total sales.

Tip:
You can search for fields using the search bar in the data pane.

3. Drag the field to the page and onto the **Map** drop zone. A graduated symbol map is created.
4. Expand the legend to display the Layer options pane.
5. Browse to the **Symbology** tab.
6. Change **Symbol type** to **Counts and amounts (Color)**.
7. Choose a number field for the **Divide by** parameter. The field should have a number that can be used to create a proportion from the first number field, such as total population.

Usage notes

Click the **Flip card** button to turn the map card over. The back of the card includes statistics and a place to write a description of the map.

The Layer options pane is accessible from the layer legend and can be used to view the classification values being mapped, change the style of the map, and view information about selected features.

Use the **Legend** tab to view the classification values of the choropleth map and make selections based on the values.

Use the **Symbology** tab to do the following:

- Change the field being displayed on the map or switch to a different type of map.
- Change the statistics for the display field. This option is only available if location was enabled on the dataset with aggregation allowed for identical features or if the dataset was created through spatial aggregation.
- Change the classification type.
- Change the number of classes being displayed.
- Change, add, or remove the **Divide by** field.

Use the **Appearance** tab to change the symbol style properties, such as color palette, symbol size, outline thickness and color, and layer transparency.

Use the **Attributes** tab to view details for features selected on the map.

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How choropleth maps work

In a process referred to as data classification, graduated numeric values are grouped into ranges, and each classification range is represented by a shade or color on the color ramp. The values should be proportions to reduce bias from different-sized areas.

Data classification

The following classification options are available for choropleth maps:

Classification method	Description	Example
Natural breaks	Classes are based on natural groupings inherent in the data. This is the default classification. The natural breaks method should be used when you want to emphasize the natural groupings inherent in your data. Natural breaks should not be used to compare maps created with different data.	Use natural breaks to compare the crime rates in neighborhoods across a city. The crime rates will be grouped so that neighborhoods with a similar crime rate will be symbolized with the same color.
Equal interval	Divides the range of attribute values into equal-sized subranges. The equal interval classification emphasizes the amount of an attribute relative to other values and should be used for data that has familiar ranges.	Use equal intervals to compare the percentage of trees with invasive beetles across parks in a county. The percentages range from 0 to 100. If you choose to use four bins, the classes will be based on 25% intervals.
Quantile	Divides the attributes into bins with equal numbers of features. The quantile classification can distort the look of your map by placing similar values in different classes. Therefore, this classification method should be used on data that is relatively uniform. You can also use quantile classification as a method of visual ranking.	Use quantile intervals to compare the unemployment rates across states in the United States. If you apply five bins to the 50 states plus the District of Columbia, there will be approximately 10 states per bin. The results can be used to see the unemployment rates ranked in groups of 10.
Standard deviation	Classifies a feature based on how much the feature's attributes vary from the mean. The standard deviation method works best on datasets that are normally distributed and for analyses in which the mean, or the distance from the mean, is important. **Tip:** Try pairing the standard deviation classification with a diverging color ramp. Diverging color ramps style the upper and lower extremes with dark shades and style the mean with a neutral color.	Use standard deviation and a diverging color ramp to compare the average life expectancy between countries. The countries with the highest and lowest life expectancy will be displayed in different dark shades. The colors will become lighter as the classes move closer to the mean global life expectancy.

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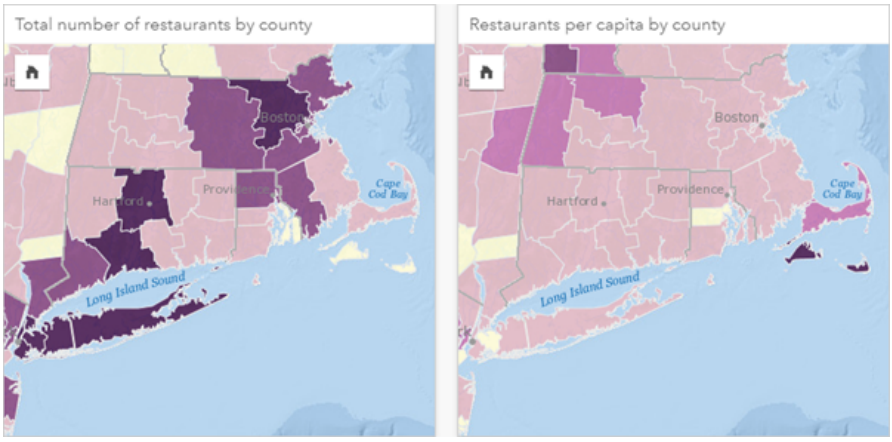
Classification method	Description	Example
Unclassed	Numeric data is displayed on a continuous scale, rather than in discrete classes. The unclassed method should be used when you want to see gradual changes in your data.	Use an unclassed color ramp to style average temperature measurements for a given time range taken at regularly placed weather stations. The points will show gradual changes in temperature over the study area.
Manual	Manually add class breaks that are appropriate for your data. The manual method should be used when there are known ranges that must be applied to your data, such as when you want to create multiple maps with the same bins.	Use a manual classification to compare the average household income in neighborhoods across a city over time. The manual classification can be used to apply the same bins to both maps so that patterns and comparisons can be made without making false assumptions due to differences in the classification.

Normalization and proportional data

Styling your map using graduated colors, like with a choropleth map, can lead to visual misinterpretations, especially when the features on the map are areas of various sizes or populations. In these cases, larger areas will naturally draw your attention, especially if they're styled with darker colors. You can counter the bias created from different-sized areas in choropleth maps by styling the maps by averages, proportions, rates, and ratios instead of counts or totals. When the data being displayed on a map is a proportional value, it's taking into account the differences between the features, whether it be population, area, or another factor.



(Left) The total number of restaurants in each county. This map is displaying totals, so it should not use graduated colors. (Right) The number of restaurants per capita in each county. This map is displaying proportional data, so a choropleth map is appropriate.

Both maps above use colors to show the number of restaurants by county. However, the map on the left shows the total number of restaurants and the map on the right shows the number of restaurants per capita. The counties have some variation in area, but the biggest variation is in the population across counties. The combination of large areas and a large number of restaurants emphasizes features such as Long Island and the Boston area, even over the smaller counties in New York City that are the same color. However, when the population of each county is taken into account, like in the map on the right, we see that the counties around Cape Cod and inland from the coast have a larger number of restaurants per capita and the majority of the other counties have an average number of restaurants per capita. The per capita map is a correct choropleth map.

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Note:
If you want to make a map of counts or totals, such as the total number of restaurants by county, you can make a graduated symbol map.

If you want to create a choropleth map but you do not have proportional data, you can create proportions using a process called normalization. When you normalize your data, you take a number, like total crimes, and divide it by another number, like total population, to create a proportional value. Normalization can be performed when you create a choropleth map using the **Divide by** parameter on the **Symbology** tab. In the example above, the total number of restaurants in each county was normalized using the total population of the county.

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Create and use maps with column chart symbols

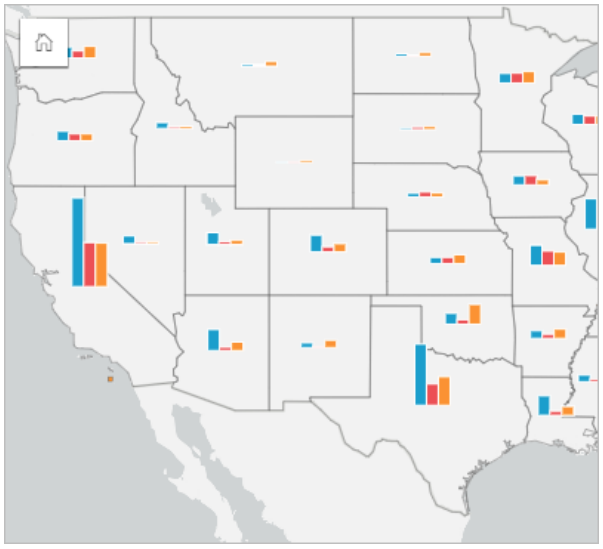
Column chart symbols are used with maps to show the number of occurrences or proportions of categorical data associated to a single feature, using either a count or a summary statistic. Column chart symbols are created on a map using a string field and a location field containing coincident values.

Column chart symbols can answer questions about your data, such as the following:

- How are categorical values distributed geographically?
- How is the data ranked?

Example

A GIS analyst working for a consortium of colleges wants to find which states have high-value colleges (colleges with a high ratio of earnings after graduation compared to tuition and fee costs). Part of her analysis includes comparing the number of public, private for-profit, and private nonprofit schools both within and between states. Creating a map with column chart symbols allows the analyst to make both comparisons simultaneously.



The analyst can tell from the map that the states with larger populations have more colleges overall. She decides to normalize the data by changing the symbols from **Expanded** to **Stacked Percent**. That way, she can compare the proportions of college types between states without being influenced by the total numbers of colleges in the state.

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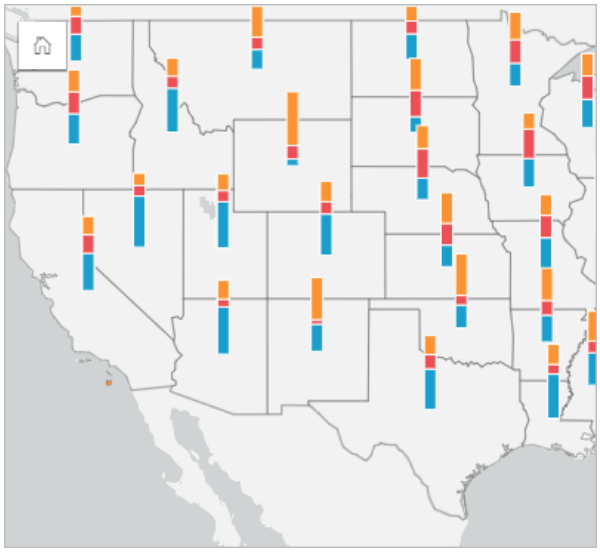

Create a map with column chart symbols

Note:
Column chart symbols can only be created with multipart datasets in which features are collocated. These datasets can be created using a one-to-many join, or by enabling location on a dataset. If location is enabled with addresses or coordinates, **Repeat identical features** must remain unselected.

Complete the following steps to create a map with column chart symbols:

1. Create a multipart dataset using one of the following methods:
   - Create a join between two datasets. Generally, these datasets will include the features you want to display as column chart symbols and a boundary layer.

     The join should be one-to-many, meaning each boundary feature contains more than one feature to create the column chart. In the example above, a join was created between a dataset with college data and state boundaries.

   - Enable location for your dataset.

     If you enable location for points using addresses or coordinates, **Repeat identical features** must remain unselected. This method should only be used in situations where multiple data points appear in the exact same location. For example, a dataset containing monthly status updates for fire hydrants in a city could contain a new input each month for each fire hydrant. Enabling location without repeating identical features will aggregate the inputs for each hydrant.

     If you enable location using geography, there should be multiple features within each boundary. This method functions the same as a one-to-many join.
2. Expand a dataset in the data pane so that the fields are visible.
3. Select one of the following combinations of fields:
   - A location field plus a string field
   - A location field, a string field, and a number or rate/ratio field

   If you created a join in step 1, the location field you select must be the field that corresponds to the boundaries.

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Tip:

You can search for fields using the search bar in the data pane.

4. Drag the fields to the page and drop them on the **Map** drop zone.
   A map is created.

   If the map was created using a location field, string field, and number or rate/ratio field, then the map will be styled using pie chart symbols. If the map was created using a location field and a string field, then the map will be styled using unique symbols.
5. Expand the legend to display the Layer options pane.
6. Browse to the **Symbology** tab.
7. Change **Symbol type** to **Columns**.

Usage notes

The **Layer options** pane is accessible from the layer legend and can be used to view the classification values being mapped, change the style of the map, and view information about selected features.

Use the **Legend** tab to view the values and counts of the column chart symbols and make selections based on the values. To change the color associated with a category, click the symbol and choose a color from the palette, or enter a hex value.

Use the **Symbology** tab to do the following:

- Change the field displayed on the map, or switch to a different type of map.
- Change the numeric variable. The numerical variable determines the height of the bars or bar segments and can be based on a count of features or a number or rate/ratio field. If a number or rate/ratio field is chosen, the heights can be based on a sum, minimum, maximum, or average.
- Change the display between **Stacked Count**, **Stacked Percent**, and **Expanded**.
  - **Stacked Count**—Each geographic feature is symbolized using a single bar with categories visualized as subgroups of the bar. The bar height is determined by the overall count for the geographic feature, and the height of each category segment is determined by the count of the category.
  - **Stacked Percent**—Each geographic feature is symbolized using a single bar with categories visualized as subgroups of the bar. The bar height is uniform for each geographical feature, and the height of each category segment represents the percentage of that category relative to the geographic feature.
  - **Expanded**—Each category is represented by a separate bar. Bar heights are determined by the count for each category.
- Configure the map pop-ups to display with or without statistics, or disable pop-ups for the layer.

Use the **Appearance** tab to change the symbol style properties, such as symbol size and layer transparency.

Use the **Attributes** tab to view details for features selected on the map.

Use the **Visualization type** button to switch directly between a map with column chart symbols and other visualizations, such as a summary table, stacked bar chart, chord diagram, or treemap.

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Limitations

Column chart symbols show all unique categories associated with a single feature or location. If the features contain many unique categories or large differences between minimum and maximum counts, the column chart symbols may be difficult to interpret.

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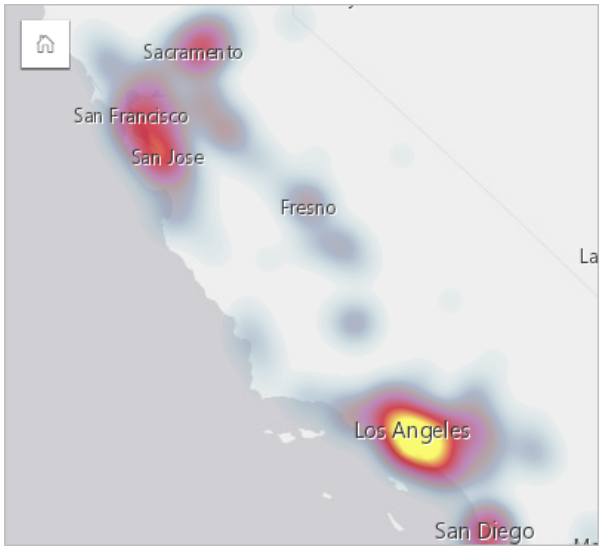
Create and use a heat map

Create a heat map to visualize areas with the most point features as the hottest. Heat maps help answer questions about your data, such as: How is it distributed?

Heat maps are more of a visual aid than an accurate way to show point density, and they're best used in conjunction with another visualization type, such as a time series chart. As a general rule, if your map has more than 2,000 points, apply a density calculation and map the calculated result instead of creating a heat map.

Example

A retail chain is trying to decide which region of California has the most potential for high sales volume and should have new store branches added. The market researcher uses a heat map to quickly determine the areas where the revenue is highest.



Create a heat map

To create a heat map, complete the following steps:

1. Drag a point dataset to the page and drop it on the **Map** drop zone.

   Note:
   You can also create a map by selecting a field and clicking the **Map** button above the data pane.

2. Expand the legend to display the Layer options pane.
3. Browse to the **Symbology** tab.
4. Change **Symbol type** to **Heat map**.

Usage notes

Click the **Flip card** button to turn the map card over. The back of the card includes a count of points and a place to write a description of the map.

The **Layer options** pane can be used to change the style of the map and view information about selected features.

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Use the **Legend** tab to view the count of points in the dataset.

Use the **Symbology** tab to switch to a different type of map.

Use the **Appearance** tab to adjust the layer transparency.

Use the **Attributes** tab to view details for features selected on the map.

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Create and use a link map

Link maps are used in link analysis to show the relationships between locations. Link maps can show the relationships either without direction (spider lines) or with directions (flow maps). The connections can also show the magnitude of the relationship, such as the number of phone calls between locations.

Link maps help answer questions about your data, such as: How is it related?

Example

A nongovernmental health organization is studying the spread of an infectious disease during a past outbreak. A directed link map (also called a flow map) is used to visualize the spread from two of the countries hit the hardest by the disease to other countries.

Create a link map

To create a link map, complete the following steps:

1. Expand a dataset in the data pane so that the fields are visible.
2. Select one of the following data options:
   - Two location fields
   - Two location fields plus a number or rate/ratio field

   Tip:

   One or more location fields can be added to your dataset using Enable Location or by creating a relationship with a dataset that has a location field. When enabling location for a link map by coordinates or addresses, it is best practice to keep the Repeat identical features parameter unchecked.

   You can search for fields using the search bar in the data pane.

3. Drag the fields to the page and drop them on the **Map** drop zone.

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Usage notes

Click the **Flip card** button to turn the map card over. The back of the card includes a place to write a description of the map.

The **Layer options** pane is accessible from the layer legend and can be used to change the style and statistics of the map.

Nodes can be sized using the following centrality methods:

- Degree—The number of direct neighbors of the node. If the map is directed (a flow map), the degree can be measured as either indegree (the number of direct neighbors with connections directed toward the node) or outdegree (the number of direct neighbors with connections directed away from the node).
- Betweenness—The extent to which a node lies on the shortest path between other nodes in the network. The normalization parameter is disabled for this centrality method because the betweenness calculation always applies normalization.
- Closeness—The average of the shortest distance paths to all other nodes. The normalization parameter is disabled for this centrality method.
- Eigenvector—The measure of the influence of a node in a network based on its proximity to other important nodes.

The **Symbology** tab and **Appearance** tab display different options based on the selections you make in the **Layer options** pane. The following options are available for link maps:

Selection	Symbology	Appearance	Legend
None	The **Directional flow** parameter can be used to change the links to arrows from one node to the other. The centrality method can be set from the **Size node using** parameter. The Edge weight parameter is used to calculate weighted centrality values. By default, the **Edge weight** parameter is set to **Uniform**, meaning the centrality calculation is unweighted. A field can be chosen to apply weights to the calculation. **Edge weight** is available for betweenness, closeness, and eigenvector centralities. The **Normalized** parameter can be used to normalize the node centralities by dividing by another field to create a ratio or proportion. The **Normalized** parameter is enabled by default but can be disabled for nodes using betweenness and closeness centrality. The Natural Breaks, Equal Interval, and Unclassed classifications can be chosen in the **Classification type** parameter. If Natural Breaks or Equal Interval is chosen, the number of classes can also be edited. Click **View centralities** to create a reference table showing the centrality values for each node. The table includes a column for entity (field name), node (feature), and centrality.	Change the layer transparency of the link map.	Unavailable

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<table>
<tr><th>Selection</th><th>Symbology</th><th>Appearance</th><th>Legend</th></tr>
<tr><td></td><td colspan="2">Tip:
Drag a string field to the Layer options pane and drop it on the link to style the links by unique values.</td><td></td></tr>
<tr><td rowspan="2">Node</td><td>Use the Choose node field parameter to switch the selected node to a different location field.</td><td>Change the Node style options, including the following options:
Symbol shape
Size (min - max)
Fill color
Outline thickness
Outline color</td><td rowspan="2">Unavailable</td></tr>
<tr><td colspan="2">Use the Add button and Delete button to add new node fields or delete existing node fields. New node fields will be connected to the selected node field. You must have three or more node fields to delete a node.
Tip:
Drag a location field to the Layer options pane and drop it on the Add button or on an existing node to add node fields.
Use <code>Ctrl+click</code> to select multiple nodes. The following options are available:
Use the Merge nodes button and Unmerge nodes button to merge or unmerge the values from the From and To fields. Merging the fields will set the nodes to the same symbol.
Use the Unlink button and Link button to remove or add a link between two node fields. These options are only available if there are three or more node fields.</td></tr>
</table>

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<table>
<tr><th>Selection</th><th>Symbology</th><th>Appearance</th><th>Legend</th></tr>
<tr><td rowspan="2">Link</td><td>The Weight parameter can be used to change or remove the number or rate/ratio field being used to apply weight to the links.
The Type parameter can be used to change or remove the string field being used to style the links by unique category.</td><td>Change the Link style options parameter, including the following options:
Pattern
Thickness (min - max)
Color</td><td>The Legend tab is enabled if a Weight field or Type field is added. The Legend can be used to view the classification values or unique categories for the links and to make selections on the chart.</td></tr>
<tr><td colspan="3">If the arrows are pointing in the wrong direction, use the Flip button to change the direction of the flow.
If the map includes three or more node fields, the Delete button can be used to remove a link from the map. Deleting a link also removes a node field that has become disconnected from the rest of the map.
Tip:
 Drag a number or rate/ratio field to the Layer options pane and drop it on the selected link to change the Weight parameter. Use a string field to change the Type parameter.</td></tr>
</table>

The distance between nodes can be viewed by hovering over the links. The distance is reported in the default units for your account.

The **Visualization type** button can be used to switch a link map to another visualization, such as a bar chart. To change the visualization type, the location fields must have a **Display field** set.

Limitations

A limit to the number of connections that can be displayed is based on the maximum query limit for the dataset. The error message **There's too much data to complete this operation** will be displayed if the number of connections is greater than the limit. The maximum query limit for point features is 16 thousand. The maximum query limit for line and area features is 8 thousand.

For example, a dataset of flights throughout Europe contains hundreds of thousands of flight numbers for 126 airports. Every airport has at least one direct flight to every other airport. Therefore, the number of connections is:

```
126 origins * 126 destinations = 15876 connections
```

The number of flights does not affect the query limit, but the number of airports does. If one extra airport is added to the dataset with direct flights to all other airports, the number of connections increases to 16,129, which is over the query limit. However, if there is not a connection between every unique value, the number of unique values can be higher. If some of the airports do not have direct flights between each other then the number of airports that can be displayed could increase until the number of connections surpasses the query limit.

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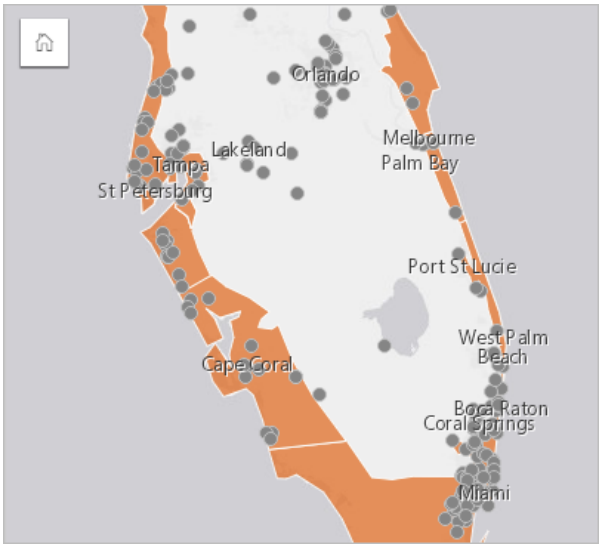
Create and use a location map

Create a location map to see where your point, line, and area features are located (or alternatively, where features are not located). A location map renders all of the features in a dataset using a single, uniform symbol. Location maps help answer questions about your data, such as: Where is it located? How is it distributed?

Location maps are most useful for datasets where you can see most or all of the features on the map with relatively little overlap. If there are too many point features to distinguish on the map, consider creating a binned map or a heat map.

Example

An insurance company is conducting an assessment to determine how many of its policies are within a storm surge area, and the associated risk. A location map can be used to give the analyst an idea of the number of policies that are in the high-risk area.



The above location map shows customer locations as point features and the storm surge area as area features in the bottom layer. The location map shows that there is a relatively high density of points within the storm surge area compared to the number of points inland.

Create a location map

To create a location map, complete the following steps:

1. Do one of the following:
   - Drag a dataset to the page and drop it on the **Map** drop zone.
   - Expand the dataset, select the location field, drag the field to the page, and drop it on the **Map** drop zone.
2. If your dataset has a default symbol other than a single symbol, expand the legend to see the **Layer options** pane, click the **Symbology** tab, and change **Symbol type** to **Location (Single symbol)**.

Usage notes

Click the **Flip card** button to turn the map card over. The back of the card includes a count of features and a text box for a description of the map.

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The Layer options pane can be used to change the style of the map and view information about selected features.

Use the **Legend** tab to view the count of features in the dataset.

Use the **Symbology** tab to switch to a different type of map.

Use the **Appearance** tab to change the symbol style properties such as the symbol shape, fill color, outline thickness, and layer transparency.

Use the **Attributes** tab to view details for features selected on the map.

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Create and use maps with pie chart symbols

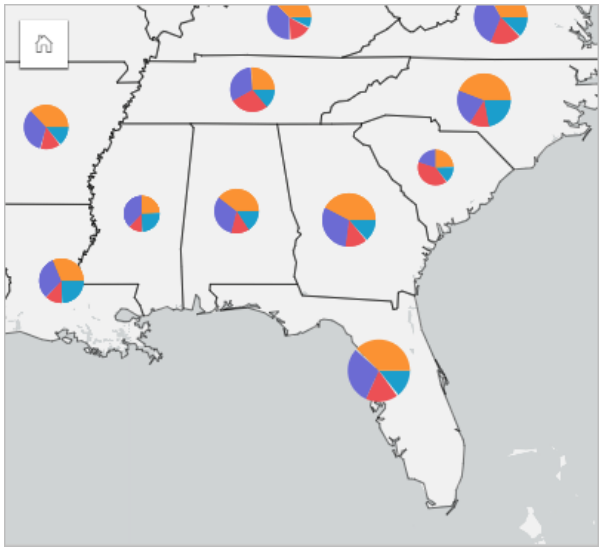
Pie chart symbols are used in maps to show the proportions of categorical data associated with a single feature, using either a count or a summary statistic. Pie chart symbols are created on a map using a string field and a location field containing coincident values.

Pie chart symbols can answer questions about data, such as the following:

- What are the proportions of categories for each feature?
- What is the count or summary statistic relative to another location?

Example

An insurance company is reviewing purchases of its policies across the United States to determine where there is market potential for each policy class (automobile, disability, life, and property). The analyst in charge of the review joins the insurance portfolio data for the company with a state boundary layer and uses the result to create pie chart symbols showing the proportions of each policy class that are being purchased in each state, with each pie chart sized by the number of policies in the state.



The analyst can use associated charts, filters, or the map legend to determine which states have potential for each policy class. The analyst selects automobile policies and sees that there is low automobile insurance uptake across the Midwest. The analyst will do more research to determine why there are states with low or no automobile insurance uptake (for example, is automobile insurance not offered, or is there a major regional competitor?) and whether there is potential to increase uptake in those states.

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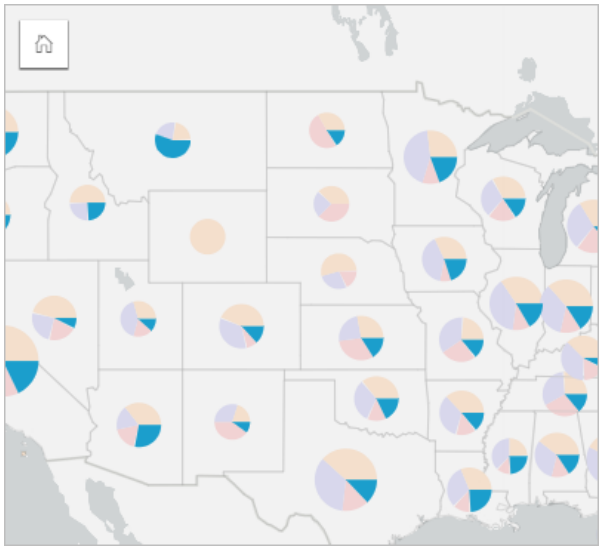

Create pie chart symbols on a map

Note:
Pie chart symbols can only be created with multipart datasets in which features are collocated. These datasets can be created using a one-to-many join, or by enabling location on a dataset. If location is enabled with addresses or coordinates, **Repeat identical features** must remain unselected.

Complete the following steps to create a map with pie chart symbols:

1. Create a multipart dataset using one of the following methods:
   - Create a join between two datasets. Generally, these datasets will include the features you want to display as pie chart symbols and a boundary layer.

     The join should be one-to-many, meaning each boundary feature contains more than one feature to create the pie chart. In the example above, a join was created between a dataset with insurance data and state boundaries.

   - Enable location for your dataset.

     If you enable location for points using addresses or coordinates, **Repeat identical features** must remain unselected. This method should only be used in situations where multiple data points appear in the exact same location. For example, a dataset containing monthly status updates for fire hydrants in a city could contain a new input each month for each fire hydrant. Enabling location without repeating identical features will aggregate the inputs for each hydrant.

     If you enable location using geography, there should be multiple features within each boundary. This method functions the same as a one-to-many join.
2. Expand a dataset in the data pane so that the fields are visible.
3. Select one of the following combinations of fields:
   - A location field plus a string field
   - A location field, a string field, and a number or rate/ratio field

   If you created a join in step 1, the location field you select must be the field that corresponds to the boundaries.

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Tip:

You can search for fields using the search bar in the data pane.

4. Drag the fields to the page and drop them on the **Map** drop zone.
   A map is created.

   If the map was created using a location field, string field, and number or rate/ratio field, then the map will be styled using pie chart symbols. If the map was created using a location field and a string field, then the map will be styled using unique symbols. Complete the following steps to change the unique values to pie chart symbols:

   a. Expand the legend to display the Layer options pane.

   b. Browse to the **Symbology** tab.

   c. Change **Symbol type** to **Pies**.

Usage notes

The **Layer options** pane is accessible from the layer legend and can be used to view the classification values being mapped, change the style of the map, and view information about selected features.

Use the **Legend** tab to view the values and counts of the pie chart symbols and make selections based on the values. To change the color associated with a category, click the symbol and choose a color from the palette, or enter a hex value.

Use the **Symbology** tab to do the following:

- Change the field displayed on the map, or switch to a different type of map.
- Change the numeric variable. The numeric variable divides the pie chart into proportional segments and can be based on a count of features or a number or rate/ratio field. If a number or rate/ratio field is chosen, the proportions can be based on a sum, minimum, maximum, or average.
- Change the classification type (natural breaks, equal interval, or unclassed).
- Change the number of classes displayed.
- Configure the map pop-ups to display with or without statistics, or disable pop-ups for the layer.

Use the **Appearance** tab to change the symbol style properties, such as symbol size, outline style, and layer transparency.

Use the **Attributes** tab to view details for features selected on the map.

Use the **Visualization type** button to switch directly between a map with pie chart symbols and other visualizations, such as a summary table, stacked bar chart, chord diagram, or treemap.

Limitations

Pie chart symbols show all unique categories associated with a single feature or location. If the features contain many unique categories, the pie chart symbols may be difficult to interpret.

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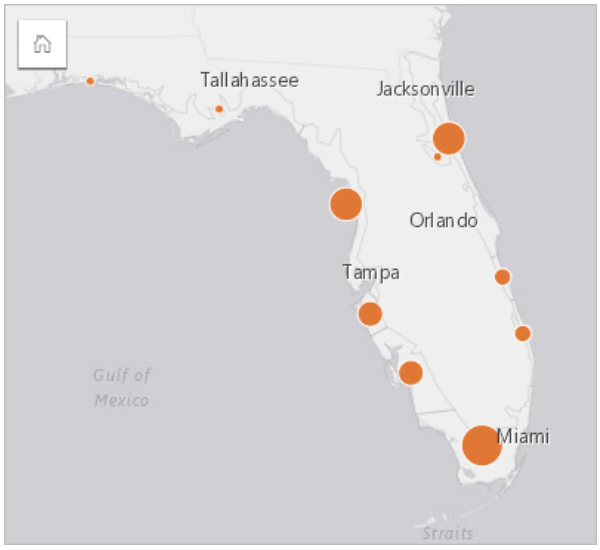
Create and use a graduated symbols map

Create a graduated symbols map to show symbols of graduated sizes to indicate numeric values, where larger symbols represent larger values. Graduated symbols maps use the **Counts and amounts (Size)** smart mapping symbol type. Graduated symbols maps help answer questions about data, such as: Where is it located? Where is it biggest? Where is it smallest?

Graduated symbols make it easy to distinguish between low and high values, allowing you to show differences and make comparisons on a map. Adjust the size of the symbols to clarify the story you're telling.

Example

An insurance company is conducting an assessment to determine how many of its policies are within a storm surge area, and the associated risk. A graduated symbols map using the sum of total insured values (TIV) can be used to determine which storm surge areas have the highest value of policies.



The above graduated symbols map is the result of a spatial aggregation between the insurance policies and storm surge layers. The map indicates the highest TIV on the southern tip with the largest symbol.

Create a graduated symbols map

To create a graduated symbols map, complete the following steps:

1. Expand a dataset in the data pane so that the fields are visible.
2. Select a number field ∑.

   Tip:

   You can search for fields using the search bar in the data pane.

3. Drag the field to the page and drop it on the **Map** drop zone.
   A graduated symbols map is created using **Counts and amounts (Size)** as the **Symbol type**.

A graduated symbols map is also created when you perform spatial aggregation.

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Usage notes

Click the **Flip card** button to turn the map card over. The back of the card includes statistics and a text box for a description of the map.

The Layer options pane is accessible from the layer legend and can be used to view the classification values being mapped, change the style of the map, and view information about selected features.

Use the **Legend** tab to view the classification values of the graduated symbols map and make selections based on the values.

Use the **Symbology** tab to do the following:

- Change the field being displayed on the map or switch to a different type of map.
- Change the statistics for the display field. This option is only available if location was enabled on the dataset with aggregation allowed for identical features or if the dataset was created through spatial aggregation.
- Change the classification type.
- Change the number of classes being displayed.
- Change, add, or remove the **Divide by** field.

Use the **Appearance** tab to change the symbol style properties, such as symbol size, fill color, outline thickness and color, and layer transparency.

Use the **Attributes** tab to view details for features selected on the map.

How graduated symbols maps work

Graduated symbols maps use data classification to apply symbols to number ranges. The classification method that you use will depend on the data you're using and the information you want to convey on your map.

The following classification options are available for graduated symbols maps:

Classification method	Description	Example
Natural breaks	Classes are based on natural groupings inherent in the data. This is the default classification. The natural breaks method should be used when you want to emphasize the natural groupings inherent in your data. Natural breaks should not be used to compare maps created with different data.	Use natural breaks to compare the number of crimes in neighborhoods across a city. The crime totals will be grouped so that neighborhoods with similar crime totals are symbolized with the same symbol size.
Equal interval	Divides the range of attribute values into equal-sized subranges. The equal interval classification emphasizes the amount of an attribute relative to other values and should be used for data that has familiar ranges.	Use equal intervals to compare the total sales at store branches. If you use four bins, the stores will be divided into 25 percent ranges.

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Classification method	Description	Example
Quantile	Divides the attributes into bins with equal numbers of features. The quantile classification can distort the look of your map by placing similar values in different classes. Therefore, this classification method should be used on data that is relatively uniform. You can also use quantile classification as a method of visual ranking.	Use quantile intervals to compare the carbon emissions between countries for a given year. If your dataset includes the emissions from 100 countries and you apply 10 bins, you'll be able to distinguish between groups of carbon emitters (10 highest emitters, 10 lowest emitters, and so on), but not within groups.
Standard deviation	Classifies a feature based on how much the feature's attributes vary from the mean. The standard deviation method works best on datasets that are normally distributed and for analyses where the mean or the distance from the mean is important.	Use standard deviation to compare the number of admissions at hospitals across the state. You can use the map to see where the hospitals with an average number of admissions are located, as well as the locations of hospitals one or two standard deviations above or below the mean admissions.
Unclassed	Numeric data is displayed on a continuous scale, rather than in discrete classes. The unclassed method should be used when you want to see proportional changes in your data.	Use an unclassed color ramp to compare the carbon emissions between countries. Unlike with the quantile classification, this method will give you the ability to distinguish between all of the countries because each country will have a slightly different symbol size (for example, the top carbon emitter will have a slightly larger symbol than the second highest emitter).
Manual	Manually add class breaks that are appropriate for your data. The manual method should be used when there are known ranges that must be applied to your data, such as when you want to create multiple maps with the same bins.	Use a manual classification to compare the number of vacant houses in neighborhoods across a city over time. The manual classification can be used to apply the same bins to both maps so that patterns and comparisons can be made without making false assumptions due to differences in the classification.

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Charts

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Create charts

To create interactive charts, select one or more string, number, rate/ratio, or date/time fields from the data pane and drag them onto the page, or use the **Chart** button at the top of the data pane.

You can also switch to different supported visualization types from existing cards.

Tip:

You can copy a chart card onto another page by dragging it to the **New page** tab + or an already created page. If you want to copy the chart onto the same page, use `Ctrl+C` to copy and `Ctrl+V` to paste.

Chart types

There are several types of charts that can be created using ArcGIS Insights. Insights uses smart defaults to create the best type of chart for the data you want to visualize, so you know you are always getting the best type of chart for the field that you select.

The table below indicates the inputs for each chart, related visualizations you can switch to using the **Visualization type** button, and questions the chart can help you answer.

Visualization	Minimum data requirements	Related visualization types	Questions it can help you answer
Bar chart	One string field	• Unique values map • Summary table • Reference table • KPI • Column chart • Treemap • Bubble chart • Line graph • Donut chart • Point chart	How is it distributed (by category)?
Box plot	One number or rate/ratio field	• Proportional symbol map • Summary table • Reference table • KPI • Histogram	How is it distributed? What are the high values? What are the low values?

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Visualization	Minimum data requirements	Related visualization types	Questions it can help you answer
Bubble chart	One string field	• Unique values map • Summary table • Reference table • KPI • Bar chart • Column chart • Treemap • Line graph • Donut chart	How is it distributed (by category)?
Chord diagram	Two string fields	• Summary table • Reference table • Bar chart • Stacked bar chart • Column chart • Stacked column chart • Treemap • Heat chart • Data clock • Link chart • Line graph	How is it related?
Column chart	One string field	• Unique values map • Summary table • Reference table • KPI • Bar chart • Treemap • Bubble chart • Line graph • Donut chart • Point chart	How is it distributed (by category)?

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Visualization	Minimum data requirements	Related visualization types	Questions it can help you answer
Combo chart	One of the following: • One string field and two number or rate/ratio fields • Two datasets with the same string field	• Summary table • Reference table • Treemap • Scatter plot • Point chart	How is it distributed (by category)? How is it related?
Data clock	Two string fields	• Summary table • Reference table • Bar chart • Stacked bar chart • Column chart • Stacked column chart • Treemap • Heat chart • Chord diagram • Link chart • Line graph	How has it changed? How is it related?
Donut chart	One string field	• Unique values map • Summary table • Reference table • KPI • Bar chart • Column chart • Treemap • Bubble chart • Line graph	How is it distributed (by category)?

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Visualization	Minimum data requirements	Related visualization types	Questions it can help you answer
Heat chart	Two string fields	• Summary table • Reference table • Bar chart • Stacked bar chart • Column chart • Stacked column chart • Treemap • Chord diagram • Data clock • Link chart • Line graph	How is it related?
Histogram	One number field	• Proportional symbol map • Summary table • Reference table • KPI • Box plot	How is it distributed? What are the high values? What are the low values?
KPI	One number field	None	How is it related?
Line graph	One string field	• Unique values map • Summary table • Reference table • KPI • Bar chart • Column chart • Treemap • Bubble chart • Donut chart	How is it distributed (by category)?

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Visualization	Minimum data requirements	Related visualization types	Questions it can help you answer
Link chart	Two string fields	• Summary table • Reference table • Bar chart • Stacked bar chart • Column chart • Stacked column chart • Treemap • Heat chart • Chord diagram • Data clock • Line graph	How is it related?
Point chart	One string field and one number or rate/ratio field	• Summary table • Reference table • KPI • Bar chart • Column chart • Treemap • Bubble chart • Line graph • Box plot • Donut chart	How is it distributed (by category)?
Scatter plot	Two number or rate/ratio fields	• Summary table • Reference table • KPI	How is it related?
Scatter plot matrix	Three or more number or rate/ratio fields	• Summary table • Reference table	How is it related?

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Visualization	Minimum data requirements	Related visualization types	Questions it can help you answer
Stacked bar chart	Two string fields	• Summary table • Reference table • Bar chart • Column chart • Stacked column chart • Treemap • Heat chart • Chord diagram • Data clock • Link chart • Line graph	How is it distributed (by category)?
Stacked column chart	Two string fields	• Summary table • Reference table • Bar chart • Stacked bar chart • Column chart • Treemap • Heat chart • Chord diagram • Data clock • Link chart • Line graph	How is it distributed (by category)?
Time series graph	One date/time field	• Reference table	How has it changed?

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Visualization	Minimum data requirements	Related visualization types	Questions it can help you answer
Treemap	One string field	• Unique values map • Summary table • Reference table • KPI • Bar chart • Stacked bar chart • Column chart • Stacked column chart • Heat chart • Chord diagram • Data clock • Link chart • Line graph • Point chart	How is it distributed (by category)?

Change variables

As the data story emerges from your visualizations, you can show different data and adjust properties such as grouping your data, as well as change chart styling. Editable fields on charts are shown in gray drop-down boxes. You can choose a different field to show on one axis or both axes. Click an editable field on your chart, and choose a different field from the list.

Visualizations that summarize data, such as bar charts, time series graphs, line graphs, and summary tables allow you to choose a different statistic type. For example, you can switch from displaying the sum of sales per region to the average sales per region by using the statistic type drop-down menu.

Use the chart toolbar

Every card has a toolbar that can be used to find more information or improve the appearance of your data.

Tool	Description	Applicable charts
Layer options	The **Layer options** button can be used to display the **Layer options** pane. The options available on this pane depend on the chart type.	All

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Tool	Description	Applicable charts
Chart statistics	The **Chart statistics** button can be used to display relevant statistical calculations about your data. The following statistics can be displayed for bar charts, column charts, time series graphs, and line graphs: • **Mean** • **Median** • **Upper quartile** • **Lower quartile** • **Custom** The following statistics can be displayed for histograms: • **Mean** • **Median** • **Normal distribution** The following statistics can be displayed for scatter plots: • **None** • **Linear** • **Exponential** • **Polynomial**	Bar chart, column chart, histogram, scatter plot, time series graph, line graph
Card filter	The **Card filter** button can be used to remove any unwanted data from your chart. Filters can be applied to all string, number, rate/ratio, and date/time fields. A card filter does not affect other cards using the same dataset. For more information, see Filter data.	All
Selection tools	Selections can be used to highlight important features. Selections on one card are reflected on any other card using the same data. The following selection tools may be available on your chart: • **Select** • **Box select** • **Invert selection** For more information, see Make selections.	All except donut chart and KPI
Visualization type	The **Visualization type** drop-down menu shows all available card types. The drop-down list can be used to quickly change your card to a map, summary table, or another type of card. The availability of visualizations depends on what type of data is being displayed on your card.	All

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Tool	Description	Applicable charts
Sort	The **Sort** option is available for most charts that use a string field. The following sort options are available: • **Sort ascending** • **Sort descending** • **Sort A to Z** • **Sort Z to A** • **Sort manually** (available with bar and column charts)	Bar chart, column chart, line graph
Maximize	The **Maximize** button is used to enlarge the card. Other cards on the page will be reduced to thumbnails. The card can be returned to its previous size using the **Restore down** button.	All
Enable cross filters	The **Enable cross filters** button is used to allow filters to be created on the card using selections on other cards. Cross filters can be removed using the **Disable cross filters** button. For more information, see Filter data.	All
Flip card	The **Flip card** button displays information on the back of the card about your chart, such as a description of your analysis and a time stamp for when your data was last updated, if applicable. The back of the card also includes statistics, such as count, mean, and median. For some charts, the back of the card can be used to export the data from the card as a CSV.	All
Delete	The **Delete** button removes the card from your page. If you did not intend to delete your card, you can retrieve it using the **Undo** button.	All

Modify an axis

By default, all numeric axes in Insights are on a linear scale. One or more axis can be changed to a logarithmic scale for scatter plots, time series graphs, and line charts. Logarithmic scales are nonlinear scales that can be used to display datasets with large ranges of data values. A logarithmic scale uses logarithmic orders of magnitude to display the data at a more manageable scale. By default, Insights will use a base 10 logarithmic scale. Changing the scale of the axis does not change the value of the data, just the way it is displayed.

The scale of an axis can be changed by clicking the axis and choosing **Linear** or **Log**.

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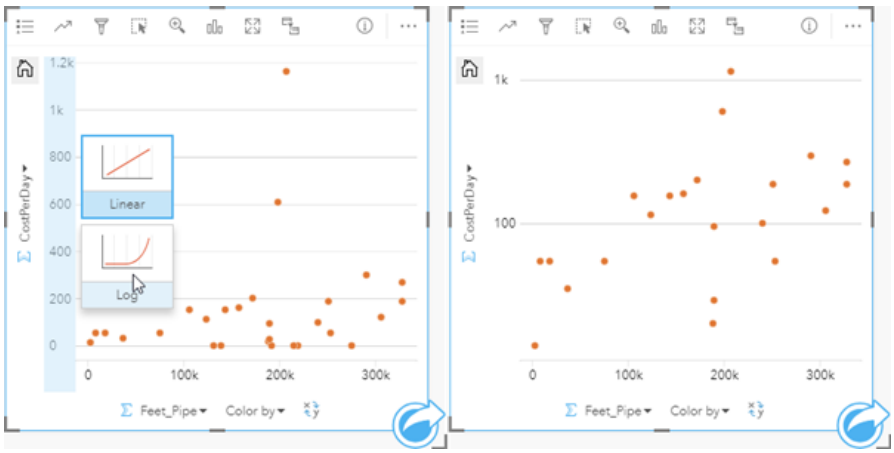

Left—Changing the scale of the y-axis to Log by clicking the axis and choosing the Log scale. Right—A scatter plot with the x-axis displaying data on a linear scale and the y-axis displaying data on a logarithmic scale.

Field names are used to label axes by default. To change the axis labels on a chart, use the following steps:

1. Click the **Card options** button ⋯.
2. Click the **Edit labels** button .
3. Click a label to highlight the text.
4. Type the new axis label.
5. Hit `Enter` or `Return` on your keyboard to make the changes go into effect.

Change the layer options

The **Layer options** pane can be accessed by clicking the **Layer options** button . The options and tabs available in the **Layer options** pane are dependent on the type of chart and current style.

Tab	Description	Applicable charts
Legend	The **Legend** tab displays the symbols on the chart along with the corresponding categories. The **Legend** tab is interactive, so it can be used to select features on your chart (available for unique symbols). If your chart is displayed using **Unique symbols**, you can change the color associated with a category by clicking the symbol and choosing a color from the palette or entering a hex value.	All except histograms

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Tab	Description	Applicable charts
Symbology	The **Symbology** tab is used for the following purposes: • Bar and column charts — Change the **Symbol type** between **Single symbol** and **Unique symbols**. Other charts that can be symbolized using unique or single symbols, such as scatter plots, must be changed using **Subgroup** or **Color by** on the x- or y-axis. • Bar, column, line, and combo charts — Add value labels to the chart. • Data clocks and heat charts — Change the **Classification type** between natural breaks, equal interval, or quantile classifications. • Link charts — Change the layout of the chart between **Force directed**, **Hierarchical**, and **Radial**. • Point charts — Add confidence intervals to your chart.	Bar chart, column chart, combo chart, data clock, heat chart, link chart, point chart
Appearance	The **Appearance** tab can be used to change the **Symbol color** for charts displayed with single symbols, such as histograms. The **Symbol color** can be chosen from the color palette or customized using a hex code.	Bar chart, column chart, combo chart, histogram, scatter plot, time series graph, line graph, box plot, scatter plot matrix, link chart, point chart

Copy a chart

A chart card can be duplicated on a page by activating the card (a card is active when the **Action** button is visible) and using `Ctrl+C` to copy the card and `Ctrl+V` to paste it on the page.

A chart card can be copied to a different page by dragging the card to the **New page** tab + or to an existing page. When a chart is copied to a new page, the dataset will also be copied, if necessary, along with all of the processes used to create the chart. The dataset will not be copied if it already exists on the new page unless one of the datasets contains a dataset filter, a calculated field, or a location field created by enabling location.

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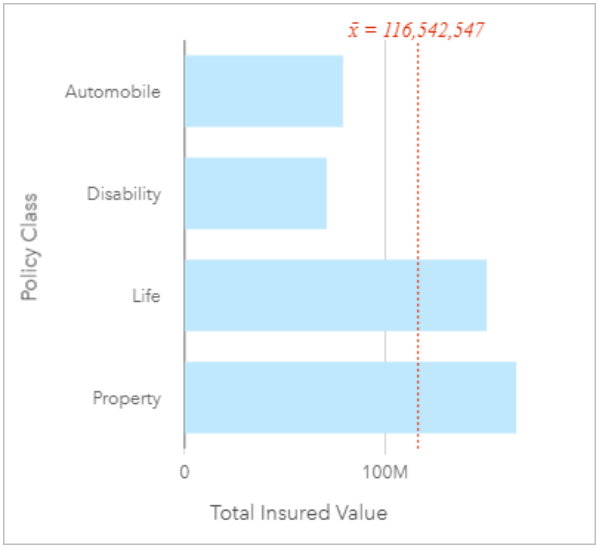
Create and use a bar chart

A bar chart is created by displaying a string field on the y-axis and a count, number field, or rate/ratio field on the x-axis. The length of each bar represents the value of each category.

Bar charts can answer questions about your data, such as: How are numeric values distributed or summarized by category? How is your data ranked?

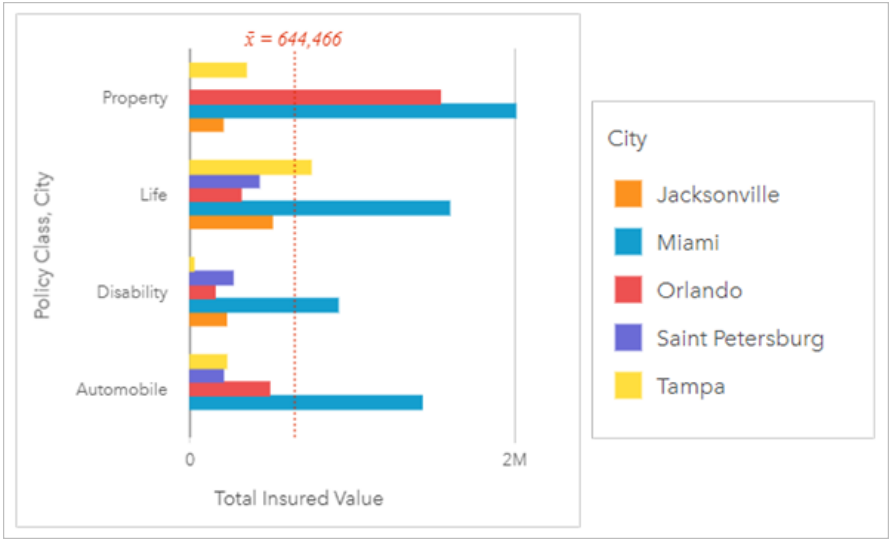
Examples

An insurance company is reviewing the types of policies it offers to compare to the findings from a recently completed market research project. The first step in the review is to determine the total value of policies in each policy class. You can use a bar chart to visualize the sum of total insured values (TIV) for each policy class.



The bar chart above provides a sum of the TIV for each category of insurance policy: disability, automobile, life, and property. When the chart is sorted in ascending order, you can see the highest and lowest values.

The insurance company is especially interested in expanding its business in five cities of interest. The **Subgroup** field can be used to compare the TIV for each policy class across cities.



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The grouped bar chart above shows the distribution of subgroups for each category. The **Policy Class** values (property, life, disability, and automobile) have subgroups that show a different colored bar for each city that's included in the card filter.

Create a bar chart

To create a bar chart, complete the following steps:

1. Select one of the following data options:
   - One or two string fields
   - One or two string fields plus a number or rate/ratio field

   Note:
   If you do not select a number or rate/ratio field, your data will be aggregated and a count will be displayed.

   You can search for fields using the search bar in the data pane.

2. Create the bar chart using the following steps:
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.
   c. Drop the selected fields on **Bar Chart**.

Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

Usage notes

The **Layer options** button opens the **Layer options** pane. You can use the **Layer options** pane to view the legend, change the chart options, and update the chart style.

The **Legend** tab is used to view the symbols on the chart. The pop out legend button displays the legend as a separate card on your page. You can use the legend to make selections on the chart when a subgroup is applied. To change the color associated with a value, click the symbol and choose a color from the palette or enter a hex value.

The **Symbology** tab is used to change the **Symbol type** to **Unique symbol** and to turn labels on or off. The **Symbology** tab is not available if the chart has a subgroup field specified.

Labels display the number values associated with the chart. The following configurations are available for labels:

- **Decimal places** — You can choose a number of decimal places from zero to five, or choose **Default** or **Auto** for the labels. **Default** will abbreviate large numbers, while **Auto** will choose an appropriate precision.
- **Label alignment** — Four alignment options are available for bar charts: **Horizontal, outside**, **Horizontal, inside**, **Vertical, outside**, and **Vertical, inside**.
- **Context label** — Characters, such as a symbol or unit, can be added to the label. The context label can be placed to the left (default) or right of the value.

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The **Appearance** tab is used to change the symbol color (single symbol only) and change the outline color on the chart.

You can symbolize the value of each bar as a count of features in each category on the y-axis or as a number or rate/ratio field. If you use a field, the bar values can be calculated as a sum, minimum, maximum, average, percentile, or median of values from the field for each category.

Note:
The median and percentile statistics are not available for certain remote feature layers. If your remote feature layer does not support median or percentile, you can copy the layer to your workbook.

You can optionally select the **Subgroup** field on the y-axis. The **Subgroup** field must be a string field and is used to divide each category on the y-axis into subcategories.

Tip:
You can style related maps with the same field you used to group your bar chart. When you interact with the chart or map, you can see simultaneous categorical and spatial patterns.

Use the **Chart statistics** button to display the mean, median, upper quartile, lower quartile, or a custom value.

Use the **Sort** button to sort the categorical data ascending or descending by the numeric variable, alphabetically, or manually. If you choose **Sort manually**, you can click and drag bars to a new position on the chart. Click **Apply** to apply the changes, or **Cancel** to return to the previous order.

Note:
Charts on a shared page will use the same default sorting style that was used when the page was shared. **Sort manually** will be called **Predefined** and manual sorting will not be available to viewers. Charts that were sorted ascending, descending, or alphabetically when shared will not have a **Predefined** sorting option.

Use the **Visualization type** button to switch directly between a bar chart and other visualizations, such as a summary table, bubble chart, or line graph.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card, the **Export image** tab allows users to export an image of the card, and the **Export data** tab allows users to export the data from the card.

When you create a bar chart, a result dataset with the string and number fields used to create the chart is added to the data pane. You can use the result dataset to find answers with nonspatial analysis using the **Action** button.

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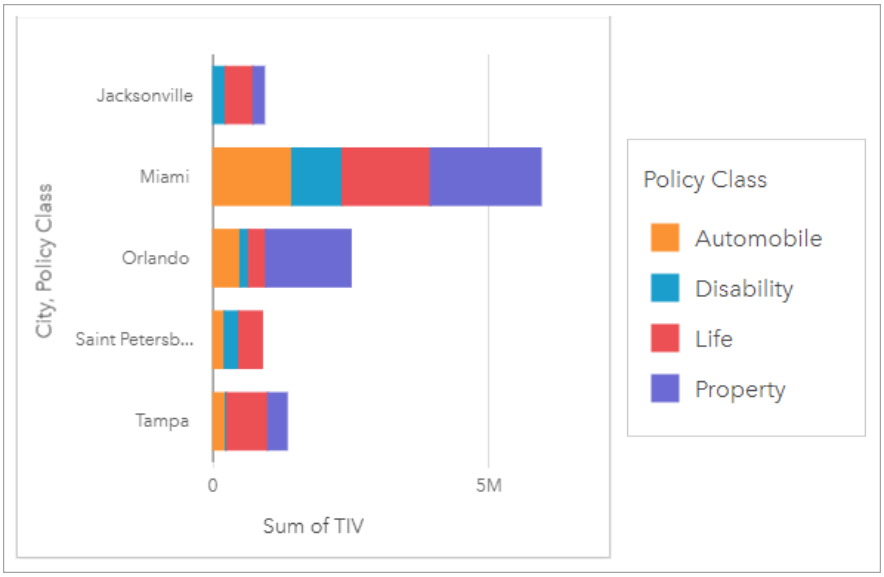
Create and use a stacked bar chart

Stacked bar charts display the relative size—either as a count, percentage, or other numeric variable—of a categorical variable, subdivided by color based on a subgroup.

Stacked bar charts can answer questions about your data, such as How are numeric values distributed or summarized by category and subcategory? How is your data ranked?

Example

An insurance company is reviewing the types of policies it offers to compare its current offerings to the findings from a recently completed market research project. The insurance company is especially interested in expanding its business in five cities of interest. A stacked bar chart can be used to visualize the sum of total insured values (TIV) for each city of interest and policy class.



The analyst is interested to see that Miami has the highest TIV, despite having approximately half the population of Jacksonville. Based on these values, it seems like Jacksonville could be a good choice for expanding business. The analyst will also look closer at advertising and competition in Miami so she can create a strategy for the other cities.

The company believes it may be able to break into new markets by advertising bundle options to existing customers. The marketing team thinks it would be best to customize which bundles are promoted for each city based on which policy classes are being under-purchased. The analyst can determine which bundles to promote in each city by changing the numeric variable on the stacked bar chart from the sum of TIV to the count of policies and displaying the chart with a stacked percent. The changes to the chart allow the analyst to determine the proportions of policies sold from each class for the cities of interest.

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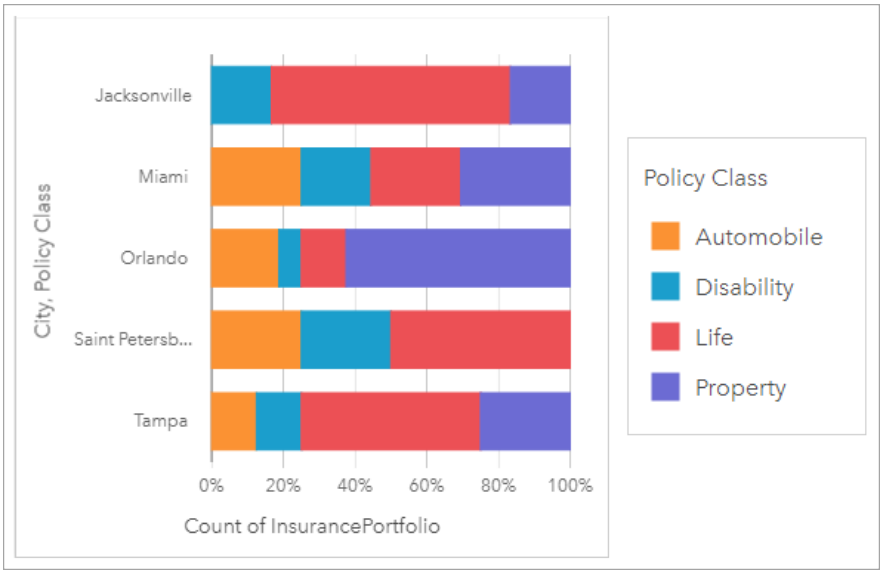

The chart shows that most of the cities have at least one policy class with a very low percentage of the overall count of policies for the city. For example, Jacksonville and Saint Petersburg have no policies in the Automobile and Property classes, respectively. The company could try to increase the sales of those policy classes by advertising insurance bundles to existing life insurance customers, which make up a relatively high proportion of the policies in both Jacksonville and Saint Petersburg.

Create a stacked bar chart

To create a stacked bar chart, complete the following steps:

1. Select one of the following data options:
   - Two string fields
   - Two string fields plus a number or rate/ratio field

   Note:
   If you do not select a number or rate/ratio field, your data will be aggregated and a count will be displayed.

   You can search for fields using the search bar in the data pane.

2. Create the stacked bar chart.
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.
   c. Drop the selected fields on **Stacked Bar Chart**.

Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

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Usage notes

The **Layer options** button can be used to select data from the subgroup. To change the color associated with a category, click the symbol and choose a color from the palette, or enter a hex value.

The **Appearance** tab can be used to change the layout between **Stacked count** and **Stacked percent**. The **Stacked count** layout displays the numerical variable on the chart as totals for both the category and subcategory, with the length of the bar and segments inside the bar representing the amount of the numerical variable. The **Stacked percent** layout displays all categories as the same size, representing a range from 0 to 100%. The subcategories are all displayed as proportions of the bars. The **Appearance** tab can also be used to change the outline color.

The value of each bar can be symbolized as a count of features in each category on the y-axis, or as a number or rate/ratio field. If a field is used, the bar values can be calculated as a sum, minimum, maximum, average, percentile, or median of values from the field for each category.

Note:
The median and percentile statistics are not available for certain remote feature layers. If your remote feature layer does not support median or percentile, you can copy the layer to your workbook.

The subgroup can be removed to change the stacked bar chart to a bar chart.

Use the **Chart statistics** button to display the mean, median, upper quartile, lower quartile, or a custom value. Statistics are not available for charts using the **Stacked percent** layout.

Use the **Sort** button to sort the categorical data in either ascending or descending order by the numeric variable or alphabetically.

Use the **Visualization type** button to switch directly between a stacked bar chart and other visualizations, such as a summary table, heat chart, or chord diagram.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card, the **Export image** tab allows users to export an image of the card, and the **Export data** tab allows users to export the data from the card.

When you create a stacked bar chart, the result dataset with the string and number fields used to create the chart is added to the data pane. The result dataset can be used to find answers with nonspatial analysis using the **Action** button.

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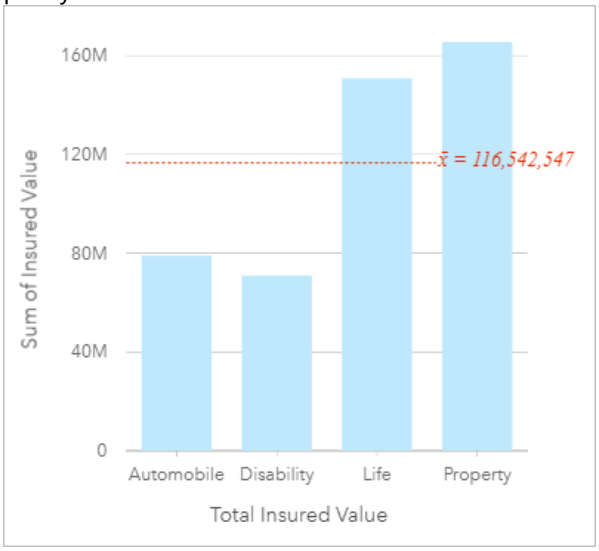
Create and use a column chart

A column chart is created by displaying a string field on the x-axis and a count, number field, or rate/ratio field on the y-axis. The length of each column represents the value of each category. Column charts can also use a subgroup to create a grouped or stacked column chart so that comparisons can be made between and within categories.

Column charts can answer questions about your data, such as: How are numeric values distributed or summarized by category? How is the data ranked?

Examples

An insurance company is reviewing the types of policies it offers to compare its current offerings to the findings from a recently completed market research project. The first step in the review is to determine the total value of policies in each policy class. A column chart can be used to visualize the sum of total insured values (TIV) for each policy class.



The column chart above provides a sum of the TIV for each category of insurance policy: Disability, Automobile, Life, and Property. When the chart is sorted in ascending order, it's easy to see the highest and lowest values.

The insurance company is especially interested in expanding its business in five cities of interest. The Subgroup field can be used to compare the total insured value for each policy class across cities.

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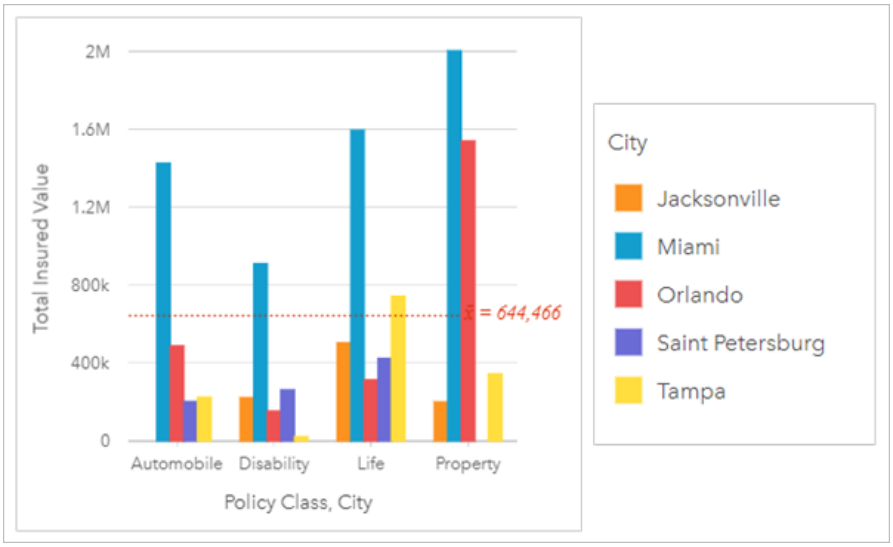

The column chart above shows the distribution of subgroups for each category. The Policy_Class values (Property, Life, Disability, and Automobile) have subgroups that show a different colored column for each city.

Create a column chart

To create a column chart, complete the following steps:

1. Select one of the following data options:
   - One or two string fields
   - One or two string fields plus a number or rate/ratio field

   Note:
   If you do not select a number or rate/ratio field, your data will be aggregated and a count will be displayed.

   You can search for fields using the search bar in the data pane.

2. Create the column chart using the following steps:
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.
   c. Drop the selected fields on **Column Chart**.

Tip:

Drag a matching string field from a second dataset onto your column chart to create a combo chart.

Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

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Usage notes

The **Layer options** button opens the **Layer options** pane. You can use the **Layer options** pane to view the legend, change the chart options, and update the chart style.

The **Legend** tab is used to view the symbols on the chart. The pop out legend button displays the legend as a separate card on your page. You can use the legend to make selections on the chart when a subgroup is applied. To change the color associated with a value, click the symbol and choose a color from the palette or enter a hex value.

The **Symbology** tab is used to change the **Symbol type** to **Unique symbol** and to turn labels on or off. The **Symbology** tab is not available if the chart has a subgroup field specified.

Labels display the number values associated with the chart. The following configurations are available for labels:

- **Decimal places** — You can choose a number of decimal places from zero to five, or choose **Default** or **Auto** for the labels. **Default** will abbreviate large numbers, while **Auto** will choose an appropriate precision.
- **Label alignment** — Five alignment options are available for column charts: **Horizontal, outside**, **Horizontal, inside**, **Vertical, outside**, **Vertical, inside**, and **Angled**.
- **Context label** — Characters, such as a symbol or unit, can be added to the label. The context label can be placed to the left (default) or right of the value.

The **Appearance** tab is used to change the symbol color (single symbol only) and change the outline color on the chart.

The value of each column can be symbolized as a count of features in each category on the x-axis, or as a number or rate/ratio field. If a field is used, the column values can be calculated as a sum, minimum, maximum, average, percentile, or median of values from the field for each category.

Note:
The median and percentile statistics are not available for certain remote feature layers. If your remote feature layer does not support median or percentile, you can copy the layer to your workbook.

An optional **Subgroup** field can be selected on the x-axis. The Subgroup field must be a string field and will be used to divide each category on the x-axis into subcategories.

Tip:
Style related maps with the same field you used as a subgroup on your column chart. When you interact with the chart or map, you'll see simultaneous categorical and spatial patterns.

Use the **Chart statistics** button to display the mean, median, upper quartile, lower quartile, or a custom value.

Use the **Sort** button to sort the categorical data in ascending or descending order by numeric variable, alphabetically, or manually. If you choose **Sort manually**, you can click and drag columns to a new position on the chart. Click **Apply** to apply the changes, or **Cancel** to return to the previous order.

Note:
Charts on a shared page will use the same default sorting style that was used when the page was shared. **Sort manually** will be called **Predefined** and manual sorting will not be available to viewers. Charts that were sorted ascending, descending, or alphabetically when shared will not have a **Predefined** sorting option.

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Use the **Visualization type** button to switch directly between a column chart and other visualizations, such as a summary table, treemap, or donut chart.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card, the **Export image** tab allows users to export an image of the card, and the **Export data** tab allows users to export the data from the card.

When you create a column chart, a result dataset with the string and number fields used to create the chart will be added to the data pane. The result dataset can be used to find answers with nonspatial analysis using the **Action** button.

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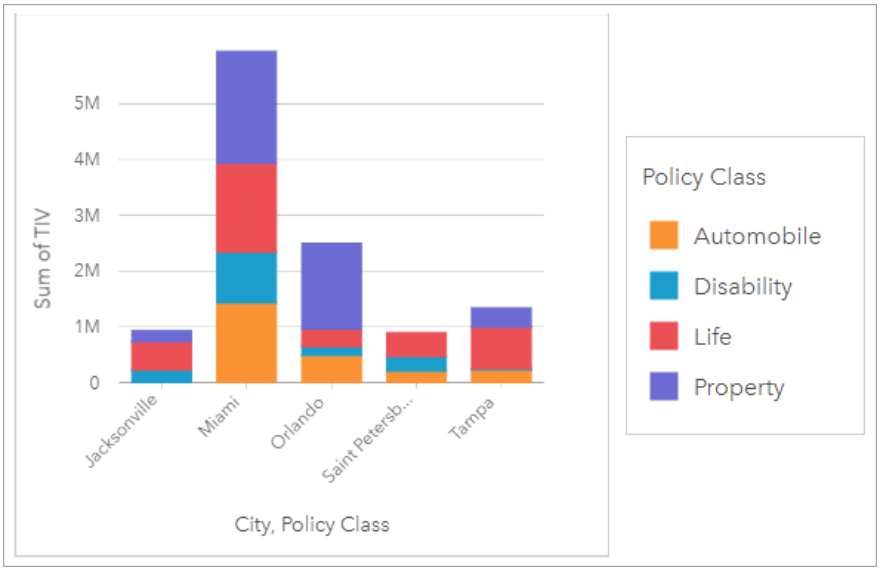
Create and use a stacked column chart

Stacked column charts display the relative size—either as a count, percentage, or other numeric variable—of a categorical variable, subdivided by color based on a subgroup.

Stacked column charts can answer questions about your data, such as How are numeric values distributed or summarized by category and subcategory? How is your data ranked?

Example

An insurance company is reviewing the types of policies it offers to compare its current offerings to the findings from a recently completed market research project. The insurance company is especially interested in expanding its business in five cities of interest. A stacked column chart can be used to visualize the sum of total insured values (TIV) for each city of interest and policy class.



The analyst is interested to see that Miami has the highest TIV, despite having approximately half the population of Jacksonville. Based on these values, it seems like Jacksonville could be a good choice for expanding business. The analyst will also look closer at advertising and competition in Miami so she can create a strategy for the other cities.

The company believes it may be able to break into new markets by advertising bundle options to existing customers. The marketing team thinks it would be best to customize which bundles are promoted for each city based on which policy classes are being under-purchased. The analyst can determine which bundles to promote in each city by changing the numeric variable on the stacked column chart from the sum of TIV to the count of policies and displaying the chart with a stacked percent. The changes to the chart allow the analyst to determine the proportions of policies sold from each class for the cities of interest.

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The chart shows that most of the cities have at least one policy class with a very low percentage of the overall count of policies for the city. For example, Jacksonville and Saint Petersburg have no policies in the Automobile and Property classes, respectively. The company could try to increase the sales of those policy classes by advertising insurance bundles to existing life insurance customers, which make up a relatively high proportion of the policies in both Jacksonville and Saint Petersburg.

Create a stacked column chart

To create a stacked column chart, complete the following steps:

1. Select one of the following data options:
   - Two string fields
   - Two string fields plus a number or rate/ratio field

   Note:
   If you do not select a number or rate/ratio field, your data will be aggregated and a count will be displayed.

   You can search for fields using the search bar in the data pane.

2. Create the stacked column chart.
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.
   c. Drop the selected fields on **Stacked Column Chart**.

Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

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Usage notes

The **Layer options** button can be used to select data from the subgroup. To change the color associated with a category, click the symbol and choose a color from the palette, or enter a hex value.

The **Appearance** tab can be used to change the layout between **Stacked count** and **Stacked percent**. The **Stacked count** layout displays the numerical variable on the chart as totals for both the category and subcategory, with the height of the column and segments inside the column representing the amount of the numerical variable. The **Stacked percent** layout displays all categories as the same size, representing a range from 0 to 100%. The subcategories are all displayed as proportions of the columns. The **Appearance** tab can also be used to change the outline color.

The value of each column can be symbolized as a count of features in each category on the y-axis, or as a number or rate/ratio field. If a field is used, the column values can be calculated as a sum, minimum, maximum, average, percentile, or median of values from the field for each category.

Note:
The median and percentile statistics are not available for certain remote feature layers. If your remote feature layer does not support median or percentile, you can copy the layer to your workbook.

The subgroup can be removed to change the stacked column chart to a column chart.

Use the **Chart statistics** button to display the mean, median, upper quartile, lower quartile, or a custom value. Statistics are not available for charts using the **Stacked percent** layout.

Use the **Sort** button to sort the categorical data in either ascending or descending order by the numeric variable or alphabetically.

Use the **Visualization type** button to switch directly between a stacked column chart and other visualizations, such as a summary table, treemap, or line graph.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card, the **Export image** tab allows users to export an image of the card, and the **Export data** tab allows users to export the data from the card.

When you create a stacked column chart, the result dataset with the string and number fields used to create the chart is added to the data pane. The result dataset can be used to find answers with nonspatial analysis using the **Action** button.

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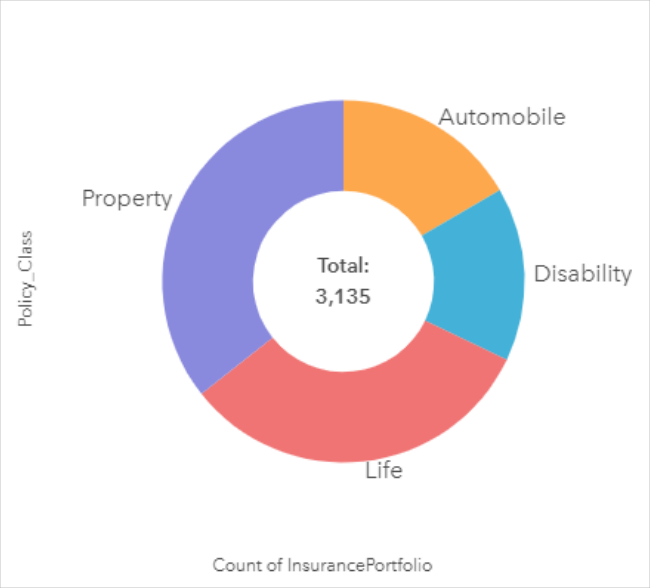
Create and use a donut chart

Donut charts are used to show the proportions of categorical data, with the size of each piece representing the proportion of each category. A donut chart is created using a string field and a count of features, number, or rate/ratio field.

Donut charts can answer questions about your data, such as: What are the proportions of categories to the total?

Example

An insurance company is reviewing the types of policies it offers to compare to the findings from a recently completed market research project. One step in the review is to compare the total value of policies in each policy class. A donut chart can be used to visualize the proportion of total insured value (TIV) in each policy class.



The donut chart above gives a visual representation of each policy class, with the total insured value in the center.

Create a donut chart

To create a donut chart, complete the following steps:

1. Select one of the following data options:
   - A string field
   - A string field plus a number or rate/ratio field

   Note:
   If you do not select a number or rate/ratio field, your data will be aggregated and a count will be displayed.

   You can search for fields using the search bar in the data pane.

2. Create the donut chart using the following steps:
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.
   c. Drop the selected fields on **Donut Chart**.

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Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

Usage notes

Donut charts are symbolized using unique symbols.

The **Layer options** button opens the **Layer options** pane. The **Layer options** pane contains the following functions:

- The **Legend** tab can be used to make selections on the chart. To change the color associated with a value, click the symbol and choose a color from the palette or enter a hex value. The pop out legend button displays the legend as a separate card on your page.
- The **Appearance** tab changes the outline color on the chart.

Each piece on the donut chart can represent either a count of features in that category or the sum of a number or rate/ratio field. The total of either the count or the specified field is displayed in the center of the donut chart.

Use the **Visualization type** button to switch directly between a donut chart and other visualizations, such as a unique values map, summary table, bar chart, or treemap.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card and the **Export data** tab allows users to export the data from the card.

When you create a donut chart, a result dataset with the string and number fields used to create the chart will be added to the data pane. The result dataset can be used to find answers with nonspatial analysis using the **Action** button.

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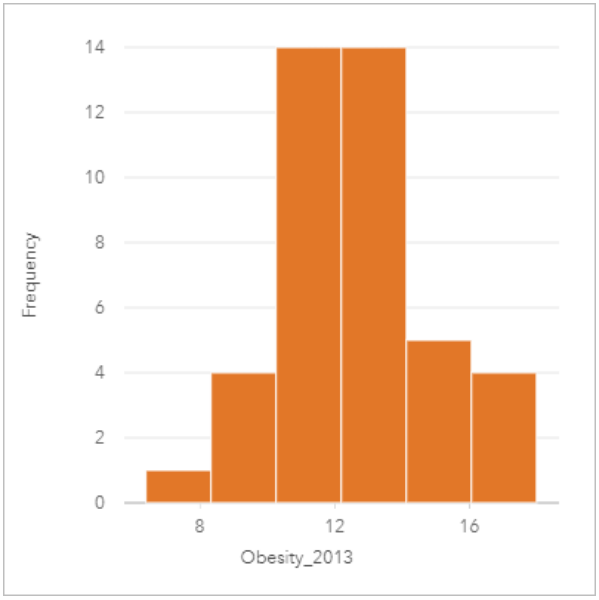
Create and use a histogram

Histograms aggregate numerical data into equal interval groups, called bins, and display the frequency of values within each bin. A histogram is created using a single number or rate/ratio field.

Histograms can answer questions about your data, such as: What is the distribution of numeric values and their frequency of occurrence in a dataset? Are there outliers?

Example

A nongovernmental health organization is studying obesity rates among adolescents in the United States. A histogram of the frequency of obesity in youth across each state can be used to determine the distribution of obesity rates, including the most and least common frequencies and overall range.



The histogram above shows a normal distribution and indicates that the most frequently occurring rates are between the 10 and 14 percent range.

Increasing or decreasing the number of bins can have an effect on how you analyze your data. While the data does not change, its appearance can. It's important to choose an appropriate number of bins for your data so that patterns in the data are not misinterpreted. Too few bins can hide important patterns, and too many bins can make small but expected fluctuations in data appear important. The following figure is an example of an appropriate number of bins for the data. Each bin contains a range of approximately 1 percent, and the data can be examined at a finer scale to see patterns that are not visible when using six bins. In this case, the pattern that emerges is a normal distribution around the mean with a slight, but likely not significant, skew toward the left.

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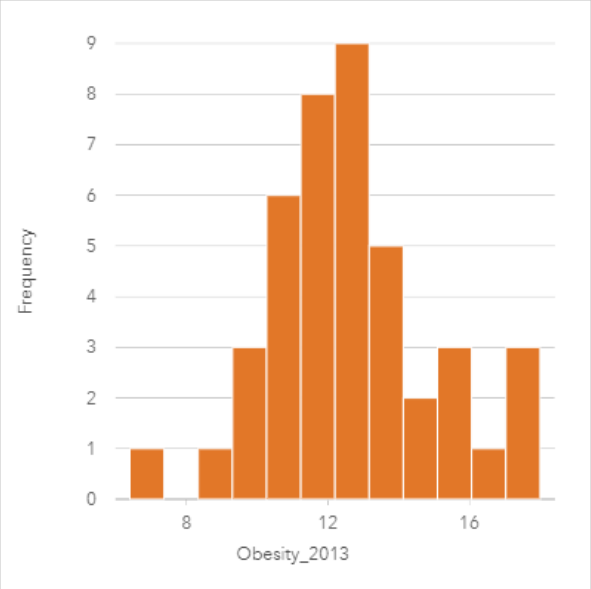

Create a histogram

To create a histogram, complete the following steps:

1. Select a number ∑ or rate/ratio field ᴿ/ᵦ.

   Tip:

   You can search for fields using the search bar in the data pane.

2. Create the histogram using the following steps:
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.
   c. Drop the selected fields on **Histogram**.

Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

Histograms can also be created using **View Histogram**, which is accessed from the **Action** button under **Find answers** > **How is it distributed?**

Usage notes

Histograms are symbolized using single values. You can use the **Layer options** button to change the symbol color and outline color, which will be applied to all bins.

When a histogram is created, Insights automatically calculates an appropriate number of bins for displaying your data. You can change the number of bins using the slider along the x-axis or by clicking the number of bins and entering a new number.

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Note:
If the chosen number of bins does not divide evenly into the data range, then bins will be calculated using decimal values. Histograms display rounded integers as their bin labels, rather than decimals. The rounded integers are for display only, and the decimal values are used for all calculations. In a case where a bin includes data values near the upper or lower limit and the label is rounded, the bin starting and ending values may appear incorrect because the labels are displaying rounded values rather than decimals.

Use the **Chart statistics** button to display the mean, median, and normal distribution of the data. A normal distribution curve represents the expected distribution of a random sample of continuous data, where the highest frequency of values is centered around the mean and the frequency of values decreases as the values increase or decrease away from the mean. A normal distribution curve is useful for determining if your data has bias (for example, the data has a higher frequency of low values) or outliers.

Use the **Visualization type** button to switch directly between a histogram and a graduated symbols map or summary table.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card and the **Export data** tab allows users to export the data from the card.

The back of a histogram displays the following calculated values: mean, median, standard deviation, skewness, and kurtosis (simplified). Skewness and kurtosis are described in the following table:

Statistic	Description
Skewness	Skewness determines whether the data's distribution is symmetrical. Skewness measurement determines whether most of the distribution values lie to the left or the right of the mean. The skewness of normal distribution is zero, showing an equal amount of the data on either side of the mean. Skewness values can be zero, negative, or positive as follows: • Zero—The data has a symmetrical distribution. • Negative—The data is asymmetrical with a skew to the right. The highest frequency of values are found to the right of the mean, and the left tail is longer than the right tail. The median is larger than the mean. • Positive—The data is asymmetrical with a skew to the left. The highest frequency of values are found to the left of the center, and the right tail is longer than the left tail. The mean is larger than the median.
Kurtosis	Kurtosis describes the shape of the frequency distribution and gives a measure of the likelihood that the distribution will produce outliers. Distributions with relatively heavy tails are termed leptokurtic and have kurtosis greater than zero. Distributions with relatively light tails are termed platykurtic and have a kurtosis less than zero. The kurtosis of a normal distribution is equal to three, or when using simplified kurtosis, the kurtosis of a normal distribution is zero (this is found using the same formula as kurtosis, minus 3). Simplified kurtosis values can be zero, negative, or positive as follows: • Zero—The mode is the same as the mean. • Negative—The data distribution has shorter tails and the peak is flatter. • Positive—The tails of the curve are longer and the peak is higher.

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Create and use a scatter plot

Scatter plots are used to determine the strength of a relationship between two numeric variables. The x-axis represents the independent variable, and the y-axis represents the dependent variable.

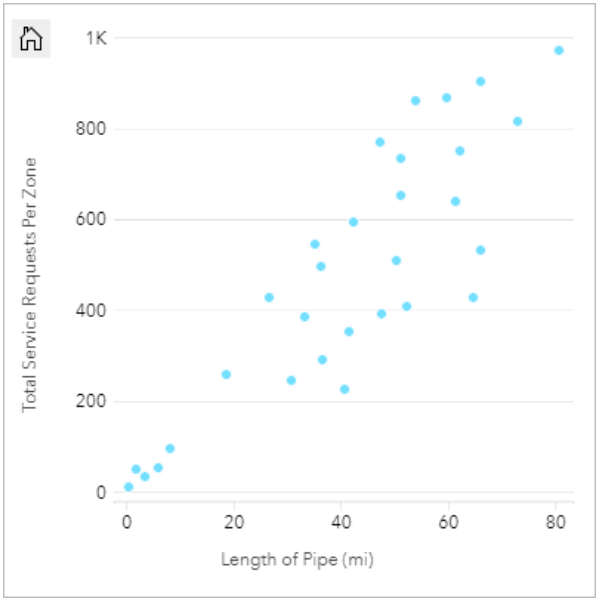
Scatter plots can answer questions about your data such as, What is the relationship between two variables? How is the data distributed? Where are the outliers?

Examples

The examples below show scatter plots using two variables, three variables, and bins.

Two variables

A public works department has noticed an increase in leaks on water mains. The department wants to know how much of an effect the total length of pipes has on the number of leaks compared to the impact of properties of the pipes, such as age or circumference. A scatter plot can be used to plot the total number of leaks versus the total length of pipes in each zone.



The public works department also wants to know whether there is any difference between pipes surveyed at different times of the year. Using the **Color by** option, the department can style the points using unique colors for every unique value in the specified field.

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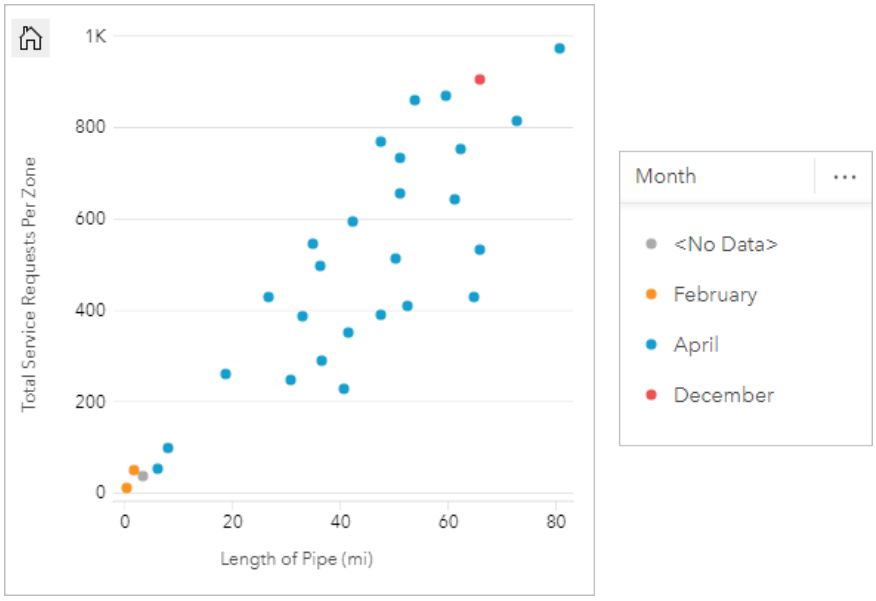
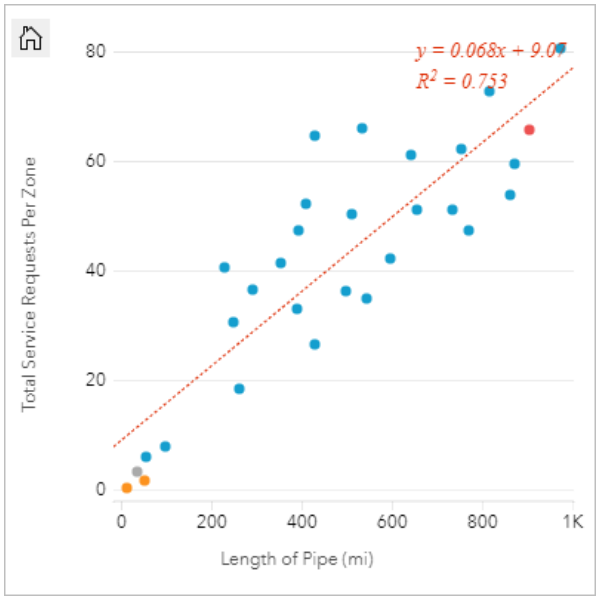


The scatter plot indicates that most of the pipe surveys occurred in April.

A scatter plot can use regression analysis to estimate the strength and direction of the relationship between dependent and independent variables. Statistical models are illustrated with a straight or curved line, depending on your selected chart statistic. The R2 value can be added to give a measure of the impact of the length of pipes on the number of leaks.



Add a third variable

A public works department has noticed an increase in leaks on water mains. The department wants to know how much of an effect the total length of pipes has on the number of leaks versus the impact of properties of the pipes, such as age or circumference. The department also wants to know whether there is a relationship between the number of leaks or length of pipes and the cost per day (including construction, maintenance and repairs, and lost resources through leaks). A scatter plot with proportional symbols can be used to plot the total number of leaks versus the total length of pipes in each zone, with the size of the points representing the cost per day.

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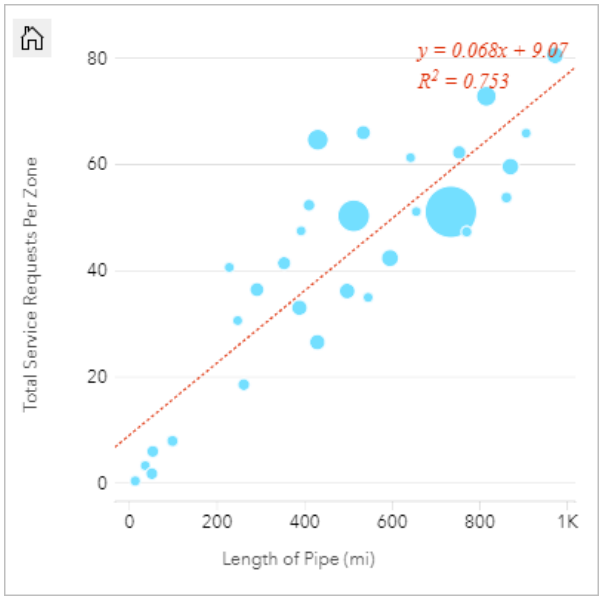
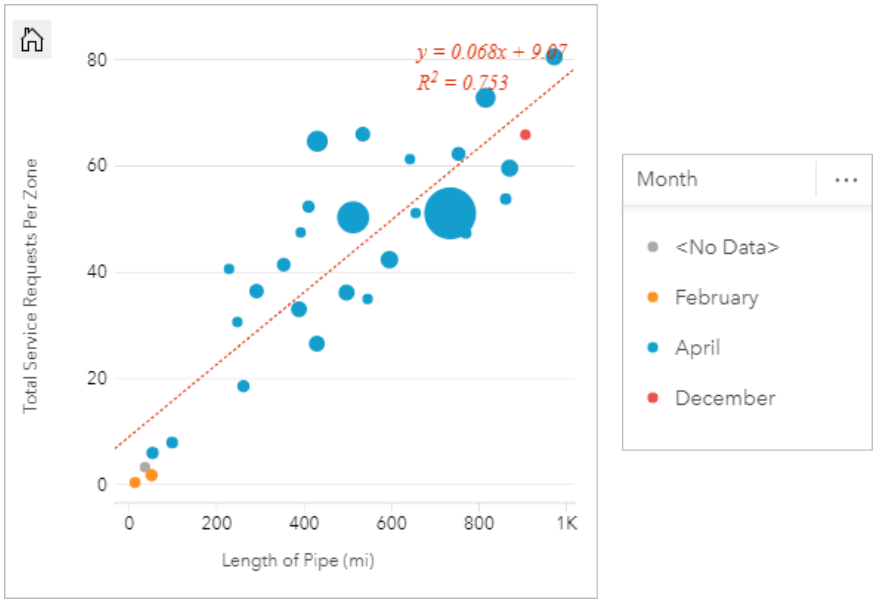


Tip:

Drag a number field to your page and drop it on your scatter plot to give your chart graduated symbols.

The public works department also wants to know whether there is any difference between pipes surveyed at different times of the year. Using the **Color by** option, you can style the points using unique colors for every unique value in the specified field.



The scatter plot indicates that most of the pipe surveys occurred in April.

Visualize with bins

A GIS analyst working for a consortium of colleges wants to find which states have high-value colleges. The analyst starts their analysis by creating a scatter plot showing the cost of colleges and the average earnings after

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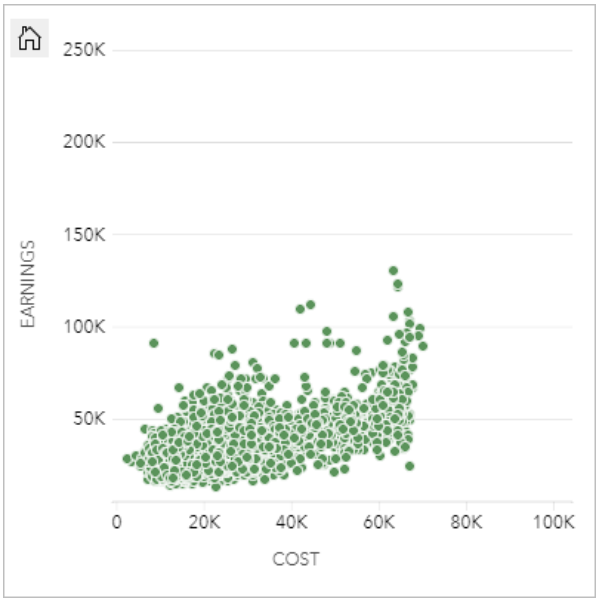
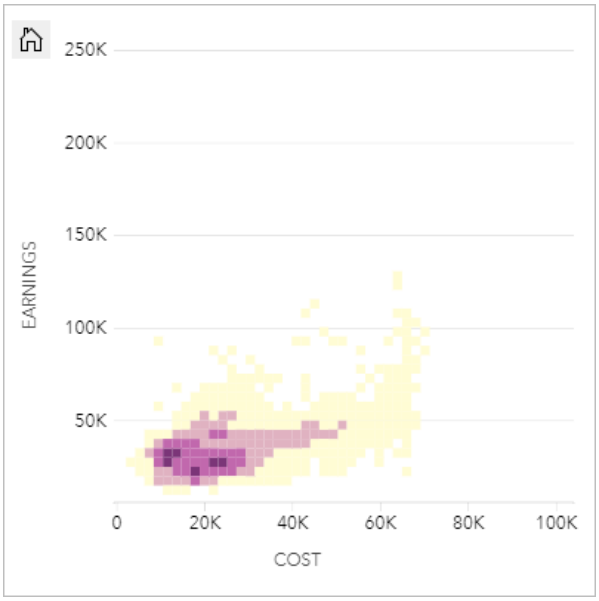
graduation. The scatter plot shows a positive relationship, but the points are too densely distributed to see more specific patterns.



The analyst can change the style of the chart to **Bins** to see the distribution of the points on the scatter plot. The pattern shows that the highest concentration of colleges have a cost around $20,000 and result in earnings below $50,000.



Create a scatter plot

To create a scatter plot, complete the following steps:

1. Select two number ∑ or rate/ratio R/B fields.

> **Tip:**
> You can search for fields using the search bar in the data pane.

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2. Create the scatter plot using the following steps:
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.
   c. Drop the selected fields on **Scatter Plot**.

Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

Scatter plots can also be created using **View Scatter Plot**, which is accessed by clicking the **Action** button under **Find answers** > **How is it related**.

Usage notes

The **Layer options** button opens the **Layer options** pane. You can use the **Layer options** pane to view the legend, change the symbol type on the chart, and change the style of the chart.

The **Legend** tab displays the symbols and values on your chart. To change the color associated with a value, click the symbol and choose a color from the palette or enter a hex value (available when a **Color by** variable is applied). The **Pop out legend** button displays the legend as a separate card on your page. The legend can be used to make selections on the chart.

The **Symbology** tab is used to change the **Color by** and **Symbol type** parameters. The **Color by** field is used to style the chart with unique values and must be a string field. The **Symbol type** parameter is used to switch the style of the chart between points and bins. If the **Symbol type** is **Bins**, the following additional configurations are available:

- Set the size of the bins by adjusting the **Resolution** value. The default **Resolution** value is calculated for your dataset using Sturges' rule.
- Specify the **Transition value** setting. If the number of point features in the chart extent is less than the transition value, the chart will display the point features. If the number of points in the chart extent is greater than or equal to the transition value, the chart will be styled with bins. The default **Transition value** is 2,000.
- The **Show pop-up** parameter determines whether pop-ups are displayed when you hover over a bin, and what information is included in the pop-ups.

The **Appearance** tab is used to adjust the following symbol properties:

- For points, you can change the symbol size, symbol color (single symbol only), outline thickness, outline color, and layer transparency.
- For bins, you can change the color palette, bin outline thickness, bin outline color, and layer transparency.

You can add a line of best fit to the scatter plot using the **Chart statistics** button . The line of best fit can be **Linear**, **Exponential**, or **Polynomial**. The equation of the line of best fit and the R2 value will also be displayed on the chart.

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Statistic	Description
Linear	Linear regression attempts to fit a straight line through a set of values so that the distances between the values and the fitted line are as small as possible. A positively sloped line (from lower left to upper right of the chart) indicates a positive linear relationship. Positive relationships mean that values increase together. A negatively sloped line indicates a negative linear relationship. A negative relationship means that one value decreases as another increases. Goodness of fit measures, such as R2, can be used to quantify the relationship. The closer to 1, the stronger the relationship is.
Exponential	This calculates an exponential (upward) curve of best fit to model a nonlinear relationship in your data (R2 for linear regression at 0 or close to 0).
Polynomial	This calculates a curve of best fit for a nonlinear relationship in your data (R2 for linear regression at 0 or close to 0). A second-degree polynomial equation is used for the calculation by default. You can change the equation to a third- or fourth-degree polynomial equation.

You can add a third number or rate/ratio variable to your scatter plot by selecting a field in the data pane and dragging it to the existing scatter plot card (not available on a scatter plot with bin symbols). The result will be a scatter plot with proportional symbols, where the size of the points represents the magnitude of the data from the third variable.

Use the **Switch axes** button to switch the variables on the x- and y-axis.

Use the **Visualization type** button to switch directly between a scatter plot and other visualizations, such as a KPI card or summary table.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card and the **Export data** tab allows users to export the data from the card.

Click the x- or y-axis to change the scale between **Linear** and **Log**.

Limitations

Binned scatter plots are not available for certain remote feature layers. If your remote feature layer does not support binned scatter plots, you can copy the layer to your workbook and create a binned scatter plot using the copy.

Export data is not available for binned scatter plots. You must set the **Symbol type** to **Single symbol** to enable exporting data from the back of a scatter plot.

Zoom tools and selection tools are not available for binned scatter plots with over 100,000 features on shared pages.

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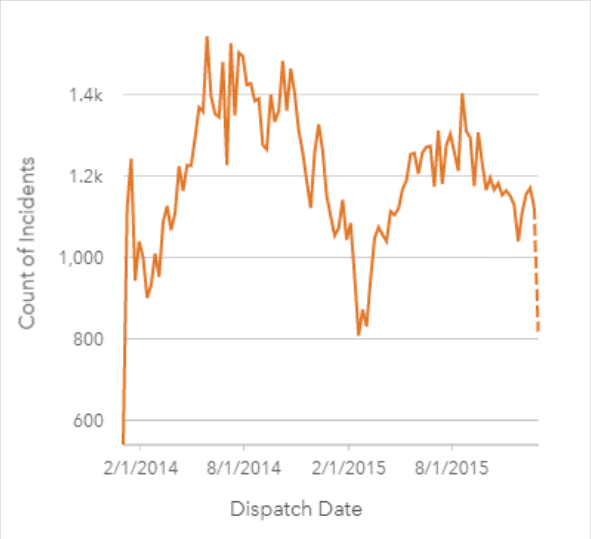
Create and use a time series graph

Time series graphs can be used to visualize trends in counts or numerical values over time. Because date and time information is continuous categorical data (expressed as a range of values), points are plotted along the x-axis and connected by a continuous line. Missing data is displayed with a dashed line.

Time series graphs can answer questions about your data, such as How does the trend change over time?

Example

A crime analyst is studying crime trends in his city to determine if initiatives to reduce crime have been effective. The analyst uses a time series graph and compares the number of incidents over time to the timing of the crime reduction programs.



The graph above shows peaks in incidents in the period from May 2014 to October 2014 and again from May 2015 to September 2015. There is a decrease in incidents in February 2014 and 2015. If the crime reduction programs occurred in those months, that would imply that the programs were effective, but only for a limited time.

The analyst realizes that looking at a total number of incidents over the two years only tells part of the story. Subgrouping the time series graph by another field, such as the crime type, can give more insight into the effectiveness of the programs for different types of incidents.

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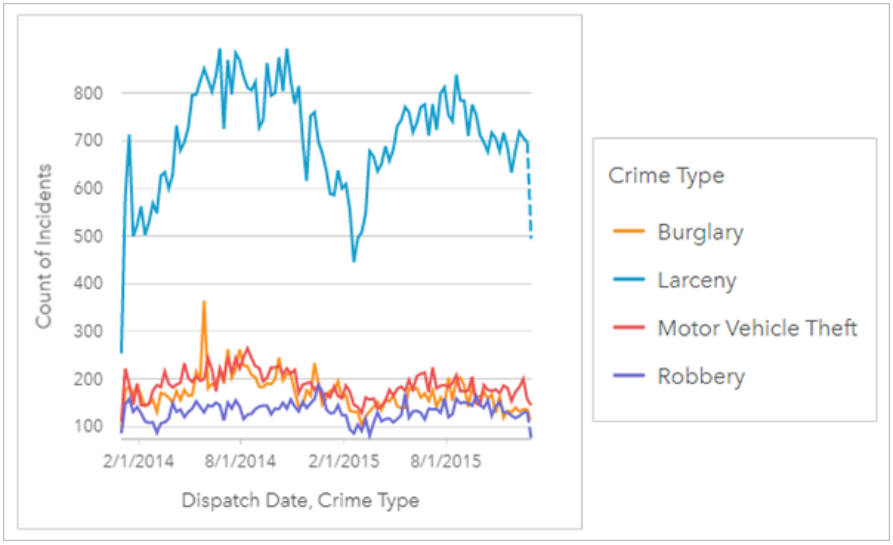

The grouped time series graph above indicates that the majority of incidents were categorized as larceny. The counts of larceny show a similar pattern to the ungrouped time series. The other incident types, burglary, motor vehicle theft, and robbery, have relatively stable counts across the two-year time period, with the exception of a spike in burglaries in May 2015. Based on what the analyst sees in the grouped time series graph, he will recommend focusing the programming on reducing the number of larceny crimes in the city.

Note:

The following cards may be helpful to pair with your grouped time series graph:

- A related map styled with the same field you used to group your time series graph, such as Day Of Week. When you interact with the time series graph or the map, you'll be able to see simultaneous temporal, categorical, and spatial patterns.
- A related bar chart using the field you used to group your time series graph to see highest and lowest values by your chart subgroup.

Create a time series graph

To create a time series graph, complete the following steps:

1. Select one of the following data options:
   - One or more date/time fields
   - One date/time field plus one or more number or rate/ratio fields
   - One or more date/time fields plus one number or rate/ratio field
   - One date/time field plus a string field
   - One date/time field plus a number or rate/ratio field plus a string field

   Note:

   If you do not select a number or rate/ratio field, your data will be aggregated and a count will be displayed.

   You can search for fields using the search bar in the data pane.

2. Create the time series graph using the following steps:

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a. Drag the selected fields to a new card.

b. Drop the selected fields onto the **Time Series** drop zone.

Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

You can also create time series graphs using **Time Series**, which is accessed from the **Action** button under **Find answers** > **How has it changed**.

Note:

When you drag a date/time field onto your page, the **Chart** drop zone is replaced with the **Time Series** drop zone because a time series graph is the only chart type that can be created using a date/time field.

Usage notes

The **Layer options** button opens the **Layer options** pane. The **Layer options** pane contains the following functions:

- The **Legend** tab is used to view the symbols on the chart. The pop out legend button displays the legend as a separate card on your page. You can use the legend to make selections on the chart. To change the color associated with a value, click the symbol and choose a color from the palette or enter a hex value (unique symbols only).
- The **Symbology** tab is used to show or remove the time slider from the card or show a gradient fill below the time series line. If the time slider is removed, you can still zoom to a time interval by dragging your pointer across the chart.
- The **Appearance** tab changes the symbol color (single symbol only) and the pattern and thickness of the line.

The trends for the time series graph can be symbolized as a count of features over time or as a number or rate/ratio field. The values in the trend line can be calculated as the sum, minimum, maximum, average, percentile, or median of values for the chart.

Note:

Median and percentile are not available for certain remote feature layers. If your remote feature layer does not support median or percentile, you can copy the layer to your workbook.

The x-axis shows the date/time fields visualized on the chart. The arrow next to the field names can be used to select or unselect date/time fields to display on the chart. If multiple date/time fields are selected, the y-axis can only display one number field or the count.

The y-axis shows the count or number fields and statistics visualized on the chart. The arrow next to y-axis can be used to select or unselect number or rate/ratio fields to display on the chart. If multiple number or rate/ratio fields are selected, the x-axis can only display one date/time field.

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Tip:

Drag additional date/time fields or number fields to an existing time series to add them to the chart. The fields must be from the same dataset used to create the chart.

You can optionally select a **Group by** field on the x-axis. The **Group by** field must be a string field and is used to divide the trend line into subcategories. A **Group by** field is only available on time series graphs containing a single date/time field and a single number field or count.

Use the **Chart statistics** button to display the mean, median, upper quartile, lower quartile, or a custom value.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card and the **Export image** tab allows users to export an image of the card.

Use the upper and lower time slider handles or drag your pointer on the chart to zoom in. Zooming in updates the time intervals for the plotted data, if applicable. When you're zoomed in, you can drag the slider to pan the time series to the left or right. Use the **Default extent** button to zoom back to the full extent of the data. For more information on the time slider and zooming, see How time series graphs work.

Note:

Zooming to a time interval will not select or filter your data.

Click the y-axis to switch the scale between **Linear** and **Log**.

How time series graphs work

Time series graphs are created by plotting an aggregated value (either a count or a statistic, such as sum or average) on a time line. The values are aggregated using time intervals based on the time range in the data being plotted.

The following time intervals are used on time series graphs:

- One decade
- Three years
- One year
- Six months
- Three months
- One month
- Two weeks
- One week
- Three days
- One day
- Six hours
- One hour
- Five minutes

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- One minute
- One second

The time slider can be used to zoom in or out on the time series graph. If the zoom level passes a required threshold, the time interval updates to the appropriate interval. The largest available time interval for an individual time series graph is the default interval. The smallest interval is the interval that corresponds to the raw data or one second, whichever is larger.

For example, a dataset has data collected on a daily basis. When a time series is created, the default interval is one week. Zooming in on the time series will update the time interval to three days or one day, depending on the zoom level. The time series cannot be zoomed in to a smaller interval than one day or zoomed out to a larger interval than one week.

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Create and use a treemap

Treemaps can be used to view your data in a hierarchical format using nested rectangles. A treemap is like a tree diagram that uses differently sized rectangles to convey numeric values for each branch. The larger the rectangle, the higher the numeric value.

Treemaps can answer questions about your data, such as: What are the proportions of categories to the total?

Examples

An insurance company is reviewing the types of policies it offers to compare its current offerings to the findings from a recently completed market research project. One step in the review is to compare the total value of policies in each policy class. A treemap can be used to visualize the proportion of total insured value (TIV) in each policy class.

This treemap has four rectangles (one for each policy class), with each rectangle representing a portion of the total insured value.

The insurance company decides to limit its focus to states that share coastline along the Gulf of Mexico. Using the location field, the analyst can create a spatial treemap that shows the total insured value for each state (Texas, Mississippi, Louisiana, Alabama, and Florida), with the states organized by their geographic location.

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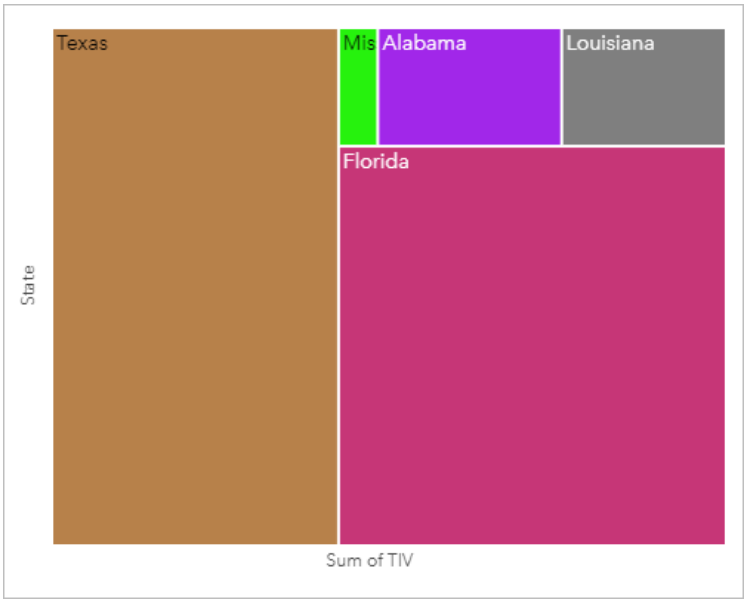

This spatial treemap has five rectangles representing the total insured value of each state bordering the Gulf of Mexico.

Create a treemap

To create a treemap, complete the following steps:

1. Select one of the following combinations of data:
   - One or two string fields
   - One or two string fields plus one or two number or rate/ratio fields

   Note:
   If you do not select a number or rate/ratio field, your data will be aggregated and a count will be displayed.

   You can search for fields using the search bar in the data pane.

2. Create the treemap using the following steps:
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.
   c. Drop the selected fields on **Treemap**.

Additionally, you can create a spatial treemap that displays your data in the same way as a standard treemap, but it's suitable for the arrangement of data with a geographic component because it creates tessellated cartograms for geovisualization (Wood, J., Dykes, J., 2008).

Tip:
You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

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Create a spatial treemap

To create a spatial treemap, complete the following steps:

1. Select one of the following data options:
   - A location field
   - A location field and a string field
   - A location field and one or two number or rate/ratio fields
   - A location field, a string field, and one or two number or rate/ratio fields

   Note:
   If you do not select a number or rate/ratio field, your data will be aggregated and a count will be displayed.

2. Create the spatial treemap using the following steps:
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.
   c. Drop the selected fields on **Treemap**.

Usage notes

Treemaps that use no or one number field are symbolized using unique symbols. The string field selected on the y-axis groups the data by unique categories that are displayed as proportional rectangles in different colors. Hovering over each rectangle provides a sum or count for each category.

Treemaps that use two number fields can be displayed using graduated colors.

The **Layer options** button opens the **Layer options** pane. The **Layer options** pane contains the following functions:

- The **Legend** tab can be used to make selections on the chart. To change the color associated with a value, click the symbol and choose a color from the palette or enter a hex value (unique values only). The pop out legend button displays the legend as a separate card on your page.
- The **Appearance** tab changes the outline color on the chart.

Use the **Visualization type** button to switch directly between a treemap and other visualizations, such as a unique values map, summary table, bar chart, or line graph.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card and the **Export data** tab allows users to export the data from the card.

When you create a treemap, a result dataset with the string and number fields used to create the chart will be added to the data pane. The result dataset can be used to find answers with nonspatial analysis using the **Action** button.

How treemaps work

Two types of treemaps can be created in ArcGIS Insights: spatial treemaps and nonspatial treemaps. Categorical values or feature locations define the structure of a treemap, and numeric values define the size or color of the individual rectangles. With either type of treemap, the area represents the numeric value shown on the x-axis. A

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subcategory can be added, which is nested inside a category, with categories being identified by their different colors. A second numeric field can be used to classify the treemap values using natural breaks.

References

Wood, Jo and Jason Dykes. "Spatially Ordered Treemaps," IEEE Transactions on Visualization and Computer Graphics 14, no. 6 (Nov–Dec 2008): 1348-1355.

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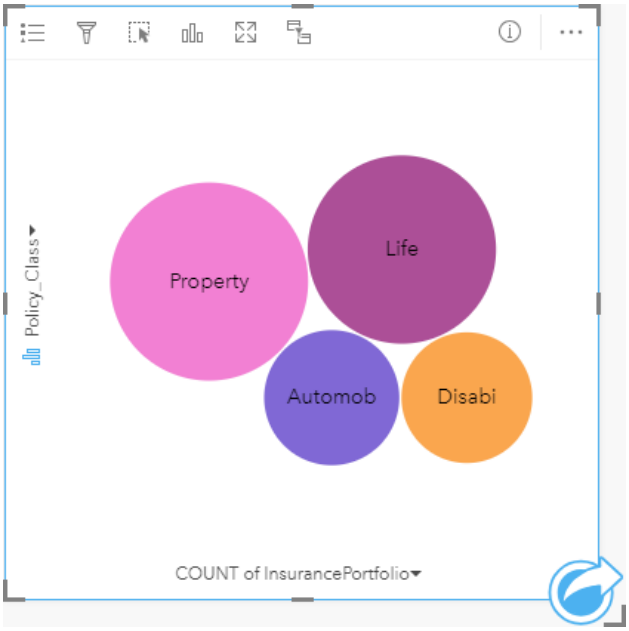
Create and use a bubble chart

A bubble chart can be used to visualize how categorical data is related.

Bubble charts can answer questions about your data, such as: How is it related? How many are there? How is it distributed?

Example

An insurance company is reviewing the types of policies it offers to compare to the findings from a recently completed market research project. The principals want to know how many policies it has sold in each class, relative to the other classes. A bubble chart with categories can be used to visually compare the count of each policy class to the other policy classes.



Create a bubble chart

To create a bubble chart, complete the following steps:

1. Select one of the following data options:
   - A string field
   - A string field plus a number or rate/ratio field

   Note:
   If you do not select a number or rate/ratio field, your data will be aggregated and a count will be displayed.

   You can search for fields using the search bar in the data pane.

2. Create the bubble chart using the following steps:
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.
   c. Drop the selected fields on **Bubble Chart**.

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Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

Usage notes

Bubble charts are symbolized using unique symbols.

The **Layer options** button opens the **Layer options** pane. The **Layer options** pane contains the following functions:

- The **Legend** tab can be used to make selections on the chart. To change the color associated with a value, click the symbol and choose a color from the palette or enter a hex value. The pop out legend button displays the legend as a separate card on your page.
- The **Appearance** tab changes the outline color on the chart.

Each bubble on the bubble chart can represent either a count of features in that category or the sum of a number or rate/ratio field.

Use the **Visualization type** button to switch directly between a bubble chart and other visualizations, such as a unique values map, summary table, column chart, or donut chart.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card and the **Export data** tab allows users to export the data from the card.

When you create a bubble chart, a result dataset with the string and number fields used to create the chart will be added to the data pane. The result dataset can be used to find answers with nonspatial analysis using the **Action** button.

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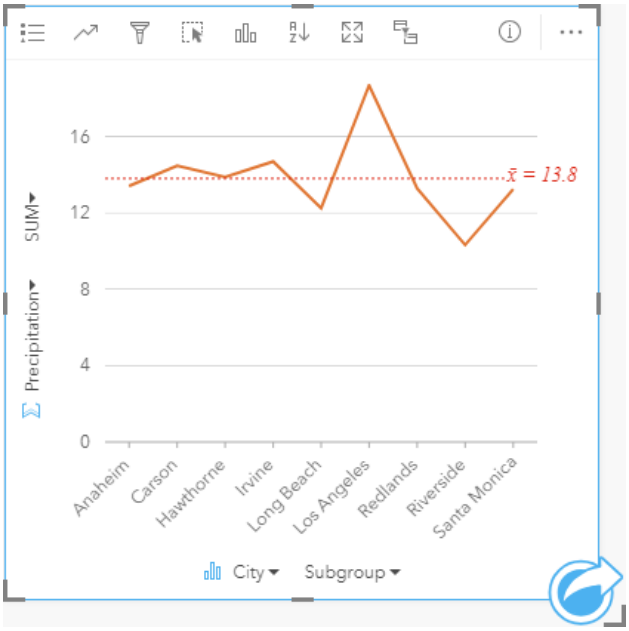
Create and use a line graph

Line graphs show information as a series of data points that are connected by straight line segments. Categories are shown along the x-axis, and statistics are shown along the y-axis. Unlike time series graphs, which only use date and time along the category axis, line graphs allow you to use string fields along the category axis.

Line graphs can answer questions about your data, such as: How are numeric values distributed or summarized by category?

Example

An environmental organization is tracking the drought conditions in Southern California and wants to compare precipitation levels across the region to determine which cities are most vulnerable. The organization uses a line graph to show the total precipitation for each city.



The line graph above shows how precipitation values fluctuate by city.

Create a line graph

To create a line graph, complete the following steps:

1. Select one of the following data options:
   - One or two string fields
   - One or two string fields plus a number or rate/ratio field

   Note:
   If you do not select a number or rate/ratio field, your data will be aggregated and a count will be displayed.

   You can search for fields using the search bar in the data pane.

2. Create the line graph using the following steps:
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.

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c. Drop the selected fields on **Line Graph**.

Tip:

Drag a matching string field from a second dataset onto your line graph to create a combo chart.

Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

Usage notes

The **Layer options** button opens the **Layer options** pane. You can use the **Layer options** pane to view the legend, change the chart options, and update the chart style.

The **Legend** tab is used to view the symbols on the chart. The pop out legend button displays the legend as a separate card on your page. You can use the legend to make selections on the chart when a subgroup is applied. To change the color associated with a value, click the symbol and choose a color from the palette or enter a hex value.

The **Symbology** tab is used to apply the **Smooth line** parameter and turn labels on or off. A smooth line is best in situations when you are displaying trends in your data without sudden changes, rather than when you want to see specific values. For example, showing trends in monthly temperature using a smooth line is an effective way to analyze seasonality.

Labels display the number values associated with the chart. The following configurations are available for labels:

- **Decimal places** — You can choose a number of decimal places from zero to five, or choose **Default** or **Auto** for the labels. **Default** will abbreviate large numbers, while **Auto** will choose an appropriate precision.
- **Label alignment** — Three alignment options are available for line graphs: **Horizontal, outside**,**Vertical, outside**, and **Angled**.
- **Context label** — Characters, such as a symbol or unit, can be added to the label. The context label can be placed to the left (default) or right of the value.

The **Appearance** tab is used to change the symbol color (single symbol only) and change the pattern and thickness of the line.

The trends for the line graph can be symbolized as a count of features over time or as a number or rate/ratio field. If a field is used, the values in the trend line can be calculated as the sum, minimum, maximum, average, percentile, or median of values from the field for each point in time.

Note:

The median and percentile statistics are not available for certain remote feature layers. If your remote feature layer does not support median or percentile, you can copy the layer to your workbook.

Use the **Chart statistics** button to display the mean, median, upper quartile, lower quartile, or a custom value.

Use the **Sort** button to sort the categorical data either ascending or descending by the numeric variable, or alphabetically.

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Use the **Visualization type** button to switch directly between a line graph and other visualizations, such as a summary table, column chart, or bubble chart.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card, the **Export image** tab allows users to export an image of the card, and the **Export data** tab allows users to export the data from the card.

When you create a line graph, a result dataset with the string and number fields used to create the chart will be added to the data pane. The result dataset can be used to find answers with nonspatial analysis using the **Action** button.

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Create and use a chord diagram

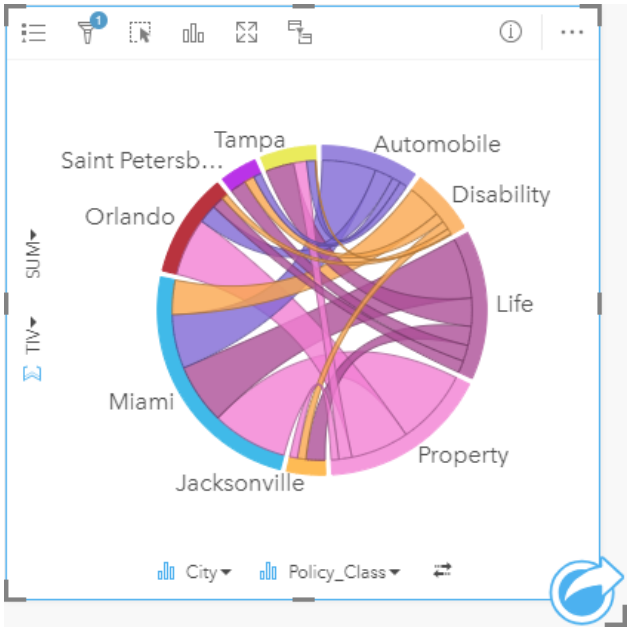
Chord diagrams provide a way to visualize tabular datasets in an appealing and informative manner to show directed relationships between categories.

Chord diagrams can answer questions about your data, such as the following:

- What is the volume of flow between categories?
- Are there anomalies, differences, or similarities in the volume of flow?

Examples

An insurance company is reviewing the types of policies it offers to compare its current offerings to the findings from a recently completed market research project. One step in the review is to compare the total insured value (TIV) of policies in each policy class across cities. A chord diagram can be used to visualize the distribution of subgroups for each category.



The chord diagram above provides a sum of the TIV for each category of insurance policy across cities. The Policy_Class values (Property, Life, Disability, and Automobile) and City values (Miami, Jacksonville, Orlando, Saint Petersburg, and Tampa) are displayed as different colored arcs around the circle. The length of the arc and thickness of the chords are determined by the sum of the TIV. You can see not only which city or policy class recorded the highest and lowest values, but also the policy classes that contribute to the sum of TIV for each city. Miami recorded the largest sum of TIV in each policy class, while cities such as Saint Petersburg and Jacksonville have policies in three out of the four policy classes.

When the values in the two category fields are the same, the rate/ratio layout is used. Each chord is bidirectional, with its thickness and value determined by the extent of the relationship or volume of the flow between the categories.

A census bureau department is studying the state-to-state migration flows among eight states on the West Coast of the United States in a particular year. A chord diagram can be used to determine the migration behavior among the states.

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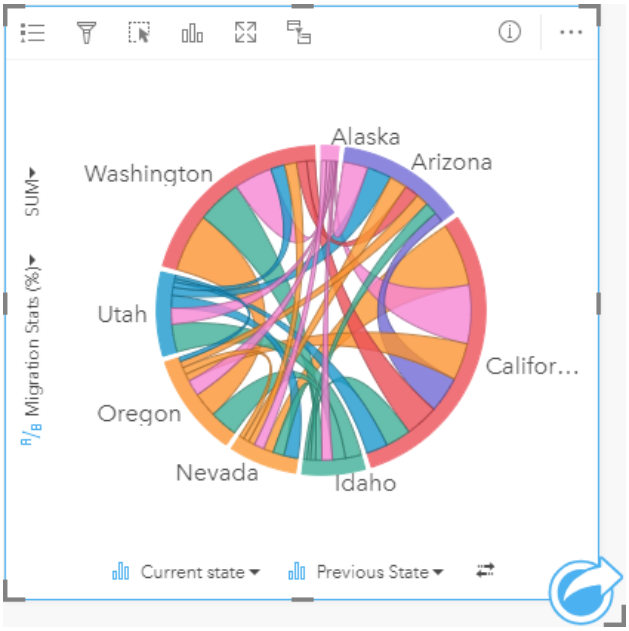

The states (Alaska, Arizona, California, Idaho, Nevada, Oregon, Utah, and Washington) are displayed as different colored arcs around the circle. The arc length for each state represents the flow (migration) into the state, so you can see which states recorded the highest influx. The chords show the directed flow between states. In the ratio layout, each chord represents the bidirectional flow between two states, so tapered chords indicate more volume of flow in one direction than the reverse. For example, more people migrated from Alaska to California than vice versa.

Create a chord diagram

To create a chord diagram, complete the following steps:

1. Select one of the following combinations of data:
   - Two string fields
   - Two string fields plus a number or rate/ratio field

   Note:

   If you do not select a number or rate/ratio field, your data will be aggregated and a count will be displayed.

   You can search for fields using the search bar in the data pane.

2. Create the chord diagram using the following steps:
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.
   c. Drop the selected fields on **Chord Diagram**.

Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

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Chord diagrams can also be created using **View Chord Diagram**, which is accessed from the **Action** button under **Find answers** > **How is it related?**

Usage notes

Chord diagrams are symbolized by unique colors.

The **Layer options** button opens the **Layer options** pane. The **Layer options** pane can be used to make selections on the chart. To change the color associated with a value, click the symbol and choose a color from the palette or enter a hex value. The pop out legend button displays the legend as a separate card on your page.

The categories are arranged in a circle as arcs. The chords are the links or connections between the arcs in the circle that show the relationships or flow between the two categories. The length of each arc and the thickness of each chord are determined by its value.

The values in the chord diagram can be symbolized as a count of features in the categories or as a number or rate/ratio field. If a field is used, the values can be calculated as a sum, minimum, maximum, average, percentile, or median of values from the field.

Note:
The median and percentile statistics are not available for certain remote feature layers. If your remote feature layer does not support median or percentile, you can copy the layer to your workbook.

Use the **Visualization type** button to switch directly between a chord diagram and other visualizations, such as a grouped summary table, bar chart with a Subgroup field, data clock, or heat chart.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card and the **Export data** tab allows users to export the data from the card.

When you create a chord diagram, a result dataset with the string and number fields used to create the chart will be added to the data pane. The result dataset can be used to find answers with nonspatial analysis using the **Action** button.

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Create and use a data clock

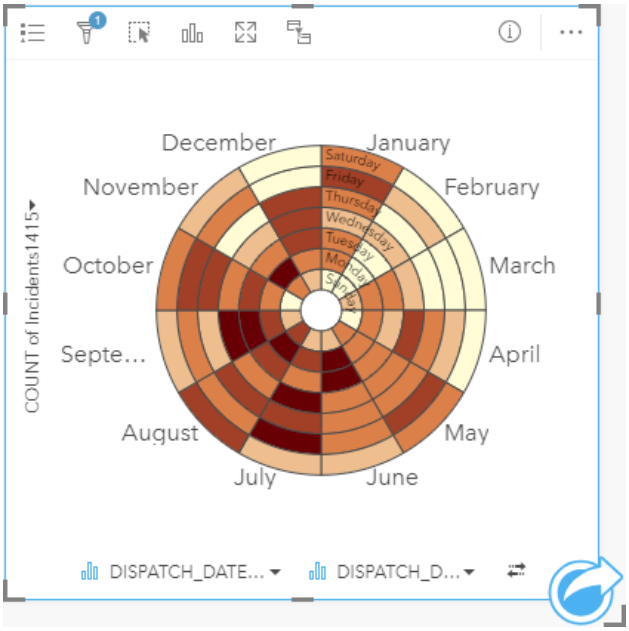
A data clock is a circular chart that is divided into cells by a combination of concentric circles and radial lines, similar to the spokes on a bicycle wheel. The concentric circles divide the data in one way, such as by month, and the radial lines divide the data in a different way, such as by day of the month.

Using a data clock, you can visualize the distribution of your data in two dimensions, allowing you to look for patterns that you might otherwise miss. Data clocks are useful for visualizing trends in temporal data to understand how much data exists at different periods of time.

Data clocks can answer questions about your data, such as: What is the temporal distribution of a dataset at two different frequencies?

Examples

A crime analyst is studying theft-related crimes in her city. She wants to know which months and days of the week have the most and least incidents so that she can look for patterns and root causes of crime. A data clock can be used to visualize the relative prevalence of crimes throughout the year.



Create a data clock

To create a data clock, complete the following steps:

1. Select one of the following combinations of data:
   - Two string fields
   - Two string fields plus a number or rate/ratio field

   Note:
   If you do not select a number or rate/ratio field, your data will be aggregated and a count will be displayed.

   You can search for fields using the search bar in the data pane.

2. Create the data clock using the following steps:

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a. Drag the selected fields to a new card.
b. Hover over the **Chart** drop zone.
c. Drop the selected fields on **Data Clock**.

Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

Data clocks can also be created using **View Data Clock**, which is accessed from the **Action** button under **Find answers** > **How has it changed?**

Usage notes

Data clocks are symbolized using graduated colors.

The **Layer options** button opens the **Layer options** pane. The **Layer options** pane contains the following functions:

- The **Legend** tab can be used to make selections on the chart. The pop out legend button displays the legend as a separate card on your page.
- The **Symbology** tab changes the classification type and number of classes.
- The **Appearance** tab changes the color palette and outline color.

Use the **Visualization type** button to switch directly between a data clock and other visualizations, such as a grouped summary table, a line graph with a **Subgroup** field, or a heat chart.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card and the **Export data** tab allows users to export the data from the card.

When you create a data clock, a result dataset with the string and number fields used to create the chart will be added to the data pane. The result dataset can be used to find answers with nonspatial analysis using the **Action** button.

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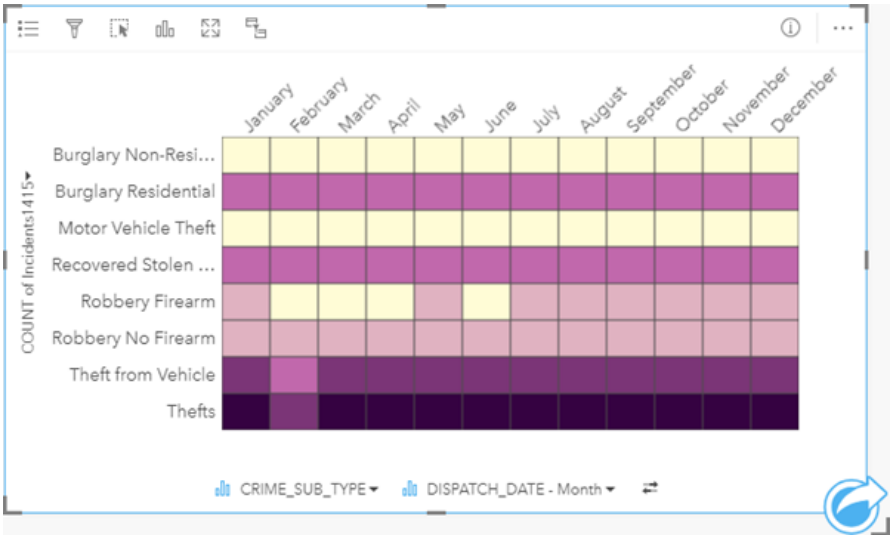
Create and use a heat chart

A heat chart is used to visualize the numeric relationship between two categorical variables. A heat chart consists of a rectangular grid composed of two categorical variables. Each cell in the grid is symbolized using a numeric value.

Heat charts can help you answer questions about your data, such as: How are numeric values distributed or summarized by two categories? How are two categories related?

Examples

A crime analyst is studying the frequency of theft-related crimes in her city. She wants to know the type of incident occurring most often and the months that have the most crime. A heat chart can be used to visualize the relative prevalence of each crime for each month.



Create a heat chart

To create a heat chart, complete the following steps:

1. Select one of the following combinations of data:
   - Two string fields
   - Two string fields plus a number or rate/ratio field

   Note:
   If you do not select a number or rate/ratio field, your data will be aggregated and a count will be displayed.

   You can search for fields using the search bar in the data pane.

2. Create the heat chart using the following steps:
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.
   c. Drop the selected fields on **Heat Chart**.

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Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

Heat charts can also be created using **View Heat Chart**, which is accessed from the **Action** button under **Find answers** > **How is it distributed?**.

Usage notes

Heat charts are symbolized using graduated colors.

The **Layer options** button opens the **Layer options** pane. The **Layer options** pane contains the following functions:

- The **Legend** tab can be used to make selections on the chart. The pop out legend button displays the legend as a separate card on your page.
- The **Symbology** tab changes the classification type and number of classes.
- The **Appearance** tab changes the color palette and outline color.

Use the **Visualization type** button to switch directly between a heat chart and other visualizations, such as a grouped summary table, a bar chart with a **Subgroup** field, or a data clock.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card and the **Export data** tab allows users to export the data from the card.

When you create a heat chart, a result dataset with the string and number fields used to create the chart will be added to the data pane. The result dataset can be used to find answers with nonspatial analysis using the **Action** button.

Limitations

The heat chart variables cannot exceed 3,000 unique values per axis. If one or both of the variables exceed the 3,000 value limit, a filter, such as a predefined filter, can be used to reduce the size of the dataset.

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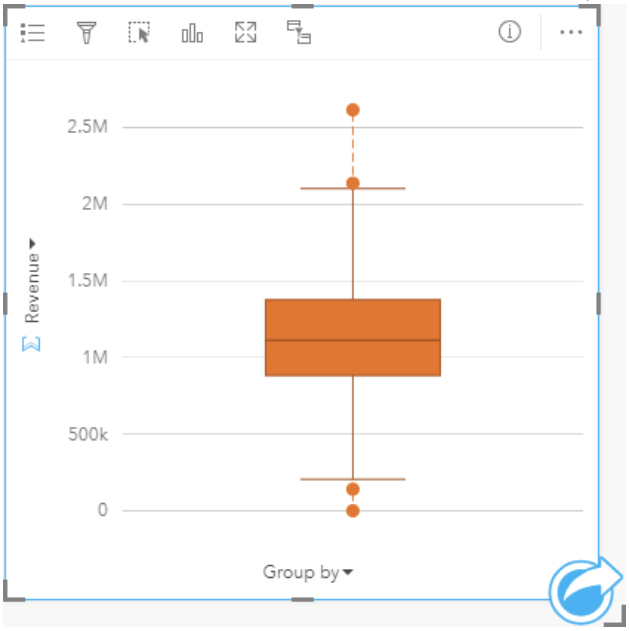
Create and use a box plot

Box plots provide a quick visual summary of the variability of values in a dataset. They show the median, upper and lower quartiles, minimum and maximum values, and any outliers in the dataset. Outliers can reveal mistakes or unusual occurrences in data. A box plot is created using a number or rate/ratio field on the y-axis.

Box plots can answer questions about your data, such as: How is my data distributed? Are there any outliers in the dataset? What are the variations in the spread of several series in the dataset?

Examples

A market researcher is studying the performance of a retail chain. A box plot of the annual revenue at each store can be used to determine the distribution of sales, including the minimum, maximum, and median values.



The box plot above shows the median sales amount is $1,111,378 (shown by hovering over the chart or using the **Flip card** button to flip the card over). The distribution seems fairly even, with the median being in the middle of the box and the whiskers being a similar size. There are also low and high outliers, which gives the analyst an indication of which stores are over- and underperforming.

To delve deeper into the data, the analyst decides to create individual box plots for each region where the stores are located. She does this by changing the **Group by** field to **Region**. The result is four individual box plots that can be compared to discern information about each region.

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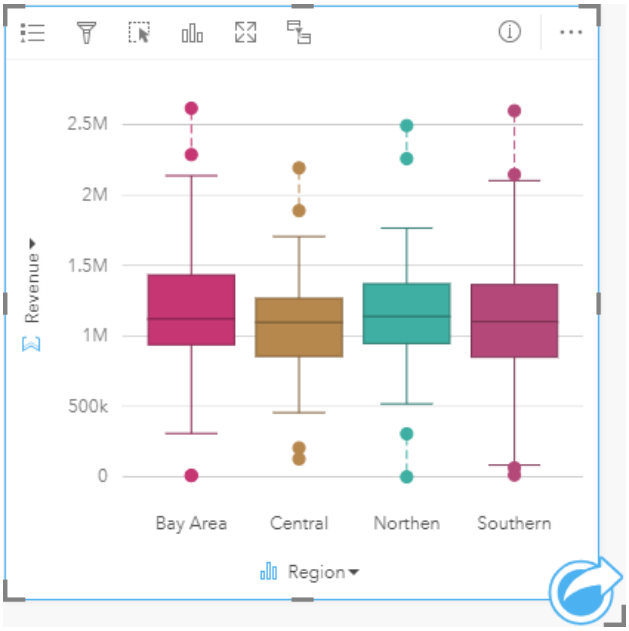

Based on the box plots, the analyst can tell that there are few differences between regions; the medians are consistent across the four box plots, the boxes are similar sizes, and all regions have outliers at both the minimum and maximum ends. However, the whiskers for the Northern and Central regions are slightly more compact than the Bay Area and Southern regions, which implies that those regions have more consistent performance than the others. In the Bay Area and Southern regions, the whiskers are a bit longer, which implies those regions have stores that are performing poorly, as well as stores that are performing well. The analyst may want to focus her analysis on those two regions to find out why there is such a variation in performance.

Create a box plot

To create a box plot, complete the following steps:

1. Select one of the following data options:
   - A number ∑ or rate/ratio field R/B.
   - A number ∑ or rate/ratio field R/B plus a string field .

   Note:
   You can search for fields using the search bar in the data pane.

2. Create the box plot using the following steps:
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.
   c. Drop the selected fields on **Box Plot**.

Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

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Note:
Box plots created from database datasets must have at least five records. Box plots with fewer than five records are most likely to occur when grouping your box plot using a string field or applying a filter to your dataset or card. Database datasets are available through database connections in Insights in ArcGIS Enterprise and Insights desktop.

Usage notes

The **Layer options** button opens the **Layer options** pane. The **Layer options** pane contains the following functions:

- The **Legend** tab is available when a group by field is applied to the x-axis of the chart. If a group by field is used, side-by-side box plots are created, with each box plot representing the spread of data in each category. The pop out legend button displays the legend as a separate card on your page. You can use the legend to make selections on the chart. To change the color associated with a value, click the symbol and choose a color from the palette or enter a hex value.
- The **Appearance** tab changes the symbol color on the chart (single symbol only).

Use the **Visualization type** button to switch directly between a box plot and other visualizations, such as a graduated symbols map, summary table, or histogram. If the box plot includes a **Group by** field, the visualization can be changed to charts, such as a line graph or column chart.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card and the **Export data** tab allows users to export the data from the card.

A key feature for a box plot is the determination of outliers. Outliers are values that are much larger or smaller than the rest of the data. Whiskers on a box plot represent the threshold beyond which values are considered outliers. If there are no outliers, the whiskers will stretch to the minimum and maximum values in the dataset. In Insights, the range for the lower and upper outlier values are indicated on the box plot as circles linked by dotted lines.

Each statistic or range in the box plot can be selected by clicking the chart.

When you create a box plot, a result dataset with the input fields and output statistics will be added to the data pane. The result dataset can be used to find answers with nonspatial analysis using the **Action** button.

How box plots work

A box plot consists of the following components:

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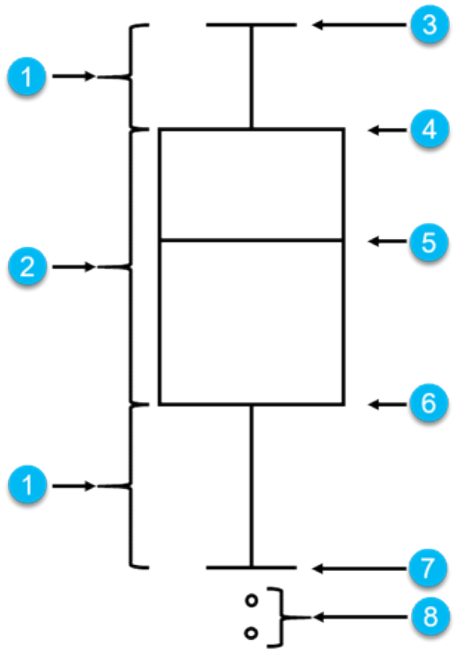

Label	Component	Description
1	Whisker	The range of data less than the first quartile and greater than the third quartile. Each whisker has 25 percent of the data. Whiskers typically cannot be more than 1.5 times IQR, which sets the threshold for outliers.
2	Box	The range of data between the first and third quartiles. 50 percent of the data lies within this range. The range between the first and third quartile is also known as the Inter Quartile Range (IQR).
3	Maximum	The largest value in the dataset or the largest value that is not outside the threshold set by the whiskers.
4	Third quartile	The value where 75 percent of the data is less than the value, and 25 percent of the data is greater than the value.
5	Median	The middle number in the dataset. Half of the numbers are greater than the median and half are less than the median. The median can also be called the second quartile.
6	First quartile	The value where 25 percent of the data is less than the value, and 75 percent of the data is greater than the value.
7	Minimum	The smallest value in the dataset or the smallest value that is not outside the threshold set by the whiskers.
8	Outliers	Data values that are higher or lower than the limits set by the whiskers.

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Create and use a link chart

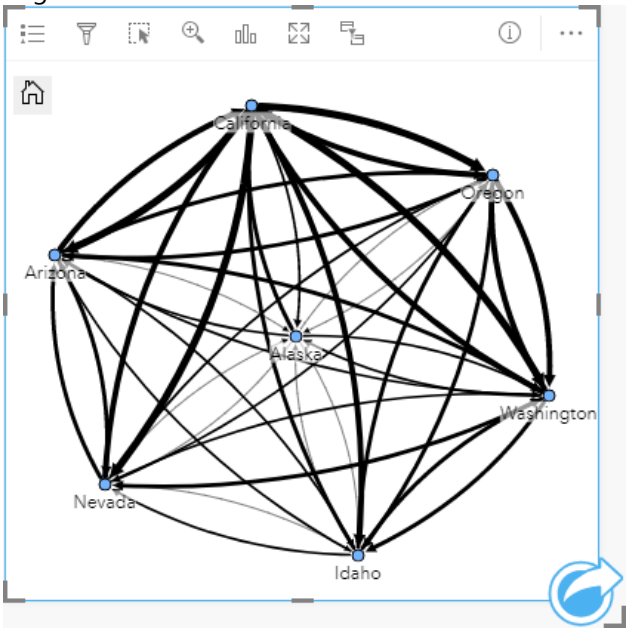
Link charts show the magnitude and direction of relationships between two or more categorical variables. They're used in link analysis for identifying relationships between nodes that are not easy to see from the raw data.

Link charts can answer questions about your data, such as the following:

- How is it related?
- In which direction does the information flow?

Example

A GIS analyst is studying patterns of migration in the United States. A link chart can be used to visualize the rate of migration between individual states. The link chart can be configured to show the direction of migration.



Create a link chart

To create a link chart, complete the following steps:

1. Select one of the following combinations of data:
   - Two string fields
   - Two string fields plus a number or rate/ratio field

   Note:
   If you do not select a number or rate/ratio field, your data will be aggregated and a count will be displayed.

   You can search for fields using the search bar in the data pane.

2. Create the link chart using the following steps:
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.
   c. Drop the selected fields on **Link Chart**.

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Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

Link charts can also be created using **View Link Chart**, which is accessed from the **Action** button under **Find answers** > **How is it related?**

Usage notes

Click on a node to display the **Hide leaf nodes** button, the **Set as root node** or **Set as central node** button , and the **Edit** button . **Hide leaf nodes** will collapse any nodes that are connected only to the selected node. The nodes can be unhidden using the **Show leaf nodes** button . **Set as root node** and **Set as central node** will change the root or central node from the node with the highest centrality to the selected node. **Set as root node** is only available for charts using a hierarchical layout and **Set as central node** is only available for charts using a radial layout. **Edit** can be used to change the style of the selected image. Symbol styles that are changed using the **Edit** button will be saved in the workbook and on the page, but not in the model.

The **Layer options** button can be used to change the style of the symbols. Select a node or link to change the style options in the **Layer options** pane. The style options include changing the size and color of nodes, changing the node symbol to an image, changing the pattern and thickness of links, and applying classification types to both links and nodes.

The nodes can be sized using the following centrality methods:

- Degree—The number of direct neighbors of the node. If the chart is directed, the degree can be measured as either indegree (the number of direct neighbors with connections directed toward the node) or outdegree (the number of direct neighbors with connections directed away from the node).
- Betweenness—The extent to which a node lies on the shortest path between other nodes in the network.
- Closeness—The average of the shortest distance paths to all other nodes.
- Eigenvector—The measure of the influence of a node in a network based on its proximity to other important nodes.

The **Symbology** tab and **Appearance** tab will display different options based on the selections you make in the **Layer options** pane. The following options are available for link charts:

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<table>
<tr><th>Selection</th><th>Symbology</th><th>Appearance</th><th>Legend</th></tr>
<tr><td rowspan="2">None</td><td>The Directed parameter can be used to change the links to arrows from one node to the other.

The centrality method can be set from the Size node using parameter.

The Edge weight parameter is used to calculate weighted centrality values. By default, the Edge weight parameter is set to Uniform, meaning the centrality calculation is unweighted. A field can be chosen to apply weights to the calculation. Edge weight is available for betweenness, closeness, and eigenvector centralities.

The Normalized parameter can be used to normalize the node centralities by dividing by another field to create a ratio or proportion. The Normalized parameter is enabled by default but can be disabled for nodes using betweenness and closeness centrality.

The Natural Breaks, Equal Interval, and Unclassed classifications can be chosen in the Classification type parameter. If Natural Breaks or Equal Interval is chosen, the number of classes can also be edited.

Click View centralities to create a reference table showing the centrality values for each node. The table includes a column for entity (field name), node (feature), and centrality.</td><td>Switch the chart layout between Force directed (default), Hierarchical, and Radial. A hierarchical layout can be directed Top to bottom ↓ (default), Bottom to top ↑, Left to right →, or Right to left ←.</td><td rowspan="2">Unavailable</td></tr>
<tr><td colspan="2">Tip:
 Drag a string field to the Layer options pane and drop it on the link to style the links by unique values.</td></tr>
<tr><td>Node</td><td>Use the Choose node field parameter to switch the selected node to a different string field.</td><td>Change the Node style options, including the following options:

• Symbol shape
• Size (min - max)
• Fill color
• Outline thickness
• Outline color

Add an image file or url to symbolize the nodes using Custom from the Symbol shape menu.</td><td>Unavailable</td></tr>
</table>

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<table>
<tr><th>Selection</th><th>Symbology</th><th>Appearance</th><th>Legend</th></tr>
<tr><td></td><td colspan="2">Use the Add button and Delete button to add new node fields or delete existing node fields. New node fields will be connected to the selected node field. You must have three or more node fields to delete a node.
Tip:
Drag a string field to the Layer options pane and drop it on the Add button or on an existing node to add additional node fields.
Use <code>Ctrl+click</code> to select multiple nodes. The following options are available:
Use the Merge nodes button and Unmerge nodes button to merge or unmerge the values from the From and To fields. Merging the fields will set the nodes to the same symbol.
Use the Unlink button and Link button to remove or add a link between two node fields. These options are only available if there are three or more node fields.</td><td></td></tr>
<tr><td rowspan="2">Link</td><td>The Weight parameter can be used to change or remove the number or rate/ratio field being used to apply weight to the links.
The Type parameter can be used to change or remove the string field being used to style the links by unique category.</td><td>Change the Link style options parameter, including the following options:
Pattern
Thickness (min - max)
Color</td><td>The Legend tab is enabled if a Weight field or Type field is added. The Legend can be used to view the classification values or unique categories for the links and to make selections on the chart.</td></tr>
<tr><td colspan="3">If the arrows are pointing in the wrong direction, use the Flip button to change the direction of the flow.
If the map includes three or more node fields, the Delete button can be used to remove a link from the map. Deleting a link also removes a node field that has become disconnected from the rest of the map.
Tip:
Drag a number or rate/ratio field to the Layer options pane and drop it on the selected link to change the Weight parameter. Use a string field to change the Type parameter.</td></tr>
</table>

Use the **Visualization type** button to switch directly between a link chart and other visualizations, such as a summary table, stacked bar chart, or chord diagram.

How link charts work

There are three layout options available when creating a link chart: force directed, hierarchical, and radial.

Force directed

A force directed layout displays the relationships between nodes in an organization that balances performance and drawing quality, including minimizing edge crossing, optimizing space, creating an even distribution of nodes, and displaying the graph symmetrically. A force directed layout is especially useful in analyses where the relationships

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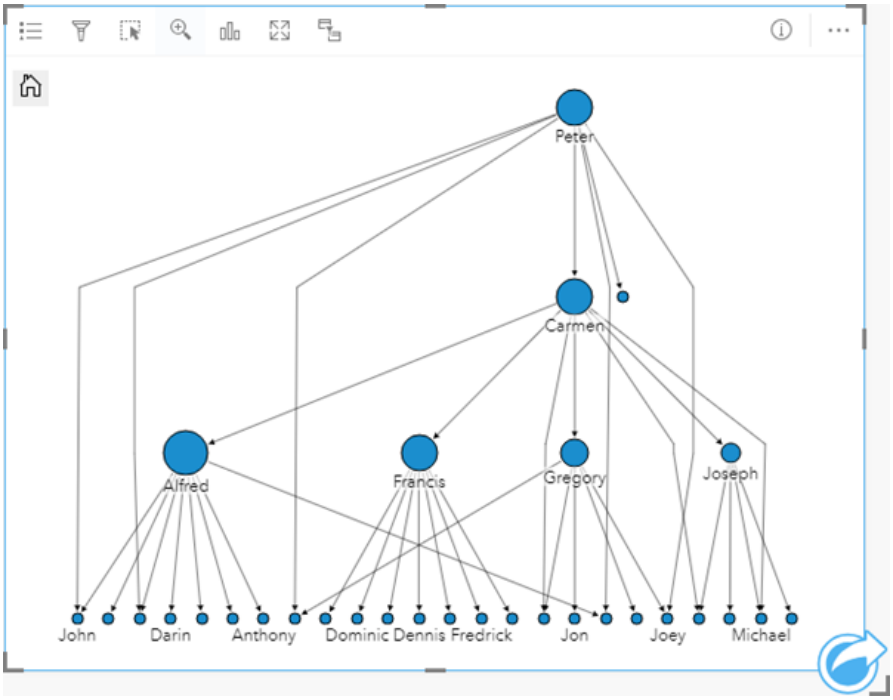
are not hierarchical, so the organization is based on optimizing the clarity of the graph. Force directed is the default layout, and is used in the example above.

Hierarchical

A hierarchical layout organizes a link chart so that the most important node (by default, this will be the node with the highest centrality) is located at the top, with links directed downward, similar to a family tree. A hierarchical layout is especially useful in analyses where the hierarchy is inherent in the dataset (for example, a workplace with an employer, managers, and employees).

Example

A police department has been tracking communication between members of a criminal organization. A link chart can be used to create connections between the different members of the organization. A hierarchical layout provides the police department with information about the internal organization, including who is the boss, and which lower level members are working together.



Radial

A radial layout functions similarly to the hierarchical layout, but with an organization that is circular rather than linear from top to bottom. In a radial layout, the most important node (by default, this will be the node with the highest centrality) is located in the center, with links directed outwards in an orbital pattern. A radial layout tends to have a more efficient use of space than a hierarchical layout, which makes it useful for large datasets. However, the change in layout can have trade-offs; for example, the hierarchical structure may be less obvious in a radial layout. Therefore, it is more useful to use a radial layout in situations when aspects like groups of related nodes are more important than the hierarchical relationship.

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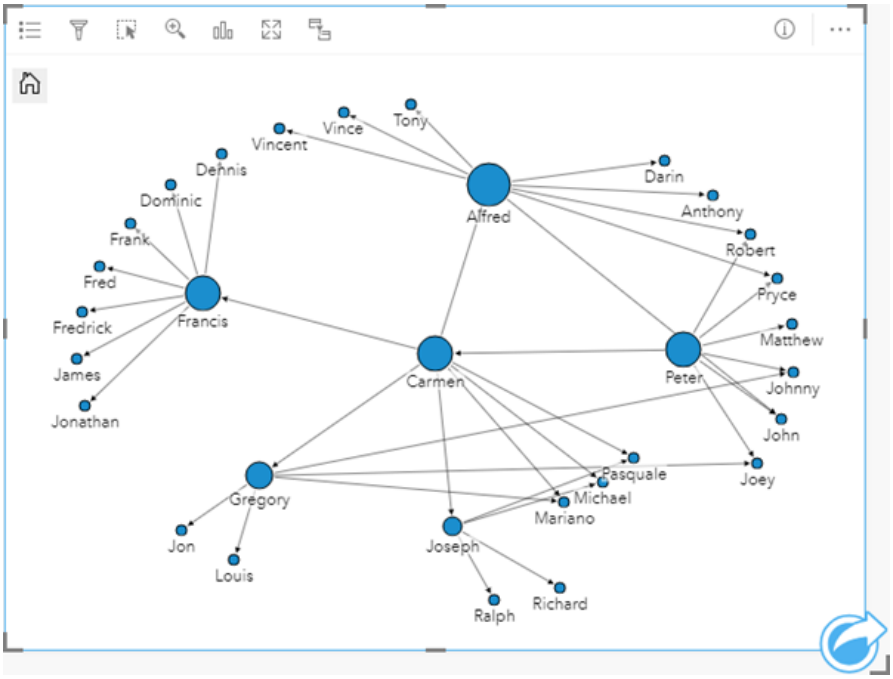
Example

In the previous example, a police department was tracking communication between members of a criminal organization. Rather than using a link chart to understand the internal hierarchy of the organization, this time the link chart can be used to look more specifically at direct relationships. By switching the chart to a radial layout, the focus is switched from Peter (the leader of the organization) to Carmen (the second-in-command). This change in focus is caused by Carmen's role as a go-between for the top level and the lower levels, whereas Peter only has contact with a small number of lower-level members. The radial organization puts more emphasis on how those levels are grouped, rather than who is commanding whom.



Limitations

A limit to the number of connections that can be displayed is based on the maximum query limit for the dataset. The error message **There's too much data to complete this operation** will be displayed if the number of connections is greater than the limit. The maximum query limit for point features is 16 thousand. The maximum query limit for line and area features is 8 thousand.

For example, a dataset of flights throughout Europe contains hundreds of thousands of flight numbers for 126 airports. Every airport has at least one direct flight to every other airport. Therefore, the number of connections is:

```
126 origins * 126 destinations = 15876 connections
```

The number of flights does not affect the query limit, but the number of airports does. If one extra airport is added to the dataset with direct flights to all other airports, the number of connections increases to 16,129, which is over the query limit. However, if there is not a connection between every unique value, the number of unique values can be higher. If some of the airports do not have direct flights between each other then the number of airports that can be displayed could increase until the number of connections surpasses the query limit.

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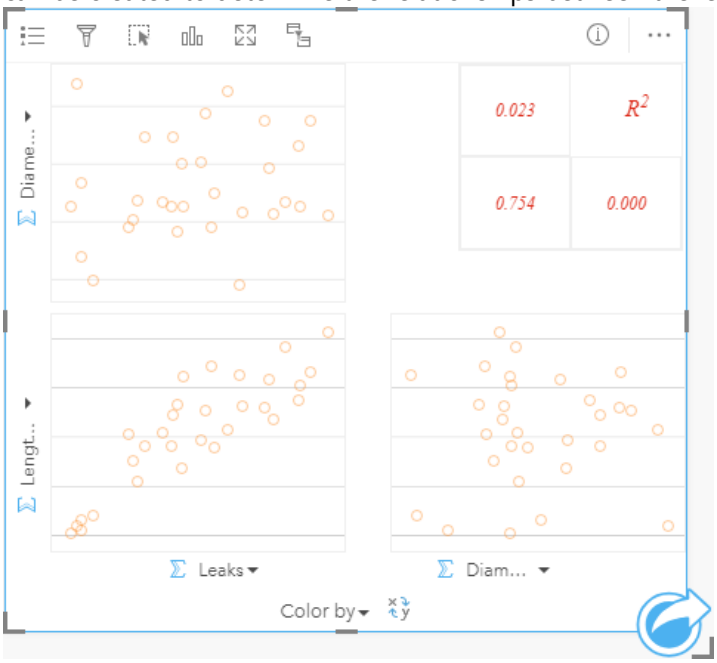
Create and use a scatter plot matrix

A scatter plot matrix is a grid of several scatter plots of up to five numeric variables. The matrix includes individual scatter plots for every combination of variables.

A scatter plot matrix can answer questions about your data, such as: What are the relationships between several variables?

Examples

A public works department has noticed an increase in leaks on water mains. The department wants to know whether the length of pipes and the average diameter have an effect on the number of leaks. A scatter plot matrix can be created to determine the relationships between the length and diameter of pipes and the number of leaks.



Create a scatter plot matrix

To create a scatter plot matrix, complete the following steps:

1. Select three to five number ∑ or rate/ratio fields.

   Note:
   You can search for fields using the search bar in the data pane.

2. Create the scatter plot matrix using the following steps:
   a. Drag the selected fields to a new card.
   b. Drop the selected fields on the **Scatter Plot Matrix** drop zone.

Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

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Note:
When you drag three to five number fields onto your page, the **Chart** drop zone is replaced with the **Scatter Plot Matrix** drop zone. The reason for the change is because a scatter plot matrix is the only chart type that can be created using three number fields.

Usage notes

Scatter plot matrices are symbolized using single symbols if a **Color by** variable is not used, or by unique values if there is a **Color by** variable assigned. The default single symbol has no fill to make it easier to read plots with large numbers of points.

The **Layer options** button opens the **Layer options** pane. The **Layer options** pane contains the following functions:

- The **Legend** tab is available when a **Color by** variable is applied to the x-axis on the chart. The pop out legend button displays the legend as a separate card on your page. The legend can be used to make selections on the chart. To change the color associated with a value, click the symbol and choose a color from the palette or enter a hex value.
- The **Appearance** tab changes the symbol color (single symbol only) and the outline color on the chart.

Use the **Switch axes** button to switch the variables on the x- and y-axes.

Use the **Visualization type** button to switch directly between a scatter plot matrix and a summary table.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card and the **Export data** tab allows users to export the data from the card.

The R2 values for each plot are displayed in a corresponding grid in the empty space of the card. The R2 value can be used to analyze the strength of the relationship between the variables in each scatter plot, with R2 values closer to 1 indicating a stronger linear relationship.

Note:
R2 values are not supported for certain remote feature layers. If you need the R2 value for an unsupported remote feature layer, you can drag the individual charts to the **Scatter Plot** drop zone and use the **Chart statistics** button to create a trend line or copy the dataset to your workbook and create a scatter plot matrix with the copy.

Create a full scatter plot from the matrix by selecting a plot and dragging it to create a new card.

Regression analysis

Scatter plot matrices are an important part of regression analysis. Multiple scatter plot matrices are required for the exploratory analysis of your regression model to test the assumptions of Ordinary Least Squares (OLS).

A scatter plot matrix can be created for the dependent and exploratory variables by clicking the **Visualize** button on the Create Regression Model pane.

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Create and use a Key Performance Indicator card

A Key Performance Indicator (KPI) card is a method of evaluating the status of a measure by comparing key indicators to a target.

KPI cards can answer questions about your data, such as how close the indicator is to the target.

Examples

An environmental organization is keeping track of global greenhouse gas emissions with the short-term goal of reducing emissions below 1990 levels. A KPI card can be used to show the current emissions (indicator) compared to the 1990 level (target).

The same KPI card can also be displayed using a gauge layout, which shows a visual comparison of the indicator and the target.

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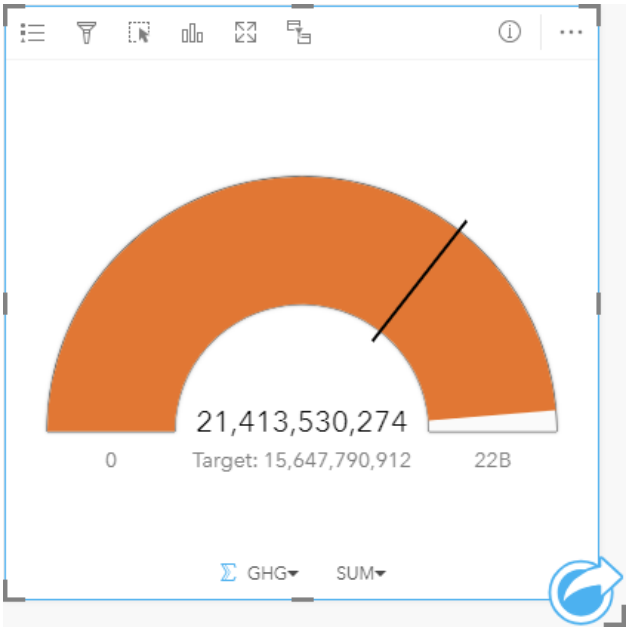

Create a KPI card

To create a KPI card, complete the following steps:

1. Select one of the following data options:
   - One or two number or rate/ratio fields
   - A string field, including subfields from a date/time field

   Note:
   If you use a string field, the number displayed will be a count of features.

   Tip:
   You can search for fields using the search bar in the data pane.

2. Create the KPI card by following these steps:
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.
   c. Drop the selected fields on **KPI**.

Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

Usage notes

By default, a KPI card is displayed as a number value. You can use the **Layer options** button to change the parameters, style, and color of the card.

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Use the **Symbology** tab to change the following settings:

- If your layout is **Number**, the **Symbology** tab can be used to change the indicator and target values.
- If your layout is **Gauge**, the **Symbology** tab can be used to change the indicator, target, minimum, and maximum values.
- If your KPI card includes a target value, the **Symbology** tab can be used to change the target label.

The **Appearance** tab changes the layout between **Number** and **Gauge**. The **Number** layout displays the numeric value of the indicator and target. The **Gauge** layout displays the indicator and the target, along with a minimum and maximum value, on a semicircular scale. The **Appearance** tab can also be used to change the **KPI color** parameter (**Equal to or above target** color and **Below target** color) and the **Target color** parameter.

Note:
KPI cards may display rounded integers for the target and indicator labels rather than decimals for some datasets. The rounded integers are for display only, and the decimal values are used for all calculations. In a case where the indicator is close to the target value and one or more of the labels is rounded, the KPI color may appear incorrect because it is reflecting the decimal values rather than the rounded values.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card and the **Export data** tab allows users to export the data from the card.

When you create a KPI card, a result dataset with the indicator value is added to the data pane. The result dataset can be used to find answers with nonspatial analysis using the **Action** button.

KPI cards using a **Number** layout can be resized smaller than the default card size. The font size for the indicator will change dynamically to fit the card as the size is decreased. The **Gauge** layout uses the default card size as the minimum.

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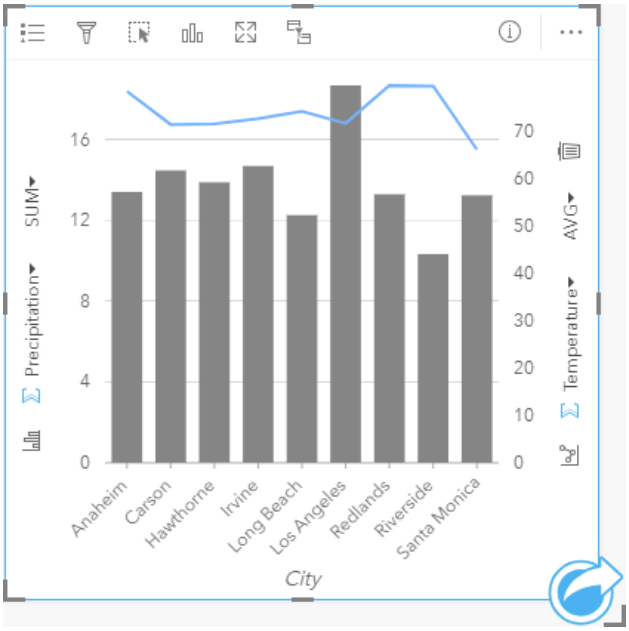
Create and use a combo chart

A combo chart is a combination of two column charts, two line graphs, or a column chart and a line graph. You can make a combo chart with a single dataset or with two datasets that share a common string field.

Combo charts can answer questions about your data, such as: What are the trends for the same categories?

Example

An environmental organization is tracking the drought conditions in Southern California and wants to compare temperatures and precipitation to determine which cities are most vulnerable. The organization uses a combo chart to show both the total precipitation and the average temperature for each city in one chart.



Create a combo chart

Combo charts can be created with a single dataset, or with two datasets that share a common string field.

A single dataset

To create a combo chart with a single dataset, complete the following steps:

1. Select a string field and two number or rate/ratio fields.

   Tip:

   You can search for fields using the search bar in the data pane.

2. Create the combo chart using the following steps:
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.
   c. Drop the selected fields on **Combo Chart**.

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Tip:

You can also create charts using the **Chart** menu above the data pane or the **Visualization type** button on an existing card. For the **Chart** menu, only charts that are compatible with your data selection will be enabled. For the **Visualization type** menu, only compatible visualizations (including maps, charts, or tables) will be displayed.

Two datasets with a common string field

To create a combo chart on top of an existing column chart or line graph, complete the following steps:

1. Select one of the following data options:
   - A number or rate/ratio field from the same dataset as the existing chart.
   - A string field that corresponds to the existing chart's string field plus a number or rate/ratio field from a different dataset than the one used in the existing chart.

   Tip:

   You can search for fields using the search bar in the data pane.

2. Drag the selected fields to the existing column chart or line graph.
3. Drop the fields on the **Combo Chart** drop zone.

   Note:

   The field must be dropped on the body of the chart. Dropping the field on the y-axis of the chart will update the numeric field for the existing chart, rather than create a combo chart.

4. Optionally change the type of chart using the **Line Graph** button or **Column Chart** button on the vertical axes.

Usage notes

The **Layer options** button opens the **Layer options** pane. You can use the **Layer options** pane to view the legend, change the chart options, and update the chart style.

The **Legend** tab displays the symbols for the column chart and line graph. The pop out legend button displays the legend as a separate card on your page. If unique symbols are used, the legend can be used to select data on the column chart. To change the color associated with a category, click the symbol and choose a color from the palette or enter a hex value.

The **Symbology** tab is used to change the **Symbol type** to **Unique symbol** for the columns, smooth the line for the line graph, synchronize the y-axes, and turn labels on or off.

The **Synchronize y-axes** check box can be used to change both axes to the same scale. Using the same scale for both y-axes is useful in cases where your variables are already using a similar scale, or you want to analyze the magnitude of difference between variables.

Labels display the number values associated with the chart. The following configurations are available for labels:

- **Decimal places** — You can choose a number of decimal places from zero to five, or choose **Default** or **Auto** for the labels. **Default** will abbreviate large numbers, while **Auto** will choose an appropriate precision.

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- **Label alignment** — Three alignment options are available for combo charts: **Horizontal, outside**, **Vertical, outside**, and **Angled**.
- **Context label** — Characters, such as a symbol or unit, can be added to the label. The context label can be placed to the left (default) or right of the value.

The **Appearance** tab is used to change the symbol color for both the column chart (single symbol only) and the line graph, change the outline color of the column chart, and change the pattern and thickness of the line graph.

The value of each bar and the trend of the line can be symbolized as a count of features in each category on the x-axis, or as a number or rate/ratio field. If a field is used, the values can be calculated as a sum, minimum, maximum, average, percentile, or median of values from the field for each category.

Note:
Median and percentile are not available for certain remote feature layers. If your remote feature layer does not support median or percentile, you can copy the layer to your workbook.

The **Column chart** button and **Line graph** button on the y-axes can be used to switch the visualizations between column charts and line graphs. If both axes are set to column chart, the columns will be subgrouped within each category.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card, the **Export image** tab allows users to export an image of the card, and the **Export data** tab allows users to export the data from the card.

Note:
Export data is not available for combo charts created with two datasets.

When you create a combo chart, result datasets with the string and number fields used to create the charts will be added to the data pane. The result dataset can be used to find answers with nonspatial analysis using the **Action** button.

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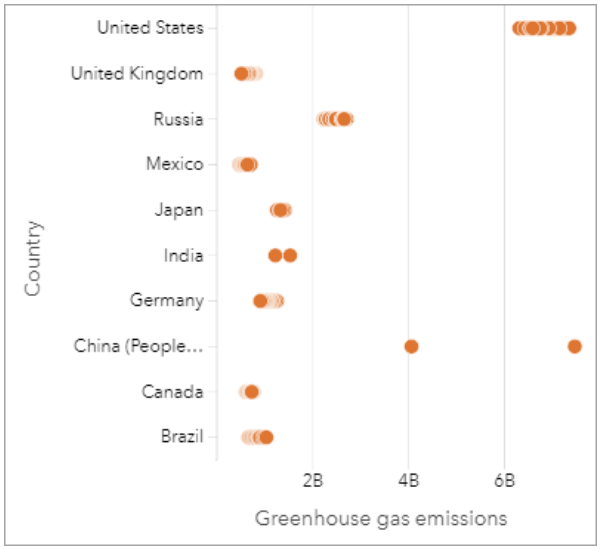
Create and use a point chart

A point chart is created by displaying a string field on the y-axis and a number or rate/ratio with a statistic on the x-axis. Each value in the category is represented by an individual point. Interval bars, such as confidence intervals or error bars, can be added to each point.

Point charts can answer questions about your data, such as How are the numeric values distributed or summarized by category?

Examples

An environmental organization is studying the cause of greenhouse gas emissions by country from 1990 to 2015. A point chart can be created to visualize patterns in greenhouse gas emissions for the 10 highest average polluting countries.



The point chart can be used to discover patterns in greenhouse gas emissions over time. For example, the points for Japan and Canada are clustered tightly together, indicating the emissions have shown little change over time in those countries. The points for the United States and China are more spread out than the other countries, indicating larger variation from year to year, although the chronology of the points is unknown. Most of the countries have clusters of many points, indicating that several years' worth of data was collected and reported. However, India and China have only two points each.

Create a point chart

To create a point chart, complete the following steps:

1. Select one string field and one number field ∑ or rate/ratio field.

   Note:
   You can search for fields using the search bar in the data pane.

2. Create the point chart using the following steps:
   a. Drag the selected fields to a new card.
   b. Hover over the **Chart** drop zone.

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c. Drop the selected fields on **Point Chart**.

Usage notes

The **Layer options** button opens the **Layer options** pane. The **Layer options** pane contains the following functions:

- The **Legend** tab displays the symbols used on the point chart.
- The **Symbology** tab is used to add interval bars to the points on the chart.
- The **Appearance** tab changes the symbol color and outline color.

Use the **Sort** button to sort the categorical data in either ascending or descending order by the numeric variable, or alphabetically.

Use the **Visualization type** button to switch directly between a point chart and other visualizations, such as a summary table, bubble chart, or KPI card.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card and the **Export data** tab allows users to export the data from the card.

Use point charts

Point charts can be created on their own or as part of a regression analysis. A point chart can be used in both the exploratory analysis and confirmatory analysis stages of determining model validity.

During exploratory analysis, a point chart can be used to find patterns in your explanatory variables, such as clustering, overlapping distributions, and spread in your data. These patterns can give you insight into your data and allow you to make changes to your explanatory variables that will create a more effective model.

Variables with clustering may indicate that certain categories or regions have hidden influences. It may be necessary to analyze those regions separately from the rest of the data.

One of the objectives of regression analysis is to create the strongest model possible with the fewest number of variables. Overlap between explanatory variables may indicate that the variables are too narrowly defined and some variables can be combined.

Interval bars showing error or confidence intervals can be used to assess variance between variables. Variables with high variance may need to be standardized.

During confirmatory analysis, a point chart can be created from the function dataset by clicking **Show confidence intervals**. The point chart shows the standardized coefficient for the intercept and explanatory variables, plus the 90, 95, and 99 percent standardized confidence intervals. These confidence intervals can be used to analyze the effectiveness of the variables; if the confidence intervals overlap 0, the variable may not be an effective addition to the model.

Resources

Use the following resources to learn more about using point charts:

- Regression analysis
- Function datasets

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Tables

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Create a table

Tables are used to display your data in a tabular format. A table can either show the raw data (reference table) or format the data into groups with summary statistics (summary table).

Tip:

You can copy a table card to another page by dragging it to the **New page** tab ┼ or an existing page. To copy the table to a different position on the same page, press `Ctrl+C` to copy and press `Ctrl+V` to paste.

Add and remove fields

You can add, remove, or update fields in a table to display a different field or statistic.

Add a field

Complete the following steps to add a field:

1. Select the fields you want to add to the table.
2. Drag the fields to the **Add new field** drop zone that appears in the body of the table.
   The table is updated to display the new fields.

For reference tables, the fields are added in the last position in the table by default. For summary tables, the fields are added in the last position for the string or numeric fields by default. Alternatively, you can drag the fields to the header to choose a different position.

Tip:

You can drag the same number or rate/ratio field to a summary table multiple times to display the field with all available statistics.

Remove a field

To remove a field, drag the field header to the **Delete field** drop zone that appears in the table.

Note:

If you do not want to use drop zones, you can delete a field by expanding the menu next to the field name and clicking **Delete field** in the list.

Update a field

Complete the following steps to update a field:

1. Click the arrow next to the field name or statistic type (statistics are available for number and rate/ratio fields on summary tables only).
   A menu appears with compatible fields or statistics.
2. Click the field or statistic you want to display.
   The field is updated to display the chosen field or statistic.

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Note:

For summary tables, you can only update string fields to other string fields. You can update number and rate/ratio fields to either a number or a rate/ratio field. For reference tables, you can update fields to any other field type.

Organize data

When using two or more string fields to create a summary table, the columns are created in the order you select the fields in the data pane. The order of the string fields affects how the categories are grouped. For example, to find the sales per region in each state, select state, region, and sales fields to create the table.

The fields in a reference table are added in the order you select them in the data pane, regardless of the field type.

Tip:

You can reorder your table columns by dragging a column header to the desired position. All string fields must appear in the first positions of the summary table, followed by the number and rate/ratio fields.

Sort data

You can organize data in a table using the sort buttons ↓↑. You can use multiple fields to sort a table. However, you can only sort one number field at a time.

A table is automatically sorted alphabetically by the first string field.

Ward	Year	Total collisions
<No Data>	2015	6
	2016	5
	2017	4
	2018	4
ALTA VISTA	2015	982
	2016	829
	2017	811
	2018	820
BARRHAVEN	2015	362
	2016	349
	2017	368
	2018	433
BAY		
		Total 57,991

You can use the sort buttons on other fields to provide additional sorting criteria. For grouped summary tables, the number field applies the sorting criteria in each group.

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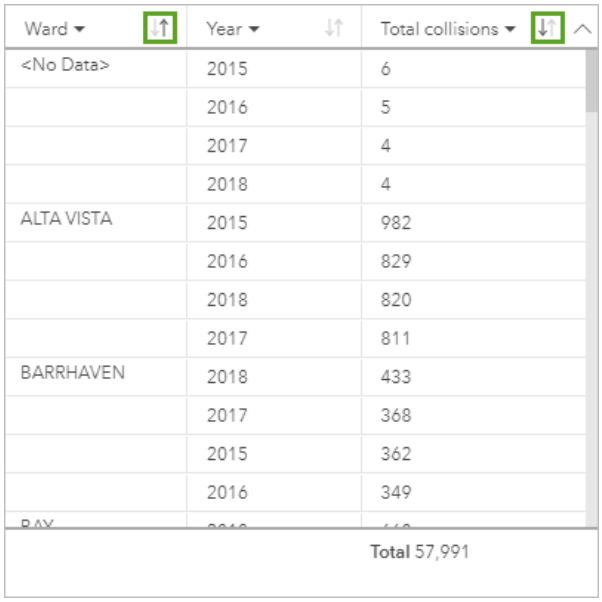
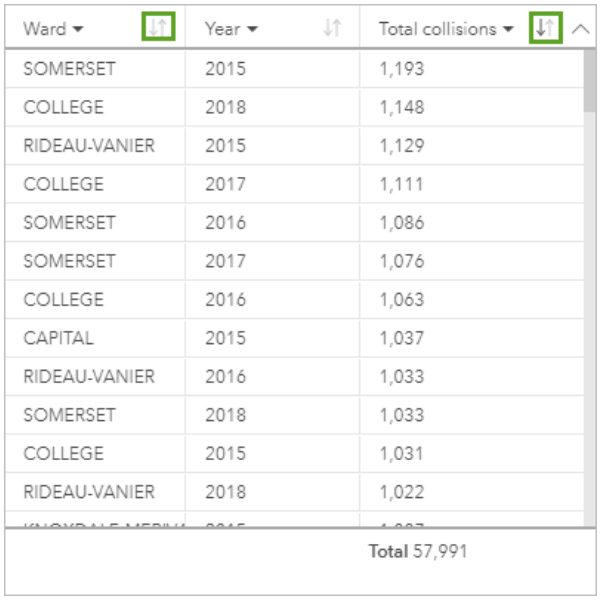


Ward	Year	Total collisions
<No Data>	2015	6
	2016	5
	2017	4
	2018	4
ALTA VISTA	2015	982
	2016	829
	2018	820
	2017	811
BARRHAVEN	2018	433
	2017	368
	2015	362
	2016	349
BAY		
		Total 57,991

To sort the table by a different field, such as a number field, you can use the sort buttons to remove the sort criteria on the string field and add sort criteria on a different field.



Ward	Year	Total collisions
SOMERSET	2015	1,193
COLLEGE	2018	1,148
RIDEAU-VANIER	2015	1,129
COLLEGE	2017	1,111
SOMERSET	2016	1,086
SOMERSET	2017	1,076
COLLEGE	2016	1,063
CAPITAL	2015	1,037
RIDEAU-VANIER	2016	1,033
SOMERSET	2018	1,033
COLLEGE	2015	1,031
RIDEAU-VANIER	2018	1,022
KNOXDALE-MERIVALE		
		Total 57,991

Note:

Grouping is removed from a summary table when sorted only by a number field.

Filter data

You can apply a card-level filter to a table to remove unnecessary text, number, or date values. To apply a filter, click **Card filter** on the table and choose the field you want to filter. You can apply multiple filters to the same table. Only data that meets the criteria for all filters is displayed in the table.

Applying a card filter does not affect other cards using the same dataset.

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Make selections

You can select features in tables by clicking a single feature, clicking and dragging the pointer over the features, or pressing `Ctrl+click`. The selected features will be represented in the table as well as other maps, charts, or tables displaying the same data. Once you select the features in a table, the following options become available:

- **Invert selection** —Click this button to switch the selected features. The inverted selection is reflected in all other cards displaying the same data.
- **Show selection** —Click this button to show only the selected features in the table. The features that are not selected are temporarily removed from the table. The selected features remain selected on all other cards displaying the same data, but no other changes occur on those cards. Click **Show selection** a second time to show the unselected features. The selected features remain selected until you click the scroll bar in the table or on another card.

Note:
Making a selection is not the same as applying a filter; selections are temporary and are reflected on all cards using the same dataset.

Copy a table

You can duplicate a table card on a page by activating the card (a card is active when the **Action** button is visible) and pressing `Ctrl+C` to copy the card and pressing `Ctrl+V` to paste it on the page.

You can copy a table card to a different page by dragging the card to the **New page** tab or to an existing page. When a table is copied to a different page, the dataset is also copied, if necessary, along with all of the processes used to create the table. The dataset is not copied if it exists on the new page unless one of the datasets contains a dataset filter, a calculated field, or a location field created by enabling location.

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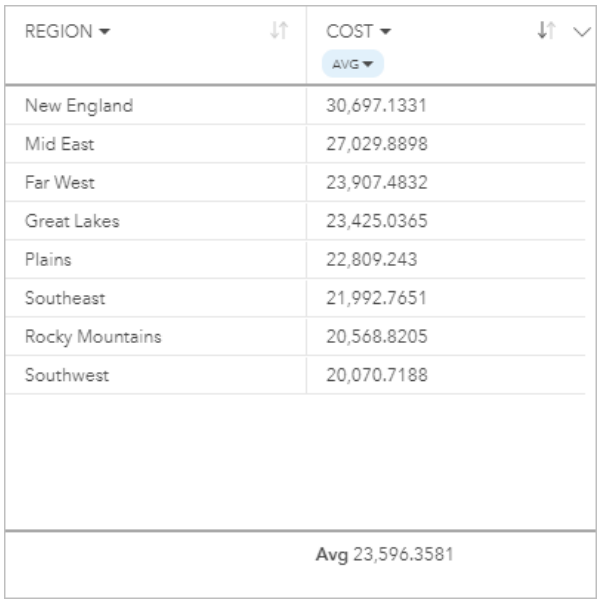
Create and use summary tables

A summary table, also called a pivot table, uses groups and statistics to transform your raw data into a more accessible format. You can use a summary table to calculate counts and statistics—including sum, average, minimum, maximum, median, and percentile—for unique categories in your data using the number fields in your dataset. The same number field can be used multiple times to calculate all of the available statistics. Subgrouping and sorting features allow you to explore your data further to gain insights that aren't available in the raw table format.

Example

A marketing researcher is planning a campaign to promote colleges with a high return on investment. As part of the research, she creates a summary table showing the average cost of colleges for each region in the United States to see how the costs compare across regions.



REGION	COST (AVG)
New England	30,697.1331
Mid East	27,029.8898
Far West	23,907.4832
Great Lakes	23,425.0365
Plains	22,809.243
Southeast	21,992.7651
Rocky Mountains	20,568.8205
Southwest	20,070.7188
	Avg 23,596.3581

Create a summary table

To create a summary table, complete the following steps:

1. Select the fields to display in the summary table.
   There is no limit to the number of fields that can be used in a summary table. String, number, and rate/ratio fields are supported in summary tables. If you use a location field, the display field is used in the summary table. Date/time fields cannot be used in summary tables.

   Tip:

   You can search for fields using the search bar in the data pane.

2. Drag the selected fields to the **Table** drop zone on a new card to create the summary table.

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Tip:

You can also create summary tables using the **Table** button above the data pane or the **Visualization type** button on an existing card. Only compatible visualizations (including maps, charts, or tables) are listed in the **Visualization type** menu.

Usage notes

You can choose a summary statistic for each number or rate/ratio field being summarized. The available statistics are sum, minimum, maximum, average, median, and percentile. You can customize the percentile statistic using the text box on the menu. For example, to view the 90th percentile, type `90` in the text box.

Note:

The median and percentile statistics are not available for certain remote feature layers. If your remote feature layer does not support median or percentile, you can copy the layer to your workbook.

The chosen statistic is calculated for each row on the summary table, as well as the entire dataset. The dataset statistic is displayed as a footer in the summary table.

The dataset statistic is calculated using the raw dataset, rather than the values from the summary table. This distinction is most important for the average statistic. For example, if you have a dataset with 10,000 features and you create a summary table that has 5 rows, the dataset average is calculated using all 10,000 features, rather than averaging the 5 rows in the table.

Use the **Visualization type** button to switch directly between a summary table and other visualizations, such as a bar chart or reference table. The visualization type options depend on the fields used to create the summary table.

Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card and the **Export data** tab allows users to export the data from the card.

When you create a summary table, a result dataset with the string and number fields used to create the table is added to the data pane. You can use the result dataset to find answers with nonspatial analysis using the **Action** button.

Note:

If you need to add a calculated field to a summary table, the field must be calculated in the original dataset used to create the summary table, not the result dataset. The field will appear in the result dataset after it is added to the summary table.

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Create a reference table

A reference table displays the fields in your data in its raw format. A reference table includes the raw values for the selected fields without grouping or summarizing the data.

Example

A GIS analyst is analyzing traffic accidents involving cyclists and pedestrians. As part of the analysis, the analyst creates a reference table that can be used to look up the year and location of the accidents, along with the number of cyclists, number of pedestrians, and total persons involved in the accidents.

	Year	Location	Cyclists	Pedestrians	Total persons
1	2016	ELGIN ST @ LAURIER A...	5	1	15
2	2015	CARLING AVE @ PRES...	4	0	14
3	2018	ELGIN ST @ LAURIER A...	4	1	21
4	2018	BANK ST @ RIVERSIDE ...	3	1	21
5	2018	GILMOUR ST @ O'CO...	3	0	5
6	2017	BANK ST @ LAURIER A...	3	1	5
7	2015	SOMERSET ST W btwn...	3	0	6
8	2015	BAYVIEW RD/BURNSI...	2	0	2
9	2015	BOOTH ST @ GLADST...	2	0	6
10	2015	BANK ST @ LAURIER A...	2	0	6
11	2015	WALKLEY RD btwn HA...	2	0	4
12	2015	CUMMINGS AVE @ O...	2	1	9
13	2015	DALY AVE @ WALLER ...	2	0	6
14	2015	GLADSTONE AVE @ C...	2	0	4

Total Records: 22,515

Contains data licensed under the Open Government Licence—City of Ottawa.

Create a reference table

To create a reference table, complete the following steps:

1. Select the fields to display in the reference table.
   There is no limit to the number of fields that can be used in a reference table. String, number, date/time, and rate/ratio fields are supported in reference tables. If you use a location field, the display field is used in the reference table.

   Tip:

   You can search for fields using the search bar in the data pane.

2. Create the reference table using the following steps:
   a. Drag the selected fields to a new card.
   b. Hover over the **Table** drop zone.
   c. Drop the selected fields on **Reference Table**.

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Tip:

You can also create tables using the **Table** button above the data pane or the **Visualization type** button on an existing card. Only compatible visualizations (including maps, charts, or tables) are listed in the **Visualization type** menu.

Usage notes

Use the **Table options** button to access the following:

- **Table formatting**
- **Column formatting**
- **Conditional formatting**
- **Sparklines**
- **Invert selection**

The **Table formatting** button opens the **Table formatting** pane. The **Table formatting** pane contains the following functions:

- Use the **Color** tab to change the table style, including the header, base row, alternating row, and gridline colors for the full table.
- Use the **Font** tab to change the header and cell text font specifications (including the font face type, size, color, bold, and italics) for the full table.

The **Column formatting** button is available when one or more columns are selected and opens the **Column formatting** pane. The **Column formatting** pane contains the following function:

- Use the **Color** tab to change the header and base row colors for the selected columns.
- Use the **Formatting** tab to update the date format (date fields only), set the number of decimal places (number fields only), change the text alignment (left, center, or right justified), add a context label (such as a unit of currency or percent sign) to the left or right of values in the column, convert numbers to a percentage (number fields only), wrap overflowing text, or freeze the column in the first position on the table.

  Note:
  The **Formatting** tab is not available when a sparklines column is selected.

- Use the **Font** tab to change the header and cell text font specifications (including the font face type, size, color, bold, and italics) for the selected columns.

The **Conditional formatting** button is used to add formatting to the specified columns based on the values in the column. You can choose one or more fields for the **Fields to format** parameter, or select columns on the table to apply conditional formatting. The following visualizations are available:

- **Rule based**—Adds format style (cell color, font color, and font styling) based on the specified rules. For number and rate/ratio fields, you can apply formatting to a cell if the value is greater than, less than, equal to, in between, or not in between the specified value. For string fields, you can apply formatting to a cell if the value contains or doesn't contain the specified string. For date fields, you can apply formatting to a cell if the value is after, before, equal to, in between, or not in between the specified date value.

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You can also specify a field rather than a constant value. The field type must correspond to the field you are formatting.

- **Data bars**—Adds bars of a specified color showing the relative magnitude of values for each row in the field. Data bars are only supported for number fields.

The **Sparklines** button is used to create visualizations to compare values or view trends from multiple number fields. A new column is created when sparklines are added to the table. The column exists only in the reference table and does not affect the fields in the input dataset. Sparklines can be created as lines, columns, or win/loss visualizations. You can update the colors and column name for the sparklines, and turn on data points indicating values such as the start and end points. For more information, see Sparklines.

Use the **Visualization type** button to switch directly between a reference table and other visualizations, such as a bar chart or summary table. The visualization type options depend on the fields used to create the reference table.

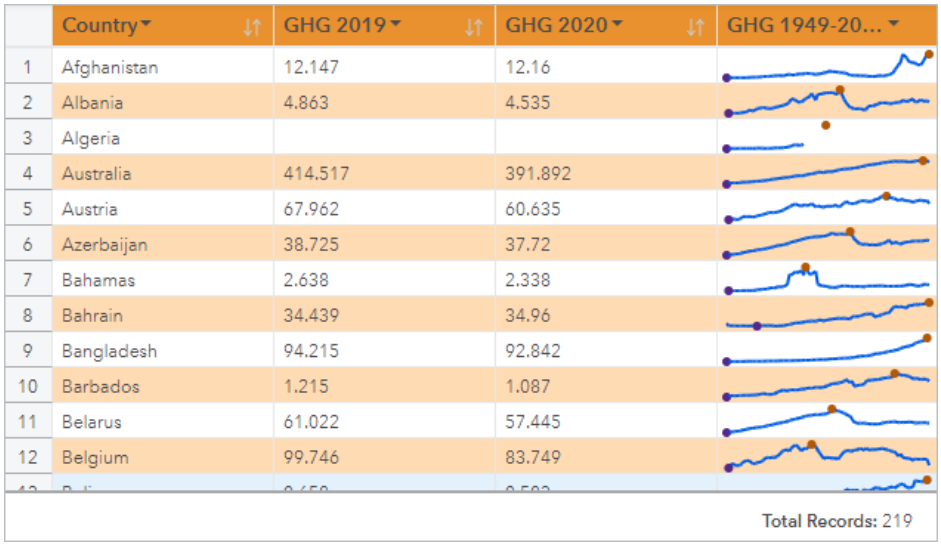
Use the **Flip card** button to view the back of the card. The **Card info** tab provides information about the data on the card and the **Export data** tab allows users to export the data from the card.

Sparklines

Sparklines are charts inserted into a reference table. The charts show trends or compare values from multiple number fields. Sparklines can be visualized as lines, columns, or win/loss charts.

Lines

Line visualizations are used to evaluate trends in the data. Choose line visualizations when the fields for the sparklines have a specific order, such as chronology. For example, a dataset contains total yearly carbon emissions by country. A line visualization can be created to show if carbon emissions are increasing, decreasing, or remaining constant for each country.



	Country	GHG 2019	GHG 2020	GHG 1949-20...
1	Afghanistan	12.147	12.16	
2	Albania	4.863	4.535	
3	Algeria			
4	Australia	414.517	391.892	
5	Austria	67.962	60.635	
6	Azerbaijan	38.725	37.72	
7	Bahamas	2.638	2.338	
8	Bahrain	34.439	34.96	
9	Bangladesh	94.215	92.842	
10	Barbados	1.215	1.087	
11	Belarus	61.022	57.445	
12	Belgium	99.746	83.749	

Total Records: 219

Data attribution: Hannah Ritchie and Max Roser (2020)—"CO_2 and Greenhouse Gas Emissions." Published online at OurWorldInData.org. Retrieved from https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions [Online Resource].

Columns

Column visualizations are used to show the difference in value in the data. Values in a column visualization can be positive or negative. Choose column visualizations when the fields for the sparklines are discreet and you want to

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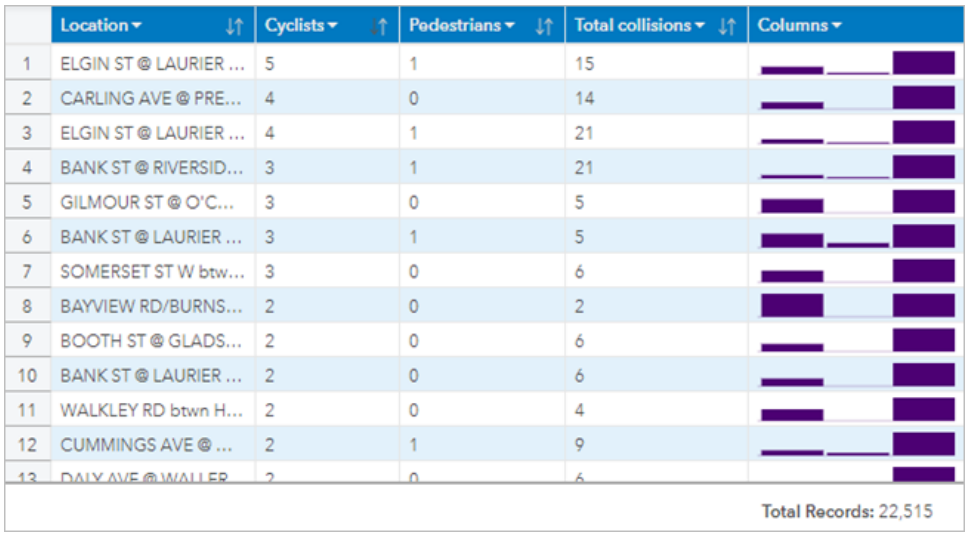
see the difference in magnitude between fields. For example, a dataset contains locations for traffic collisions in Ottawa, Canada. A column visualization can be created to show the numbers of cyclists, number of pedestrians, and total persons involved in the collision.



	Location	Cyclists	Pedestrians	Total collisions	Columns
1	ELGIN ST @ LAURIER ...	5	1	15	
2	CARLING AVE @ PRE...	4	0	14	
3	ELGIN ST @ LAURIER ...	4	1	21	
4	BANK ST @ RIVERSID...	3	1	21	
5	GILMOUR ST @ O'C...	3	0	5	
6	BANK ST @ LAURIER ...	3	1	5	
7	SOMERSET ST W btw...	3	0	6	
8	BAYVIEW RD/BURNS...	2	0	2	
9	BOOTH ST @ GLADS...	2	0	6	
10	BANK ST @ LAURIER ...	2	0	6	
11	WALKLEY RD btwn H...	2	0	4	
12	CUMMINGS AVE @ ...	2	1	9	
13	DALY AVE @ WALLER	2	0	6	

Total Records: 22,515

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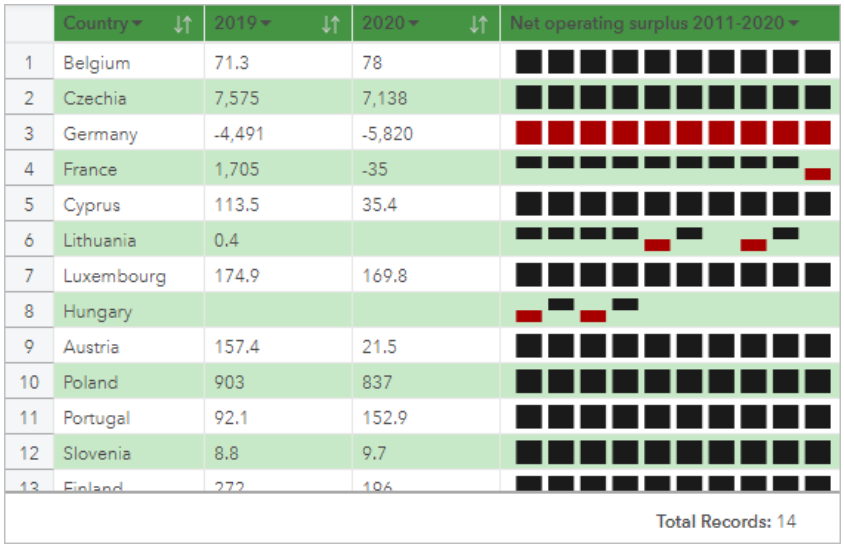
Win/Loss

Win/Loss visualizations show the direction of a value (positive or negative) without indicating differences in magnitude and are most commonly used in finance. In win/loss visualizations, wins are positive values and losses are negative values. Values of zero are not represented on a win/loss visualization. For example, a dataset contains net operating surplus data (in million units of national currency) for countries in the European Union and euro area. A win/loss visualization can be created to show when the net operating surplus is positive (win) or negative (loss).



	Country	2019	2020	Net operating surplus 2011-2020
1	Belgium	71.3	78	
2	Czechia	7,575	7,138	
3	Germany	-4,491	-5,820	
4	France	1,705	-35	
5	Cyprus	113.5	35.4	
6	Lithuania	0.4		
7	Luxembourg	174.9	169.8	
8	Hungary			
9	Austria	157.4	21.5	
10	Poland	903	837	
11	Portugal	92.1	152.9	
12	Slovenia	8.8	9.7	
13	Finland	272	196	

Total Records: 14

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Limitations

Sparklines columns will cause issues with cell heights when some table and column formatting features are applied, such as text size and text wrapping. To avoid this issue, it is best practice to apply formatting changes before adding sparklines to the table.

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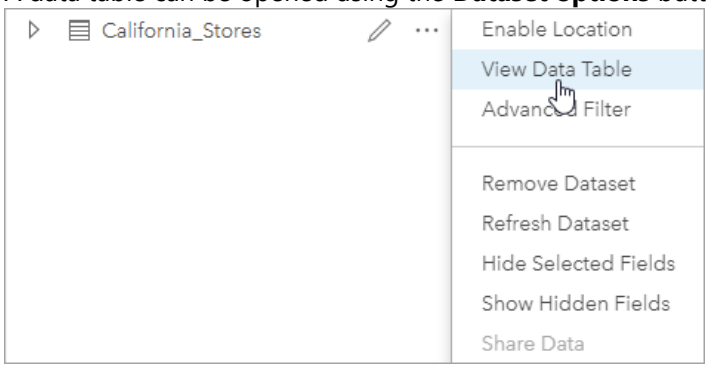
Use data tables

Data tables can be an important resource for your analysis. A data table displays your raw data and gives you the ability to sort, select, and make calculations using that data.

Open a data table

A data table can be opened using the **Dataset options** button ··· next to a dataset in the data pane.



Add and calculate fields

Use the **+ Field** button to add a new field to your data table. You can click a field name to rename the field. The field will be saved in Insights unless you delete it, but it will not be added to the source data.

Once a field has been added and that field is selected, the option to calculate the field will appear. Click in the **Enter calculate function** box for a drop-down menu with field names and simple mathematical operations. More complex calculations can be performed using functions. Insights supports string, number, date, and logical functions, which can be accessed using the **fx** button.

When a calculation is complete, a green checkmark will appear and the **Run** button will be enabled.

Edit existing fields

All fields in the data table can be renamed and resized. A field is renamed by clicking the field to highlight the text. Fields can also be renamed using the **Rename field** button in the data pane. Fields can be resized by dragging the field dividers. Fields can also be auto-resized to fit the data in the field by double clicking the field dividers.

Tip:

Renamed fields are saved within the workbook, but do not change the underlying data. In order to preserve new field names, you must share your data to create a new feature layer.

Sort fields

You can sort a field in a data table by clicking the sort arrows next to a field name. Clicking once will activate the down arrow, which sorts the field in ascending order; clicking a second time will activate the up arrow, which sorts the field in descending order; clicking a third time will deactivate all arrows and reset the field to its original order.

A data table can also be sorted by more than one field. Press Shift + click to choose more than one field to sort.

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Make selections

Features in a data table can be selected by clicking a single feature or using Ctrl + click. The features will be selected in the data table as well as any maps, charts, or other tables displaying the same data. Once a selection has been made in a data table, the following options will be available:

- Invert a selection—Click the **Invert selection** button to switch your selected features. The inverted selection will be reflected in all other cards displaying the same data.
- Show a selection—Click the **Show selection** button to show only your selected features in the data table. The features that are not selected will be temporarily removed from the table. The selected features will remain selected on all cards displaying the same data, but no other changes will take place to those cards. You can show the unselected features again by clicking **Show selection** a second time. The selected features will remain selected until you select a different set of features or click away from the selected features.

Note:

Unlike filtering, selections on data are temporary. While selections do not change the source data, they do affect the results of an analysis or statistical summary because these functions only use the current selection. However, selections do not update previously executed spatial analytics.

Dock the data table

The data table can be docked along the bottom of your Insights page using the **Dock** button. Use the **Undock** button to return your data table to free-floating.

A docked data table will not be displayed on a shared page. If you want your data to be displayed in a table form on a shared page, you can create a reference table.

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Calculate a field

You can add new fields to your dataset using the data table. The data table allows you to add fields such as growth rates, percent loss, and change over time by choosing fields from your dataset and applying operators and functions.

Note:

- The data table provides a representative view of your data and has a display limit of 2,000 rows. Sorting your table in ascending and descending order allows you to view the top 2,000 rows and the bottom 2,000 rows. All calculations will be performed on the full dataset.
- The new calculated field only appears in your workbook, not in the original dataset. For example, after adding a calculated field of `percentchange` to a CommodityPrices dataset added from Microsoft Excel, the `percentchange` field is available in your workbook but is not added to the original Excel file. If you want to preserve the calculated field outside of the workbook, you can create a new feature layer by sharing the dataset.
- You can also calculate fields using **Calculate % Change**, **Calculate Ratio**, and **Calculate Z-Score** in Find answers.

Tip:

Use the data table to add normalized data to your dataset for maps, charts, and tables. After the data is calculated and added your dataset, change the field type to identify it as a rate/ratio field. For more information on data normalization, see Choropleth maps.

Add a field to your dataset

To add a field to the dataset, complete the following steps:

1. From the data pane, click the **Dataset options** button ··· next to the dataset where you want to add a calculated field.
2. Click **View data table**.
3. Click **+ Field**.
   A column named **New Field** is appended to the table.

   Note:
   You can resize and reorder the columns, but these changes are not saved.

4. Click the heading of the new column and provide a more descriptive name.
5. Click **fx** or **Enter calculate function** to display a menu with functions, field names, and operators to build your formula. Equivalent keyboard commands can also be used to replace any of the buttons from the **fx** menu.
6. Use the functions, fields, and operators to complete your calculation as required.
7. Click **Run**. If the **Run** button is not enabled, there is an error in the syntax of your calculation.

   The new calculated field appears at the bottom of your dataset. You can remove a calculated field by selecting it and clicking the **Delete calculated field** button.

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Operators

Calculating a field can require both mathematical and logical operators. The following operators are available for calculating fields:

Operators	Use
+	Addition.
-	Subtraction.
×	Multiplication. The equivalent keyboard command is *.
÷	Division. The equivalent keyboard command is /.
xy	Power function. The equivalent keyboard command is ^.
<	Less than.
>	Greater than.
=	Equal to.
<=	Less than or equal to.
>=	Greater than or equal to.
<>	Not equal to.
,	Comma, used as a separator between syntax components in functions.
(	Left bracket.
)	Right bracket.
`AND`	Logical operator where all conditions must be met.
`OR`	Logical operator where one of the conditions must be met.
`IS NULL`	A binary operator that tests if values in a field are null. An output value of 0 is assigned when the tested value is not null, and an output value of 1 is assigned when the tested value is null.
`IS NOT NULL`	A binary operator that tests if values in a field are not null. An output value of 0 is assigned when the tested value is null, and an output value of 1 is assigned when the tested value is not null.

Note:

Mathematical operators, such as +, -, >, and =, are compatible with number and rate/ratio fields. Functions, such as `CONCATENATE()` and `DATEDIF()`, can be used in place of certain mathematical operators for string fields and date/time fields, respectively.

The `IS NULL` and `IS NOT NULL` operators are compatible with all field types (string, number, rate/ratio, and date/time) except locations. Some string fields with null values may be configured as empty strings. In those cases, `IS NULL` and `IS NOT NULL` will not return the expected results. Instead, the expressions `field=""` and `field<>""` should be used in place of `field IS NULL` and `field IS NOT NULL`, respectively.

The `AND` and `OR` operators can be used to join conditions with different syntax than their corresponding logical functions. The following examples show equivalent calculations using the functions and operators:

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Note:
When calculating fields, `AND` and `OR` must be used within the `IF()` function.

Function	Operator
`IF(AND(MeanAge>=18, MeanAge<=33),"Millennial","Other")`	`IF(MeanAge>=18 AND MeanAge<=33,"Millennial","Other")`
`IF(OR(Crime="Theft", Crime="Theft from vehicle", Crime="Shoplifting"), "Larceny", "Other")`	`IF(Crime="Theft" OR Crime="Theft from vehicle" OR Crime="Shoplifting", "Larceny", "Other")`

Functions

Functions can be accessed using the **fx** button or the **Enter calculate function** field in the data table. There are four types of functions: string, numeric, date, and logical.

When you add a function to your calculation, a pop-up displays the function syntax. You can remove the pop-up using the close button ×, or redisplay the pop-up by clicking the function in the **Enter calculate function** field.

String functions

Most string functions use string inputs to produce string outputs. The two exceptions are the `VALUE()` function and the `FIND()` function, which both use string inputs to produce numeric outputs.

Input text in string functions can be either literal (text surrounded by quotation marks) or category field values. The following table uses category fields for its examples, along with example values that could be found in those fields. Quotation marks are used in the field values to demonstrate that the fields have categorical data.

Syntax	Description	Example
`CONCATENATE(text1, [text2], ... )`	Concatenates two or more string values.	A dataset of schools in California contains fields for street address, city, and ZIP Code. A single field of mailing addresses can be created using the `CONCATENATE()` function: • Function syntax: `CONCATENATE(Address,", ", City," , CA, ",ZIP)` • Example field values: ▪ `Address` = "380 New York St" ▪ `City` = "Redlands" ▪ `ZIP` = "92373" • Result text: "380 New York St, Redlands, CA, 92373"

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Syntax	Description	Example
`FIND(find_text, within_text, [start_num])`	Gives the position of the specified text (character or characters) within a string or text field. The `FIND()` function may be most useful when used in conjunction with other functions, such as `MID()`, `LEFT()`, or `RIGHT()`.	A dataset contains a field with street addresses (including number and street name). To classify the data by street, the street name has to be removed from the rest of the address using the `MID()` function. However, each number is a different length, so the `start_num` will be different for each row. The `start_num` can be found using the `FIND()` function: • Function syntax: `FIND(" ", Address)` • Example field values: ▪ `Address` = "380 New York St" • Result number: 4
`LEFT(text, [num_chars])`	Returns part of a text field. • `num_chars`: specifies how many characters of the expression will be returned and should be an integer. The number of characters will be counted from left to right, starting in the first position. If `num_chars` is not provided, the default will be one character.	A dataset of traffic accidents includes a category field with the day of the accident, including the day of the week, date, and year. To study the accidents by the day of the week, a new field can be calculated to show the first three characters of the field (starting with day of the week) using the `LEFT()` function: • Function syntax: `LEFT(Accident_Date, 3)` • Example field values: ▪ `Accident_Date` = "Monday, November 14, 2016" • Result text: "Mon"
`LOWER(text)`	Returns a character expression with all data converted to lowercase.	A public works department is compiling a list of street signs that need to be replaced. As new entries are added to the list, the format of the `Status` field has become unstandardized, making it difficult to display the signs with unique values. The `Status` field can be standardized to have all lowercase letters using the `LOWER()` function: • Function syntax: `LOWER(Status)` • Example field values: ▪ `Status` = "Installed" • Result text: "installed"

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Syntax	Description	Example
`MID(text, start_num, [num_chars])`	Returns part of a text field. • `start_num`: specifies the position of the first character (starting at 1). The `start_num` must be an integer. • `num_chars`: specifies how many characters of the expression will be returned and should be an integer. No empty characters are returned if the `num_chars` value is greater than the length of the string. If `num_chars` is not provided, the default will be all the characters after the starting character.	A dataset of schools in California contains fields for street address, city, and ZIP Code. The street name can be isolated from the street address using the `MID()` function: • Function syntax: `MID(Address, 5, 20)` • Example field values: ▪ `Address` = "380 New York St" • Result text: "New York St"
`RIGHT(text, [num_chars])`	Returns part of a text field. • `num_chars`: specifies how many characters of the expression will be returned and should be an integer. The number of characters will be counted from right to left, starting in the last position. If `num_chars` is not provided, the default will be one character.	A dataset of national parks includes a field with the name of the park and the two-digit state code. To symbolize the parks by state, a new field can be added and calculated using the `RIGHT()` function: • Function syntax: `RIGHT(Park, 2)` • Example field values: ▪ `Park` = "Hawai'i Volcanoes National Park, HI" • Result text: "HI"
`SUBSTITUTE(source_text, old_text, new_text)`	Replaces the old text in a string with the specified new text. • `source_text`: The original text or field with text. • `old_text`: The text within the `source_text` that you want to replace. • `new_text`: The text to replace the `old_text`.	A dataset of pothole locations contains a field with street names. The dataset needs to be updated when Main Street is renamed 5th Street. The `street_name` field can be updated using the `SUBSTITUTE()` function: • Function syntax: `SUBSTITUTE(street_name, "Main", "5th")` **Note:** The `SUBSTITUTE()` function will replace all occurrences of `old_text` with `new_text`. For example, in the function `SUBSTITUTE("aba", "a", "c")` the result text is "cbc".

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Syntax	Description	Example
`TRIM(text)`	Returns the string with extra spaces removed from the ends.	A feature service contains text fields with extra spaces at the beginning and end of their values. The extra spaces can be removed using the `TRIM()` function: • Function syntax: `TRIM(City)` • Example field values: ▪ `City` = " Redlands " • Result text: "Redlands"
`UPPER(text)`	Returns a character expression with all data converted to uppercase.	A dataset with locations of NGO headquarters contains a field with the organizations' full names and their acronyms when applicable. The acronyms can be standardized to have all capital letters using the `UPPER()` function: • Function syntax: `UPPER(Org)` • Example field values: ▪ `Org` = "Nasa" • Result text: "NASA"
`VALUE(text, [format])`	Converts text to a number. • `format`: specifies the character used as a decimal separator in the number. The `format` may be either a comma (`","`) or dot (`"."`). If a `format` is not provided, the default separator will be a dot. **Note:** Nested functions within the `VALUE()` function may output unexpected results if a `format` is not provided. Therefore, it is recommended that you specify a `format` when using the `VALUE()` function. The `VALUE()` function does not currently support converting text to negative numbers.	A dataset of retail stores has a category field with the revenue amounts. The `Revenue` field can be converted to numerical values using the `VALUE()` function. • Function syntax: `VALUE(Revenue, ".")` • Example field values: ▪ `Revenue` = "1,000.00" • Result number: 1000.00

Numeric functions

Numeric functions use number inputs to produce number outputs. Number functions are most likely to be used in conjunction with other functions or as a method of transforming data.

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Input numbers can be either literal numbers or number fields. Some of the examples below use numbers as input rather than fields to better display the usage of each function.

Syntax	Description	Example
`ABS(number)`	Returns the absolute value.	• Function syntax: `ABS(-350)` • Result number: 350
`AVG(number)`	Returns the mean value.	• Function syntax: `AVG(field)` • Example number values for `field`: 4, 5, 11, 6.5 • Result: 6.63
`CEILING(number)`	Rounds a number up to the nearest multiple of 1.	• Function syntax: `CEILING(7.8)` • Result number: 8

`COS(number)`	The trigonometric cosine of the specified angle, in radians.
	The following formula can be used to convert degrees to radians:
	`radians = θπ/180`
	`where:`
	`θ = the angle in degrees`
	`π ≈ 3.14`
		• Function syntax: `COS(0.35)`
		• Result number: 0.94

`FLOOR(number)`	Rounds a number down to the nearest multiple of 1.	• Function syntax: `FLOOR(7.8)` • Result number: 7
`LN(number)`	The natural logarithm of the specified float expression. The natural logarithm uses the constant e as the base value (approximately 2.72)	• Function syntax: `LN(16)` • Result number: 2.77
`LOG(number)`	The logarithm of a number to a specific base. The default is base 10.	• Function syntax: `LOG(16, 2)` • Result number: 4

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Syntax	Description	Example
`MAX(number)` or `MAX(date)`	Returns the maximum value.	• Function syntax: `MAX(num_field)` • Example values for `num_field`: 4, 5, 11, 6.5 • Result: 11
`MIN(number)` or `MIN(date)`	Returns the minimum value.	• Function syntax: `MIN(date_field)` • Example values for `date_field`: 03/17/2018, 02/14/2019, 10/31/2020 • Result: 03/17/2018
`POWER(number, power)`	The value of the expression raised to the specified power.	• Function syntax: `POWER(2, 4)` • Result number: 16
`ROUND(number, num_digits)`	Rounds numeric values to the specified number of digits. • `num_digits` = the number of decimal places in the output ▪ If `num_digits` is positive, the number is rounded to the corresponding number of decimal places ▪ If `num_digits` is zero, the number is rounded to the nearest integer ▪ If `num_digits` is negative, the number is rounded to the specified number of digits left of the decimal point	• Function syntax: `ROUND(54.854827, 2)` • Result number: 54.85 • Function syntax: `ROUND(54.854827, -1)` • Result number: 50

`SIN(number)`	The trigonometric sine of the specified angle, in radians.
	The following formula can be used to convert degrees to radians:
	`radians = θπ/180`
	`where:`
	`θ = the angle in degrees`
	`π ≈ 3.14`
		• Function syntax: `SIN(0.79)`
		• Result number: 0.71

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Syntax	Description	Example
`STDEV(number)`	The standard deviation of a number field.	• Function syntax: `STDEV(field)` • Example number values for `field`: 4, 5, 11, 6.5 • Result: 3.09
`SUM(number)`	Returns the total value.	• Function syntax: `SUM(field)` • Example number values for `field`: 4, 5, 11, 6.5 • Result: 26.5

`TAN(number)`	Returns the tangent of the input expression.
	The following formula can be used to convert degrees to radians:
	`radians = θπ/180`
	`where:`
	`θ = the angle in degrees`
	`π ≈ 3.14`
		• Function syntax: `TAN(1.05)`
		• Result number: 1.74

Date functions

Date functions can use date fields, text, or no input, depending on which function is being used. The `DATEVALUE()` function can be used to replace a date field in the `DATEDIF()` or `TIMEDIF()` function.

Note:

Date/time fields used in `DATEDIF()` and `DATEADD()` must be in a format that includes a date (in other words, either date and time or date only). Time-only date/time fields will not be accepted.

Date/time fields used in `TIMEDIF()` must be in a format that includes a time (in other words, either date and time or time only). Date-only date/time fields will not be accepted.

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Syntax	Description	Example
`DATE(year, month, day, [hour, minute, second], [AM/PM])`	Creates a date/time field using three or more separate fields or values. The following specifications are accepted: • `year`: `"YY"` (two-digit year) or `"YYYY"` (four-digit year) • `month`: `"MM"` (1–12) • `day`: `"DD"` (1–31) • `hour`: `"HH"` (0–23) or `"hh"` (1–12) • `minute`: `"mm"` (0–59) • `second`: `"ss"` (0–59) • `AM/PM`: `"AM"/"PM"` (not case sensitive) **Note:** All input fields can be numbers or strings, except the AM/PM parameter. Numbers must be integer values. Two-digit years must be strings. If you are using the `DATE()` function with a database dataset and you have specified any time parameters (`hour`, `minute`, or `second`), you must enter an input value for all time parameters.	A dataset of restaurants includes string fields with the date and time of the most recent health inspections. A date field for the inspections can be created using the `DATE()` function: • Function syntax: `DATE(2016, Month, Day, Hour, Min, 00)` • Example field values: ▪ `Month` = 8 ▪ `Day` = 15 ▪ `Hour` = 11 ▪ `Minute` = 30 • Result date: 8/15/2016, 11:30:00 **Note:** The result dates in this example will be formatted using a 24-hour clock. To use a 12-hour clock, you must specify AM or PM. The same example function can be written as `DATE(2016, Month, Day, Hour, Min, 00, "AM")`.
`TIME(hour, minute, second)`	Creates a date/time field using three separate fields or values. The following specifications are accepted: • `hour`: `"HH"` (0–23) or `"hh"` (1–12) • `minute`: `"mm"` (0–59) • `second`: `"ss"` (0–59) • `AM/PM`: `"AM"/"PM"` (not case sensitive) **Note:** All input fields can be numbers or strings, except the AM/PM parameter. Numbers must be integer values.	A dataset of hospital records includes patient arrival times. A time field for the records can be created using the `TIME()` function: • Function syntax: `TIME(Hour, Min, 00)` • Example field values: ▪ `Hour` = 11 ▪ `Minute` = 30 • Result time: 11:30:00 **Note:** The result times in this example will be formatted using a 24-hour clock. To use a 12-hour clock, you must specify AM or PM. The same example function can be written as `TIME(Hour, Min, 00, "AM")`.

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Syntax	Description	Example
`DATEADD(date, integer, [unit])`	Adds a specified amount of time to the dates in the input field. • `date` must be a date/time field. The field must be in a format that includes a date (in other words, either date and time or date only). Time-only date/time fields will not be accepted. • `integer`: The number to add to the input date. If a constant is used, the number must be an integer and can be positive or negative. If a number field is used, decimal places will be ignored. Therefore, it is best practice to use a field that contains only integers or calculate a new field with integers (for example, by using the `ROUND()` function). • `unit`: The unit of time to be added. The supported unit values include the following: ▪ `"ss"` = seconds ▪ `"mm"` = minutes ▪ `"h"` = hours ▪ `"D"` = days (default) ▪ `"M"` = months ▪ `"Y"` = years If no unit is provided, `"D"` will be used. When months are added to a date/time field, the output will be the same day of the month, regardless of the number of days in the month. If the corresponding day of the month is not valid in the new month, the last day of the month is used. For example, if a calculation adds three months to the input field, and one of the original dates is November 30, 2021, the output value of February 30, 2022 is not valid. The result will be recorded as February 28, 2022, since 2022 is not a leap year.	A public health unit is responsible for keeping vaccine records for patients within the health district. A specific vaccine has two doses that must be taken at least 60 days apart and no more than 180 days apart. `DATEADD()` can be used to create fields with the first date the patients are eligible for their second dose and the deadline for the final dose. Eligibility date: • Function syntax: `DATEADD(first_dose_date, 60, "D")` • Example field values: ▪ `first_dose_date` = 7/11/2021 • Result date: 9/9/2021 Final date: • Function syntax: `DATEADD(first_dose_date, 180, "D")` • Example field values: ▪ `first_dose_date` = 7/11/2021 • Result date: 1/7/2022

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Syntax	Description	Example
`TIMEADD(time, integer, unit)`	Adds a specified amount of time to the times in the input field. • `time` must be a date/time field. Time can be added to all date/time fields, including fields that do not already include a time component. • `integer`: The number to add to the input time. If a constant is used, the number must be an integer and can be positive or negative. If a number field is used, decimal places will be ignored. Therefore, it is best practice to use a field that contains only integers or calculate a new field with integers (for example, by using the `ROUND()` function). • `unit`: The unit of time to be added. The supported unit values include the following: ▪ `"ss"` = seconds ▪ `"mm"` = minutes ▪ `"h"` = hours	A dataset has dates and times recorded in coordinated universal time (UTC) and needs to be converted to central standard time (CST). A date/time field with times in CST can be created using the `TIMEADD()` function: • Function syntax: `TIMEADD(UTC_date, -6, "h")` • Example field values: ▪ `UTC_date` = 7/11/2021 2:30:00 PM • Result date: 7/11/2021 8:30:00 AM

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Syntax	Description	Example
`DATEDIF(start_date, end_date, [unit])`	Calculates the elapsed time between two dates. The `start_date` must take place before the `end_date`; otherwise, the output will be a negative value. • `start_date` and `end_date` can be date/time fields or a `DATEVALUE()` function. If date/time fields are used, the field must be in a format that includes a date (in other words, either date and time or date only). Time-only date/time fields will not be accepted. • `unit`: The unit of time to be returned. The supported unit values include the following: ▪ `"ss"` = seconds ▪ `"mm"` = minutes ▪ `"h"` = hours ▪ `"D"` = days (default) ▪ `"M"` = months ▪ `"Y"` = years If no unit is provided, `"D"` will be used. Rounding is performed on the results for each unit as follows: • Seconds—Rounding is not performed for seconds. • Minutes—One minute is counted when a full 60 seconds takes place between dates. Results will be rounded down for partial minutes. • Hours—One hour is counted when a full 60 minutes takes place between dates. Results will be rounded down for partial hours. • Days—One day is counted when a full 24 hours takes place between dates. Results will be rounded down for partial days. • Months—One month is counted when a full month takes place between dates (for example, January 1 to February 1), regardless of how many days are in the specific months. Results will be rounded down for partial months. Time components, such as hours, are not considered in the calculation.	A dataset of restaurants includes the dates of their most recent health inspections. The number of days elapsed between health inspections can be calculated using the `DATEDIF()` function: Example 1: • Function syntax: `DATEDIF(Inspection1, Inspection2, "D")` • Example field values: ▪ `Inspection1` = 8/15/2016, 11:30:00 AM ▪ `Inspection2` = 10/31/2016 2:30:00 PM • Result time (days): 77 Example 2: • Function syntax: `DATEDIF(Inspection1, Inspection2, "D")` • Example field values: ▪ `Inspection1` = 8/15/2016, 11:30:00 AM ▪ `Inspection2` = 8/16/2016 8:00:00 AM • Result time (days): 0 Example 3: • Function syntax: `DATEDIF(Inspection1, Inspection2, "M")` • Example field values: ▪ `Inspection1` = 8/15/2016, 11:30:00 AM ▪ `Inspection2` = 10/31/2016 2:30:00 PM • Result time (months): 2

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Syntax	Description	Example
	• Year—One year is counted when 183 days (half a year) take place between dates. Results will be rounded down for partial years consisting of fewer than 183 full days.	
`TIMEDIF(start_time, end_time, [unit])`	Calculates the elapsed time between two date/time values. The `start_time` must take place before the `end_time`; otherwise, the output will be a negative value. • `start_time` and `end_time` can be date/time fields or a `DATEVALUE()` function. If a time is used (for example, hh:mm:ss), both the `start_time` and `end_time` must be in a time-only format. • `unit`: The unit of time to be returned. The supported unit values include the following: ▪ `"ss"` = seconds (default) ▪ `"mm"` = minutes ▪ `"h"` = hours If no unit is provided, `"ss"` will be used. Rounding is performed on the results for each unit as follows: • Seconds—Rounding is not performed for seconds. • Minutes—One minute is counted when a full 60 seconds takes place between dates. Results will be rounded down for partial minutes. • Hours—One hour is counted when a full 60 minutes takes place between dates. Results will be rounded down for partial hours.	A dataset of hospital operation records includes the start and end time of surgeries. The time each patient spends in surgery can be calculated using the `TIMEDIF()` function: • Function syntax: `TIMEDIF(TimeIn, TimeOut, "mm")` • Example field values: ▪ `TimeIn` = 11:30:00 AM ▪ `TimeOut` = 2:30:20 PM • Result time (minutes): 180

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Syntax	Description	Example
`DATEVALUE(date_text, [format])`	Converts text to a date. • `date_text` can be a string field or text entered inside quotation marks. • `format` (optional): The format of the date entered. The `format` is entered as text surrounded by quotation marks. The `format` can be entered using the following unit specifications: ▪ `"MM"` - Month (1–12) ▪ `"DD"` - Day of the month (1–31) ▪ `"YY"` - Two-digit year ▪ `"YYYY"` - Four-digit year ▪ `"HH"` - Hour (0–23) ▪ `"hh"` - Hour (1–12) ▪ `"mm"` - Minutes (0–59) ▪ `"ss"` - Seconds (0–59) ▪ `"AM"/"PM"` - Not case sensitive **Note:** Nested functions within the `DATEVALUE()` function may output unexpected results if a `format` is not provided. Therefore, it is recommended that you specify a `format` when nesting functions within `DATEVALUE()`. Dates specified without separators (for example, "10312016") will be treated as milliseconds if no `format` is provided. Therefore, it is recommended that you specify a format when entering dates without separators. For dates specified with separators but without a `format`, the format will be guessed. If the format cannot be guessed, the default `"MM-DD-YY"` will be applied. The `DATEVALUE()` function can only read text entered inside quotation marks or string fields. A date/time field cannot be used as input to the `DATEVALUE()` function.	A dataset of restaurants includes the dates of their most recent health inspections. The number of days elapsed since the last inspection can be calculated using the `DATEVALUE()` function to specify the current date: • Function syntax: `DATEDIF(Inspection_date, DATEVALUE("10/31/2016", "MM/DD/YYYY"), "D")` • Example field values: ▪ `Inspection_date` = 8/15/2016, 11:30:00 AM • Result number: 77 Dates and times can be formatted in several ways. The following examples are some of the ways you can format text into dates: • `DATEVALUE("12/25/2016 12:30:25 pm", "MM/DD/YYYY hh:mm:ss pm")` • `DATEVALUE("12/25/2016 14:23:45", "MM/DD/YYYY HH:mm:ss")` • `DATEVALUE("25-08-2008 08:40:13 AM", "DD/MM/YYYY hh:mm:ss AM")`

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Syntax	Description	Example
`NOW()`	Returns the current date and time in date/time format. The time is recorded based on coordinated universal time (UTC).	A dataset of restaurants includes the dates of their most recent health inspections. The number of days elapsed since the last inspection can be calculated using the `NOW()` function to specify the current date: • Function syntax: `DATEDIF(Inspection_date, NOW(), "D")` • Example field values: ▪ `Inspection_date`= 8/15/2016, 11:30:00 AM • Result number: 77

Logical functions

Logical functions use string or number inputs to produce string or number outputs. The inputs can be either literal (text surrounded by quotation marks or constant numbers) or field values. The following table uses a combination of field and literal values for its examples, along with example values that could be found in the given fields.

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Syntax	Description	Example
`AND(condition,condition,...)`	Tests two or more conditions and returns `TRUE` if all conditions are met. `AND()` should be used within the `condition` parameter of the `IF()` function. • `condition`: Any expression that includes at least one conditional operator. The condition can include numeric, string, and field values. The following conditional operators can be used: ▪ >: greater than ▪ <: less than ▪ >=: greater than or equal to ▪ <=: less than or equal to ▪ =: equal to ▪ <>: not equal to	A dataset contains the mean age of people living within each block group. A market researcher wants to know which block groups contain mostly millennials. The block groups with a mean age within the age range for millennials can be found using a combination of the `IF()` and `AND()` functions: • Function syntax: `IF(AND(MeanAge>=18, MeanAge<=33),"Millennial","Other")` • Example field value: ▪ `MeanAge` = 43 • Result text: "Other"

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Syntax	Description	Example
`IF(condition, TRUE_expression, [FALSE_expression])`	Tests a condition and returns a `TRUE` or `FALSE` value based on the result. • `condition`: Any expression that includes at least one conditional operator. The condition can include numeric, string, and field values. The following conditional operators can be used: ▪ >: greater than ▪ <: less than ▪ >=: greater than or equal to ▪ <=: less than or equal to ▪ =: equal to ▪ <>: not equal to • `TRUE_expression`: The expression that will be used if the condition is true. This parameter is mandatory. • `FALSE_expression`: The expression that will be used if the condition is false. If no `FALSE_expression` is provided, the default will be `null`. `TRUE_expression` and `FALSE_expression` can be any valid expression, including a nested `IF()` function. The data type for `TRUE_expression` and `FALSE_expression` should be the same type (for example, both strings or both numbers).	A dataset contains fields with store revenue and expenses, which can be used to find the status of the stores (whether they have posted a net profit or a net loss). The status of each store can be found using the `IF()` function: • Function syntax: `IF(Revenue>Expenses, "Profit","Loss")` • Example field values: ▪ `Revenue` = 400,000 ▪ `Expenses` = 350,000 • Result text: "Profit"

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Syntax	Description	Example
`ISNULL(field)*`	Tests if values in a field are null. An output value of 0 is assigned when the tested value is not null, and an output value of 1 is assigned when the tested value is null. • `field`: Supports string, number, rate/ratio, and date/time field types. `ISNULL()` can be used on its own, or within the `condition` parameter of the `IF()` function.	A dataset contains locations of traffic collisions involving cyclists, as well as the type of bike route present on the street where the collision took place. For collisions that took place on a street without a bike route, the `RouteType` field is left blank. The dataset can be updated to fill in null values using a combination of the `IF()` and `ISNULL()` functions: • Function syntax: `IF(ISNULL(RouteType), "None", RouteType)`
`ISNOTNULL(field)*`	Tests if values in a field are not null. An output value of 0 is assigned when the tested value is null, and an output value of 1 is assigned when the tested value is not null. • `field`: supports string, number, rate/ratio, and date/time field types. `ISNOTNULL()` can be used on its own, or within the `condition` parameter of the `IF()` function.	A dataset contains locations of traffic collisions involving cyclists, as well as the type of bike route present on the street where the collision took place. For collisions that took place on a street without a bike route, the `RouteType` field is left blank. The dataset can be updated to fill in null values using a combination of the `IF()` and `ISNOTNULL()` functions: • Function syntax: `IF(ISNOTNULL(RouteType), RouteType, "None")`

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Syntax	Description	Example
`OR(condition,condition, ...)`	Tests two or more conditions and returns `TRUE` if at least one condition is met. `OR()` should be used within the `condition` parameter of the `IF()` function. • `condition`: Any expression that includes at least one conditional operator. The condition can include numeric, string, and field values. The following conditional operators can be used: ▪ >: greater than ▪ <: less than ▪ >=: greater than or equal to ▪ <=: less than or equal to ▪ =: equal to ▪ <>: not equal to	A dataset contains locations of crimes across a city. A crime analyst wants to analyze the pattern of larceny compared to other similar crimes. To compare larceny to other crimes, the analyst must first determine whether or not each crime was considered larceny. The type of crime can be determined using a combination of the `IF()` and `OR()` functions: • Function syntax: `IF(OR(Crime="Theft", Crime="Theft from vehicle", Crime="Shoplifting"), "Larceny", "Other")` • Result text: "Larceny"

*Some fields with no data may be configured as empty rather than null. In those cases, `ISNULL()` and `ISNOTNULL()` will not return the expected results. Instead, the expressions `field=""` and `field<>""` should be used in place of `ISNULL(field)` and `ISNOTNULL(field)`, respectively.

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Cards

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Filter data

Attribute filters use queries to reduce the scope of the data you work with, without changing the underlying data. Filters limit what you see on the page or card from one session to another session until you change or reset the filters. You can filter dates, numbers, rate/ratios, and string fields at the dataset level or for an individual card.

One or more filters can be:

- Applied to a single card
- Applied to all cards from the same dataset
- Cumulative so you can filter at both the dataset and card levels

Note:

- Filtering a calculated field from a database dataset is not supported for dataset or card filters.
- If you adjust your card filters to the point at which no results are returned, a card error appears. Filter settings that show no values display a blank map, chart, or table. Try readjusting your filters.

Example

A retail chain is looking to expand into new markets in the Chicago area. Market research has shown that the chain's main clientele are women between the ages of 30 and 45 with a household income of at least $75,000. The market analyst has to use that information to determine which neighborhood in which to expand.

The analyst has collected data for census block groups in Chicago, including total population, population of women by age range, and median household income. The analyst calculates a new field with the percentage of the total population that is women ages 30 to 45. With that preparation finished, the analyst is ready to apply filters and find which block groups fit the criteria of the market research.

The first filter is applied to the calculated field. After studying the distribution of the data, the analyst decides to set the threshold for percentage of women ages 30 to 45 to 20 percent. The second filter is created for the median household income, which the market research indicates should have a lower limit of $75,000.

In a few steps, the analyst narrowed down the data to the 18 best block groups for the new store location. The analyst can now cross-reference the findings with zoning information and available retail rentals to find a final location.

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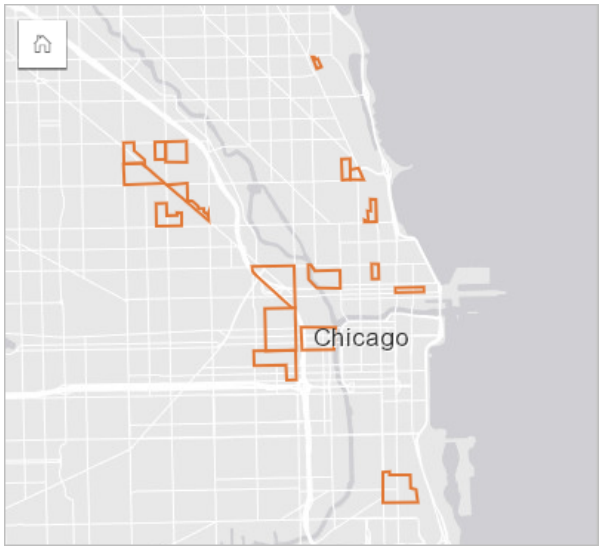


Filter types

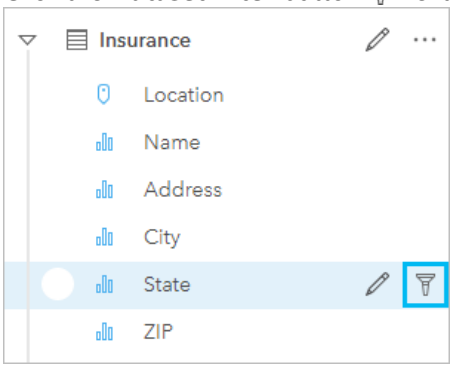
An attribute filter can be applied to either the full dataset or a single card. Multiple filters can be applied to the same dataset and card. When multiple filters are applied to the same data, the filters will be treated as if they are joined by an AND clause.

Dataset filter

A dataset filter is applied to a field from the data pane and is reflected on all cards using the dataset, regardless of whether the filtered field is displayed on the card.

Complete the following steps to create a dataset filter:

1. In the data pane, hover your pointer over the field you want to filter.
2. Click the **Dataset filter** button next to the field.



3. Adjust the filter to include the data you want to show in your cards.
4. Click **Apply**.

   All of the cards from the same dataset update to reflect the filter settings.

Card filter

A card filter is only applied to the data shown on a single card. Therefore, card filters can be used to make comparisons within a dataset by creating separate views of the same data.

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After a card filter is applied, a number will be added to the **Card filter** button showing the number of filters on the card. A result dataset will also be added to the data pane with the same filter applied to it at the dataset level. If new cards are created using the result dataset, all of the cards will reference the dataset filter on the result dataset, and the card filter will be removed from the original card. Since the original card also references the result dataset, there will be no change to the data being displayed.

Complete the following steps to create a card filter:

1. Click the card you want to filter to activate it.
2. Click the **Card filter** button. The **Card filters** pane appears.

3. From the list, choose the field you want to filter.

Note:
If the card already has an existing filter, it will be listed in the **Card filters** pane. A new filter can be created by clicking **New filter** before choosing the field by which to filter.

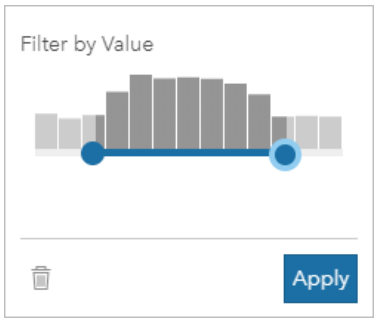
4. Adjust the filter to include the data you want to show in your cards.
5. Click **Apply**.

   Only the current card updates to reflect your filter settings.

Filter a number or rate/ratio field

Numbers and rate/ratios are continuous data that is filtered by changing the range of values that are displayed. When you filter a number or a rate/ratio field, you see a histogram with a slider along the bottom. The histogram aggregates the values in the field into equal interval bins and displays the frequency of values within each bin. The histogram allows you to see how much data you're including or excluding with your filter.

Adjust the slider at the lower and upper ends of the range, or click the nodes and enter a new value.



Filter a string field

String fields contain text or, in some circumstances, discrete number values (for example, a ZIP Code is more accurately categorized as a string than as a number). When you filter a string field, you will select or deselect unique values that you want displayed or excluded. The following methods can be used to select or deselect values from a string filter:

- Select all—Turn on or off the **Select All** box to select or deselect all the values in the filter.
- Click—Turn on or off individual values in the filter. Only boxes that are clicked will be selected or deselected.

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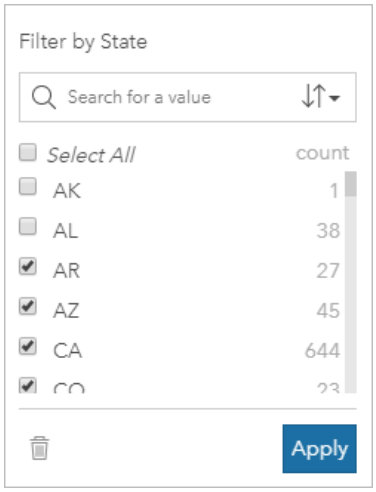
- `Shift+click`—Turn on or off multiple values. All boxes between the first and second click will be selected or deselected.

Note:
`Shift+click` can only be used on fields with fewer than 500 unique values.

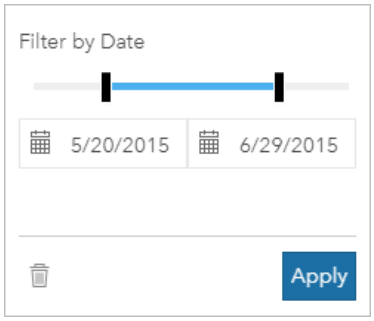


Filter a date/time field

A date/time field contains temporal data. The following options are available depending on whether the date/time field contains dates only, times only, or dates and times:

- Dates only—Change the date range by either using the calendar button to select start and end dates or adjusting the slider.
- Times only—Change the time range by using the clock button to select start and end times.
- Dates and times—Change the date/time range by using the calendar and clock buttons to select a start date and time and an end date and time.

Tip:
An advanced filter can be used to incorporate date functions, like `DATEDIF()` or `NOW()`, into your filter. See Create advanced filters for examples of expressions using dates and other functions.



A date/time field also contains subfields, such as `Year` and `Month`, which are stored and filtered as string fields.

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Remove or update your filter

Attribute filters provide a specific view of your data and do not change the underlying data. Therefore, a filter can be edited or removed if it is no longer needed.

Tip:

If you plan on updating your filter frequently, you may want to use a cross filter or predefined filter instead of a regular attribute filter.

Complete the following steps to update a dataset filter:

1. Click the active **Dataset filter** button .
2. Do one of the following:
   - Change the filter values and click **Apply** to update the filter.
   - Click the **Remove filter** button to delete the filter. You can also select all filter values and click **Apply** to remove the filter.

Complete the following steps to update a card filter:

1. Click the active **Card filter** button .
2. Click the filter that you want to update.
3. Do one of the following:
   - Change the filter values and click **Apply** to update the filter.
   - Click the **Remove filter** button to delete the filter. You can also select all filter values and click **Apply** to remove the filter.

Filter by n values

Note:

Top and bottom n values are currently available in card filters for bar charts, column charts, bubble charts, donut charts, and line charts. If you apply a filter by n values then switch to an unsupported visualization, the filter will be deleted.

Filters by n values are not available for certain remote feature layers. If your remote feature layer does not support filters by n values, you can copy the layer to your workbook and apply the filter to the copy.

Filtering using n values allows you to pick the top or bottom values on your chart based on its category and summary statistic.

Complete the following steps to filter by n values:

1. Click the **Card filter** button on a supported chart type.
2. Click the **n values** tab.
3. Choose either **Show top n values** or **Show bottom n values**.
4. Use the menu to choose a value for n, or type a number in the text box.

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5. Click **Apply**.

Cross filters

Cross filters are a way to filter your data using a selection on a different card. When the **Enable cross filters** button is activated on a card, a filter will be applied to that card whenever a compatible selection is made. For a selection to be compatible, the card with the filter and the card with the selection must be using the same dataset.

Cross filters can be applied to all charts and tables. However, polynomial trendlines on scatter plots are not supported when using cross filters.

Cross filters are not compatible with result datasets created from Buffer/Drive Times, Calculate Density, or Find Nearest. Cross filtering also cannot be used with certain remote feature layers. If these types of datasets are used, the **Enable cross filters** button is disabled. If you want to apply a cross filter to a card with one of these datasets you can copy the dataset to your workbook and apply a cross filter to the cards created by the copy.

Resources

Use the following resources to learn more about filters:

- Add a predefined filter
- Advanced filters
- Spatial filter

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Create advanced filters

Advanced filters are expression-based filters that can be used to create a custom filter at the dataset or card level. Advanced filters include access to the same operators (for example, +, ÷, >, and <>) and functions as calculated fields.

Note:
Advanced filters are not available for certain remote feature layers. If your remote feature layer does not support advanced filters, you can copy the layer to your workbook and apply an advanced filter to the copy.

Advanced filter expressions may appear incorrect when using mixed left-to-right and right-to-left characters within the same expression. For example, an expression using field names in both English and Arabic may not display properly. The results of the expression are not affected by the mixed left-to-right and right-to-left characters.

Advanced filters can be useful in situations in which the query is complicated, or if some of the information is unknown or needs to be calculated. The following are examples of how you can use advanced filters:

- You have a dataset with schools across the United States, but you want to perform analysis on schools in Dallas County, Texas. A regular filter for Dallas County returns schools in Alabama, Iowa, and Texas. An advanced filter using the expression `County="Dallas" AND State="Texas"` would filter the dataset so that only schools in Dallas County, Texas, are returned.
- You have a dataset with store locations, revenue, and expenses, but you want to see only the stores that are losing money. An advanced filter using the expression `Revenue<Expenses` would filter the dataset so that only stores with revenue less than expenses are returned.
- You have a dataset with hydrant locations, inspection dates, and inspection status over several years, but you only want to see the inspections for damaged hydrants that occurred in 2018 and after. An advanced filter using the expression `InspectionDate>=DATE(2018,01,01)AND Status="Damaged"` would filter the dataset so that only the damaged assessments occurring after January 1, 2018, will be shown.

Note:
A date function, such as `DATE()`, `DATEVALUE()`, or `NOW()`, must be used in an advanced filter expression using a date/time field. A date entered as a string value (for example, `"01/01/2018"` for January 1, 2018) will not be read as a date value and will not return results.

Apply an advanced filter at the dataset level

Use the following steps to apply an advanced filter at the dataset level:

1. Find the dataset you want to apply the filter to in the data pane.
2. Click the **Dataset options** button ··· next to the dataset.
3. On the dataset options menu, click **Advanced filter**.
4. Click inside the **Custom filter expression** box to display the available fields and functions, and begin writing your expression.
5. At the bottom of the **Custom filter expression** box, look for the green check mark ✓ indicating that the expression is valid.

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Note:
Your expression must include a conditional operator, such as <, =, or <>, to be valid for filtering (for example, `Revenue-Expenses>100000`).

6. Click **Apply**.

The expression is applied to the entire dataset. Any cards created using the dataset are refreshed and updated.

Apply an advanced filter at the card level

Use the following steps to apply an advanced filter at the card level:

1. Create a map, chart, or table using the dataset you want to filter.
2. Click the **Card filter** button on the card's toolbar.
3. In the **New filter** pane, click **Advanced**.
4. Click inside the **Custom filter expression** box to display the available fields and functions, and begin writing your expression.
5. At the bottom of the **Custom filter expression** box, look for the green check mark indicating that the expression is valid.

Note:
Your expression must include a conditional operator, such as <, =, or <>, to be valid for filtering (for example, `Revenue-Expenses>100000`).

6. Click **Apply**.

The expression is applied only to the card being filtered. Other cards that use the same dataset are not updated.

Note:
The active **Card filter** button displays the number of filters on the card, including advanced filters. When an advanced card filter is created, a result dataset will also be added to the data pane with the same filter applied to it at the dataset level. If new cards are created using the result dataset, all of the cards will reference the dataset filter on the result dataset and the card filter will be removed from the original card. Since the original card also references the result dataset, there will be no change to the data being displayed.

Remove or update an advanced filter

Use the following steps to update an advanced dataset filter:

1. Click the **Dataset options** button ··· for the dataset that has an advanced filter applied.
2. Click **Advanced filter** in the dataset options menu.
3. Do one of the following:
   - Change the filter expression and click **Apply** to update the filter.
   - Click the **Remove filter** button to delete the filter.

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Use the following steps to update an advanced card filter:

1. Click the active **Card filter** button .
2. Click the filter that you want to update.
3. Do one of the following:
   - Change the filter values and click **Apply** to update the filter.
   - Click the **Remove filter** button to delete the filter.

Expression examples

The following table provides examples of the types of expressions that can be used in advanced filters:

Expression	Description
`DATEDIF(date_field, NOW(), "D")<=28`	Filters the data to entries from the past 28 days.
`number_field>AVG(number_field)`	Filters the data to rows where the value of `number_field` is greater than average.
`number_field_1>number_field_2`	Filters the data to rows where the value of `number_field_1` is greater than the value of `number_field_2`.
`number_field<10 OR number_field>20`	Filters the data so that the middle values (in this case, numbers between 10 and 20) are not included.
`string_field IS NOT NULL`	Filters the data to only include rows where the field contains non-null values.

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Navigate maps

The following options are available for zooming in and out on your maps:

- Use the zoom tools by clicking the **Zoom tools** button on the map toolbar.
- Scroll in and out with your mouse.
- Press `Shift` while dragging the pointer to zoom in on an area of interest.

To pan, use your mouse or the arrow keys on your keyboard. After panning and zooming on a map, click the **Default extent** button to return to the map's original extent.

Tip:

If you want all of the maps on your page to display the same spatial extent when you zoom and pan, use the **Sync extents** button. It's helpful to have all the maps on your page update to reflect the location and zoom level for your area of interest.

Change the default extent

The **Default extent** button returns your map to the full extent of the layers. Complete the following steps to customize the default extent:

1. Zoom and pan your map to the desired extent.
2. On the map toolbar, click the **Zoom tools** button.

   Note:
   The map toolbar is available on an active map card. Click the map to activate the card, if necessary.

   The map toolbar displays the zoom tools.
3. Click the **Set default extent** button.

The **Default extent** button zooms and pans your map to the extent you set. You can reset to the original default extent by clicking the **Clear default extent** button from the zoom tools.

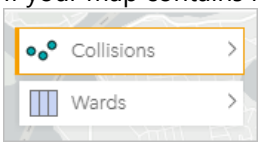
Zoom to a layer

The **Zoom to layer** button is used to zoom your map to the extent of a specific layer. Complete the following steps to zoom to a layer:

1. If necessary, click the **Layer options** button on the map toolbar to display the layers on the map.

   Note:
   The map toolbar is available on an active map card. Click the map to activate the card, if necessary.

2. If your map contains more than one layer, select a layer from the list.



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An orange outline appears on the selected layer.

3. On the map toolbar, click the **Zoom tools** button .
   The map toolbar displays the zoom tools.
4. Click the **Zoom to layer** button .
   The map zooms to the extent of the selected layer.

Note:
Some layers may be distributed so that features appear partially or completely hidden under the header. If a layer on your map is not completely visible, you can hide the card header or change the default extent of the map.

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Make selections

Selections allow you to temporarily target areas of interest, such as unusual highs or lows in your data, and highlight those data points in related maps, charts, and tables. Unlike filtering, selections on cards are temporary. While selections do not change the source data, they do affect the results of an analysis or statistical summary, because these functions only use the current selection. However, selections won't update previously executed spatial analytics.

Tip:

Selections can be used to spatially filter data and to create other maps, charts, or tables by dragging selections onto the map, chart, or table drop zone on your page.

Map cards

Features on a map can be selected using a selection tool, by interacting with the legend, or by making a selection on a different card that is displaying the same data. Selections are cleared by clicking a blank area on your map.

Selection tools

Selection tools can be used to select one or more features on a map. Your pointer will always function as **Select** when you click a feature on the map unless a different tool is chosen. You can access the selection tools using the **Selection tools** button on a map toolbar.

The following table summarizes the five selection tools that can be used with map cards.

Tool	Description
Select	**Select** is used to select individual features on your map. You can click to select a single feature or use `Ctrl+click` to select multiple features. **Select** is the default selection tool.
Box select	**Box select** is used to select multiple features within the same area. A rectangle is drawn on the map by clicking and dragging the corners to the desired extent. All features from the active layer that are within the rectangle or that intersect the rectangle will be selected.
Lasso	**Lasso** is used to select multiple features within an irregular area. A closed shape is drawn on the map by dragging the cursor to create the desired shape. All features from the active layer that are within the shape or that intersect the shape will be selected.
Zoom to selection	**Zoom to selection** is used to change the map extent and zoom level to fit the features selected on a map. **Zoom to selection** cannot be used to select features and is only available in the toolbar when there are selected features on the map.
Invert selection	**Invert selection** is used to switch all selected and unselected features. **Invert selection** is only available in the toolbar when there are selected features on the map.

Legends

Features can be selected using the legend (available in the **Layer options** pane) when a layer is styled by **Types (Unique symbols)**, **Counts and amounts (Size)**, or **Counts and amounts (Colors)**.

Selecting a category or class of values on a legend will select all of the features from that category or class on the map. Multiple categories or classes can be selected on the legend using `Ctrl+click`.

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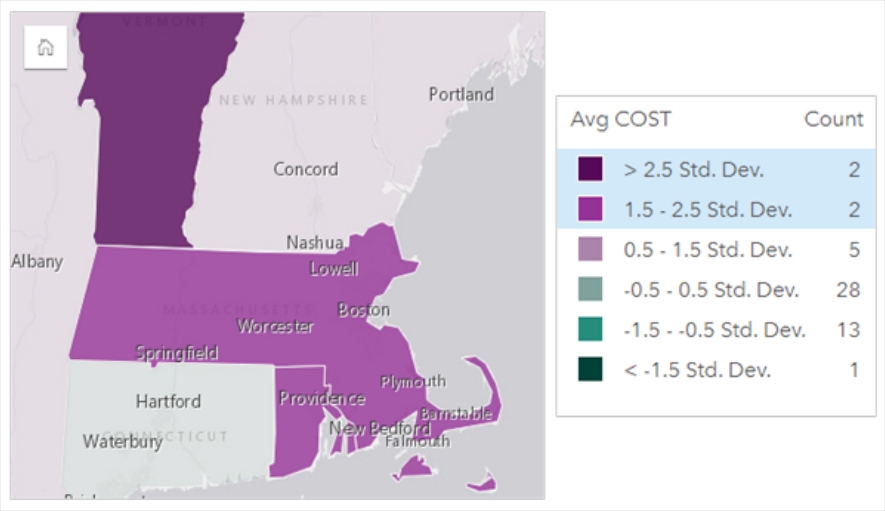

Chart cards

Features on a chart can be selected using a selection tool, by interacting with the legend, or by making a selection on a different card that is displaying the same data. Selections are cleared by clicking a blank area on your chart.

Selection tools

Selection tools can be used to select one or more features on a chart. Your pointer will always function as **Select** when you click a feature on the chart unless a different tool is chosen. You can access the selection tools using the **Selection tools** button on the chart toolbar.

Note:
The availability of selection tools depends on which type of chart is being visualized.

The following table summarizes the three selection tools that may be available with chart cards.

Tool	Description
Select	**Select** is used to select individual features on your chart. You can click to select a single feature or use `Ctrl+click` to select multiple features. **Select** is the default selection tool.
Box select	**Box select** is used to select multiple features on a chart. A rectangle is drawn on the chart by dragging the corners to the desired extent. All features that are within the rectangle or that intersect the rectangle will be selected.
Invert selection	**Invert selection** is used to switch all selected and unselected features. **Invert selection** is only available in the toolbar when there are selected features on the chart.

Legends

Features can be selected using the legend when a layer is styled by **Unique symbols**.

Selecting a category of values on a legend will select all the features from that category on the chart.

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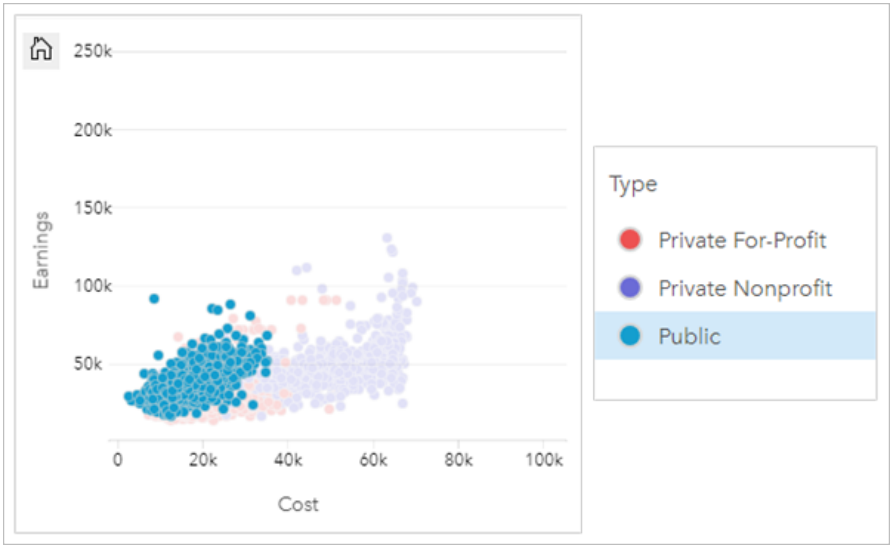

Tables

Features in summary tables can be selected by clicking the desired features or using `Ctrl+click`. The selected features will be represented in the summary table as well as any other maps, charts, or tables displaying the same data. Once a selection has been made on a summary table, the following options will be available:

- Invert a selection: Click the **Invert selection** button to switch your selected features. The inverted selection will be reflected in all other cards displaying the same data.
- Show a selection: Click the **Show selection** button to show only your selected features in the summary table. The features that are not selected will be temporarily removed from the summary table. The selected features will remain selected on all other cards displaying the same data, but no other changes will take place to those cards. You can show the unselected features again by clicking **Show selection** a second time. The selected features will remain selected until you click the scroll bar in the summary table or inside another card.

Page viewers

Selection functionality is available when viewing a shared page. Viewers can use the selection tools or selections on legends to interact with cards and activate cross filters. Viewers cannot use selections to perform a spatial filter or create a new card.

Note:
Selection tools are not supported for iPad devices.

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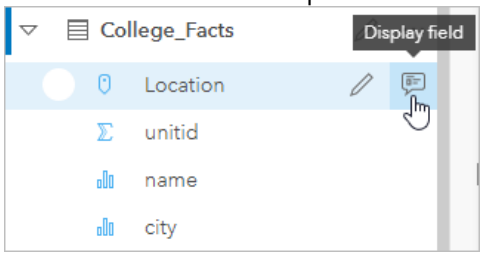
View pop-ups

Pop-ups provide a quick overview of a single feature on a map or an aspect of a chart, such as a bar or point. To see a pop-up on a map, hover over a point, line, or area. To see a pop-up on a chart, hover over a point, bar, or slice.

Display a field

Map pop-ups display information about the data on your map. By default, the map pop-ups display values from the first string field in the dataset. If there are no string fields, the first number field is used. The field displayed in the pop-ups can be changed using the **Display field** button. The **Display field** button is located in the data pane next to the **Location** field for spatial datasets.



Note:
The **Display field** button is unavailable for datasets created from database connections that have been joined or aggregated. Database connections are available in Insights in ArcGIS Enterprise and Insights desktop.

If a pop-up is styled by a field other than the **Location** field, the pop-ups will include information from both the **Style by** field and the **Display field** setting.

Configure map pop-ups

Map pop-ups can be configured to show or remove statistics such as the average, minimum, and maximum values, or they can be disabled. Complete the following steps to configure pop-ups on a map layer or disable them:

1. On a map card, click the arrow › next to a layer name.
   The **Layer options** pane appears.
2. Click the **Symbology** tab.
3. Check or uncheck **Show popup** to enable or disable pop-ups for the layer.
4. Click the **With statistics** button or **Without statistics** button to show or remove information, such as the minimum, maximum, and mean values, from the pop-up.

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Interact with cards

The key to fully understanding your data is to interact with two or more visualizations from the same dataset. Cards created from fields from the same dataset are linked, allowing you to make selections on one card and see related cards update to highlight your selections.

When you have different types of cards on the page, making selections, filtering, accessing statistics, and other interactions can reveal spatial, temporal, numeric, and categorical patterns that may not have been apparent in a single visualization. To see the variety of ways you can visualize your data, see Analysis capabilities.

You can interact with your data in the following ways:

- Activate a card
- Maximize a card to see a filmstrip view
- Bring forward or send backward
- See card statistics
- Change the visualization type
- Change the title of a card
- Hide a card header

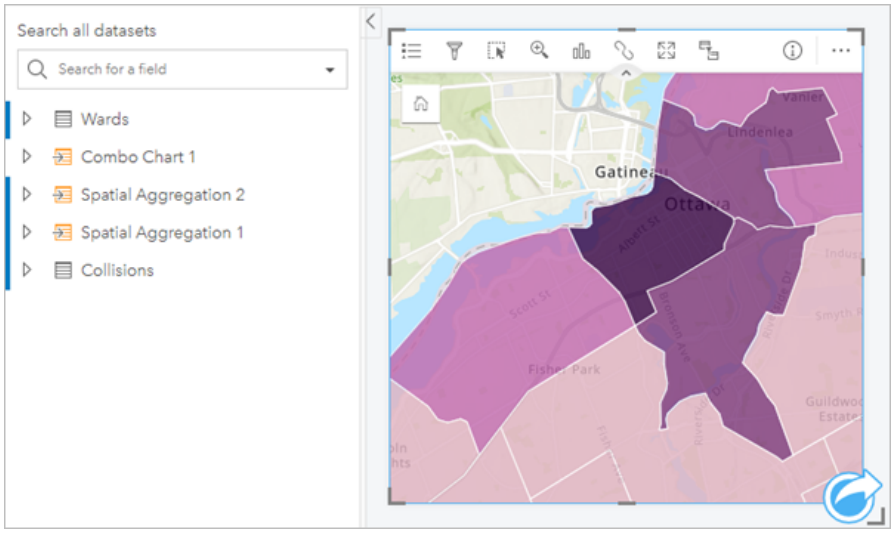
Activate a card

A card must be active to access most of the interactive capabilities in Insights, such as making selections, creating a filter, or performing analysis. You can click anywhere on a card to activate it. A card is active when the **Action** button is visible and the card header displays a toolbar. If the card header is hidden, the toolbar will not be displayed.

There are two ways to deactivate a card:

- Activate a different card.
- Click a blank area on the page.

All datasets upstream from the active card are highlighted in the data pane with a blue bar.



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Maximize a card

When you interact with a card, you may want to enlarge the card to get a better view of the data. Maximizing the card creates a filmstrip view of the cards on your page, with the maximized card at the top, and thumbnails of the remaining cards arranged below.

Click **Maximize** to expand your card.

Click **Restore down** to return to the previous page view of your cards.

Bring forward or send backward

When more than one card is created on a page, you have the option to designate the order in which overlapping cards will appear. By default, Insights uses the order that cards were created, with newer cards ordered in front of older cards.

Note:
Legends will always be ordered in front of the card that the legend describes.

Use the following steps to change the order of a card:

1. Click the card to activate it, if necessary.
2. Click the **Card options** button ···.
3. Click the **Order** button .
4. Choose one of the following ordering options:
   - **Bring to front**
   - **Bring forward**
   - **Send to back**
   - **Send backward**

Alternatively, you can use the keyboard command `f` to bring an active card forward, or `b` to send the card backward. If a textbox is active, such as a title, axis label, or text and media card, you can use `Esc` to exit the text box before using `f` or `b`.

See card statistics

Summary statistics provide a quick overview of your data. Statistics vary based on the type of chart or map you're interacting with.

Summary statistics on maps include count, minimum, maximum and mean, but vary depending on the type of data you're mapping. Maps made from datasets that are editable at the data source will also have a timestamp, which will tell you the time that the version being viewed was last updated. If the data is not up-to-date, then the dataset or workbook can be refreshed to show the latest copy of the data.

Chart statistics also vary by chart type. For example, bar chart statistics include count, mean, median, and upper or lower quartiles.

Statistics on summary tables include sum, average, minimum, maximum, median, and percentile. The statistics are calculated on number or rate/ratio fields for each unique value in the category column. Summary tables also include

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a footer statistic, which displays the statistic chosen for the number or rate/ratio field calculated for the entire dataset. For example, if the chosen statistic is Average for a table of 10,000 points grouped into five unique categories, then the footer average will be the average of the 10,000 values, rather than the average of five averages.

Access chart statistics

Click the **Chart statistics** button to see available statistics.

Access map statistics

Click the **Flip card** button to turn the map card over and see summary statistics.

Change the visualization type

You get a different perspective on your data when you change to a related visualization type. For example, if you change from a choropleth map to a histogram, you can see how your numeric data is distributed, such as which numeric ranges are the most or least concentrated, or whether or not the data is skewed.

Related visualization types are determined by the data in your visualization. Use the following steps to change the visualization of your card:

1. Click the card to see the toolbar.
2. Click the **Visualization type** button .

   Applicable visualization types can be chosen in the list. If all the visualization types are unavailable, you can't change the visualization type.
3. Click a visualization type in the list.

   The card changes to the chosen visualization type, for example, a histogram.
4. To return to the previous visualization, click the **Visualization type** button , and choose the visualization from the list.

Change the title of the card

By default, cards are assigned a title based on the order in which they are created, for example Card 1, Card 2, and so on. You can provide a more meaningful title if you wish. You can see a card title when the card is not selected.

1. If you have selected the card, click outside the card to unselect it.

   You can see the card title. For example, **Card 1**.
2. Click the card title.

   The title field turns gray.
3. Enter a new title, and click **Enter** (or click off the card).

Hide a card header

The header of a card can be hidden using the **Hide** button below the toolbar. You will have access to the **Card options** button and the **Show** button when the header is hidden. All other buttons on the toolbar will be hidden unless you show the toolbar again. Therefore, it is best practice to configure card settings like filters, styles, and cross filters before hiding the card header.

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Hidden headers will remain hidden by default on a shared page. The **Show** and **Hide** buttons are available in the page viewer to allow access to the buttons on the toolbar. The header will automatically be hidden again when a card is deactivated. Therefore, the card title will never be seen in the page viewer if the header was hidden when the page was shared.

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View the back of a card

The back of map, chart, and table cards include important information about the data on the card and functionality to export data or images from compatible cards.

To view the back of a card, click the **Flip card** button on the card toolbar.

Card info

The **Card info** tab is available on the back of all map, chart, and table cards and provides valuable information about your card. All card types include a **Description** section and a **Statistics** section.

The description is used to provide a summary of the analysis on the card, reference the data source, or provide any other information that is useful to page viewers. If a description is provided, it will be available to viewers when the page is shared. Otherwise, the **Description** section will not be visible on the shared page.

The statistics vary depending on the card type but can include information such as count of features, mean value, and the date or time the data on the card was last refreshed.

Map cards also include an **Attribution** section, which sites the source of data for the basemap used on the card.

Export image

Note:
Exporting an image of a card is currently supported for bar charts, stacked bar charts, column charts, stacked column charts, line graphs, time series graphs, and combo charts.

The card image can be exported in PNG or JPEG format from the **Export image** tab using the **PNG** and **JPEG** buttons.

The exported image will be the same size and use the same style as the card in Insights. The exported image does not include the card title, toolbar, border, or any interactive buttons (for example, the **Default extent** button on a time series chart).

Note:
The exported image is based on the preview seen on the back of card. The preview and exported image are static and will not reflect updates to the data or card. If you make changes, such as applying a filter, you must flip to the front of the card then flip back to the back of the card to refresh the preview.

Exported images do not support transparency inside the chart axes. For best results, choose a background color for charts that will be exported rather than applying a transparent background.

Export data

Note:
Exporting data from a card is currently supported for tables and most charts. Maps, link charts, time series graphs, and combo charts created with two datasets do not support exporting data.

The data on a card can be exported as a comma-separated values (CSV) file from the **Export data** tab using the **CSV** button.

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The exported dataset includes the fields used on the card. You can also use the preview on the **Export data** tab to determine which fields will be included in the exported data. For charts that display aggregated data (for example, sum of values), the data will be exported in its aggregated form.

Allow viewers to export images and data

You can allow viewers to export images and data from cards on a shared page or a shared workbook using the **Enable viewers to export as** parameter. Export is not enabled by default. Enabling export applies to all compatible cards on the shared page or in the shared workbook.

Viewers can export data and images using the **Export data** and **Export image** tabs on the back of a card. If exporting data or images is not enabled when the page or workbook is shared, the respective tab will not be visible to viewers.

Note:
Downloads may be blocked for applications or websites displaying embedded pages (for example, pages embedded in ArcGIS StoryMaps). For pages embedded in a story, the viewer must open the live content in a new tab, then export the data or image.

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Analyze

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Perform analysis

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Analysis capabilities

See the following sections to learn which map or chart you should make to perform your analysis:

- Analyze your data
- Make a map
- Make a chart

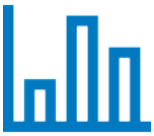
Analyze your data

The tables in the sections below describe how you can do the following:

- Understand the quantities in your data
- Understand the relationships in your data
- Understand the change in your data
- Understand the interactions in your data
- Understand the distribution of your data
- Understand the proportions in your data

Understand the quantities in your data

If you want to see the size, amount, or degree of a variable, use the following chart types:

Icon	Chart type	Requirements	Description	How to create it
	Bar chart and column chart	Unique categories	Compare aggregated quantities between categories and identify broad differences at a glance.	Create a chart using a string field.
	Stacked bar chart and stacked column chart	Two unique categories	Compare aggregated quantities between categories or subcategories and identify broad differences at a glance.	Create a chart using two string fields.
	Treemap	Unique categories	Compare aggregated quantities in a hierarchical structure by comparing the size and placement of categories.	Create a chart using a string field.
	Bubble chart	Unique categories	Compare aggregated quantities across categories using bubble size to represent magnitude.	Create a chart using a string field.
	Heat chart	Two unique categories	Compare aggregated quantities as they intersect with two categories in a matrix form. Patterns in the data can be quickly discerned as the quantities change across cells.	Create a chart using two string fields.

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Icon	Chart type	Requirements	Description	How to create it
	Key Performance Indicator (KPI) card	Unique categories or numbers	Compare the measure of a key indicator to a target value.	Create a chart using a number, rate/ ratio, or string field.

If you want to see the size, amount, or degree of data spatially, use the following map types:

Icon	Map type	Requirements	Description	How to create it
	Graduated symbol map	Numbers	Compare the quantities of your data within a spatial context. The size of the symbol corresponds to the magnitude of the data value.	Create a map using a number field.
	Aggregation map	Two spatial datasets • One dataset with boundaries • One dataset that will be aggregated into the boundaries	Compare aggregated quantities within a spatial context. A graduated symbol is assigned to each boundary area based on the magnitude of the aggregated data.	Use Spatial Aggregation.
	Map with column chart symbols	Multiple categories for a single feature	Compare the quantities of categorical data within a feature and between features.	Create a map using a string field and change the symbol type to **Columns**.

Understand the relationships in your data

If you want to see the connection or similarity between variables, use the following chart types:

Icon	Chart type	Requirements	Description	How to create it
	Chord diagram	Two unique categories	Visualize the relationships between categories and allow comparisons of similarities within a dataset or between different groups of data.	Create a chart using two string fields.
	Scatter plot	Two numbers	Assess the relationship between numbers visually and statistically, including the correlation between variables.	Create a chart using two number fields.

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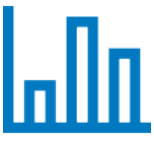
Icon	Chart type	Requirements	Description	How to create it
	Scatter plot matrix	Two or more numbers	Create multiple scatter plots at once to analyze the relationship between variables, while also comparing the relationships themselves.	Create a chart using three to five number fields.
	Link chart	Two unique categories	Visualize and assess the connections between nodes in a network.	Create a chart using two string fields.

If you want to see the connection or similarity of spatial data, use the following map types:

Icon	Map type	Requirements	Description	How to create it
	Choropleth map	Proportions, rates, or ratios	Visualize the way ratios or proportions are distributed spatially to discern spatial patterns.	Create a map using a rate/ratio field, or using a number and normalizing the data.
	Flow map	Two location fields in the same dataset	Visualize and assess the magnitude and direction of connections between nodes in a network within a spatial context.	Create a link map with direction.
	Spider lines map	Either of the following: • One dataset with two location fields • Two datasets with location fields	Visualize and assess the magnitude of connections between nodes in a network within a spatial context.	Create a link map without direction, or use Find Nearest.

Understand the change in your data

If you want to see how your data changes between categories or over time, use the following chart types:

Icon	Chart type	Requirements	Description	How to create it
	Bar chart and column chart	Unique categories	See the quantities of your categorical data and discern the differences between categories.	Create a chart using a string field.

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Icon	Chart type	Requirements	Description	How to create it
	Stacked bar chart and stacked column chart	Two unique categories	See the quantities of your categorical data and discern the differences between and within categories.	Create a chart using two string fields.
	Heat chart	Two unique categories	Chart the intersection of categorical data to see trends in two dimensions.	Create a chart using two string fields.
	Data clock	Time data or categories	See the trends in your data over two different time intervals.	Create a chart using two date/time subfields.
	Line graph	Unique categories	See the values of your categorical data with an emphasis on trends between categories.	Create a chart using a string field.
	Time series graph	Time-enabled data	See how your data changes over time and discern patterns or trends.	Create a chart using a date/time field.
	Decomposed time series graph	Time-enabled data	Decompose your time series into trend, seasonal, and remainder components.	Use Temporal Decomposition.
	Forecasted time series	Time-enabled data	Predict future values for your time series.	Use Forecast.
	Time series with moving average	Time-enabled data and numbers	Create a smoothed time series or impute missing values in your data.	Use Moving Average.
	Combo chart	Two datasets with the same unique categories	See the interaction between the quantities and trends in your data.	Create a line graph and a column chart on the same card.

If you want to see how your data changes spatially, use the following map types:

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Icon	Map type	Requirements	Description	How to create it
	Graduated symbol map	Numbers	Visualize the quantities in your data and see the way those quantities change with location.	Create a map using a number field.
	Density map	Points	Calculate the density of your data and see how the density changes with location.	Use Calculate Density.
	Heat map	Points	Visualize spatial distributions based on areas with the most and least number of points, and how those distributions relate to location.	Create a map and change the **Symbol type** to **Heat Map**.
	Binned map	Points	Aggregate your data into equally sized bins to see overall spatial trends across your data.	Create a map and change the **Symbol type** to **Bins**.
	Map with column chart symbols	Multiple categories for a single feature	Compare the quantities of categorical data within a feature and between features.	Create a map using a string field and change the symbol type to **Columns**.

Understand the interactions in your data

If you want to see the flow of information between variables, use the following chart types:

Icon	Chart type	Requirements	Description	How to create it
	Chord diagram	Two unique categories	See the quantity and direction of interactions between categories.	Create a chart using two string fields.
	Link chart	Two unique categories	Identify interactions and quantify the relationship of nodes relative to each other.	Create a chart using two string fields.

If you want to see the flow of information between places, use the following map types:

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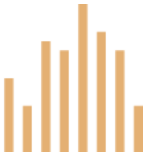
Icon	Map type	Requirements	Description	How to create it
	Flow map	Two location fields in the same dataset	Identify relationships in spatial data and see the direction that information flows through a network.	Create a link map with direction.
	Spider lines map	Either of the following: • One dataset with two location fields • Two datasets with location fields	Identify relationships in spatial data, either through geographical proximity or attribute connections.	Create a link map without direction, or use Find Nearest.

Understand the distribution of your data

If you want to see how your data is arranged numerically, use the following chart types:

Icon	Chart type	Requirements	Description	How to create it
	Histogram	Numbers	See the distribution of your numerical data and make comparisons to a bell curve, or normal distribution.	Create a chart using a number field.
	Box plot	Numbers	See the distribution of your numerical data and identify basic statistical values.	Create a chart using a number field.
	Point chart	Unique categories and numbers	See the distribution of your numerical data by category.	Create a chart using a string field and a number field.

If you want to see how your data is arranged spatially, use the following map types:

Icon	Map type	Requirements	Description	How to create it
	Location map	Location field only	View your spatial data in its most basic form to identify where your data is located.	Create a map using a location field.

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Icon	Map type	Requirements	Description	How to create it
	Choropleth map	Proportions, rates, or ratios	Classify your proportional data to see how changes in the data interact with changes in location.	Create a map using a rate/ratio field, or using a number and normalizing the data.
	Graduated symbol map	Numbers	Classify your number data to see where the quantities are largest and smallest.	Create a map using a number field.
	Heat map	Points	Visualize your data based on the number of points and discern patterns based on spatial distribution.	Create a map and change **Symbol type** to **Heat Map**.
	Density map	Points	Calculate the density of your point data and see how the density is distributed spatially.	Use Calculate Density.
	Unique value map	Unique categories	See how your data is distributed and determine how categories are affected by location.	Create a map using a string field.
	Binned map	Points	Aggregate your data into equally sized bins to see a generalized view of how your data is distributed across locations.	Create a map and change **Symbol type** to **Bins**.
	Map with column chart symbols	Multiple categories for a single feature	See the distribution of categorical data within a feature and between features.	Create a map using a string field and change the symbol type to **Columns**.

Understand the proportions of your data

If you want to see the relative proportions of categories in your data, use the following chart types:

Icon	Chart type	Requirements	Description	How to create it
	Donut chart	Unique categories	See your categories arranged proportionally to see the size of each relative to the whole.	Create a chart using a string field.

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Icon	Chart type	Requirements	Description	How to create it
	Treemap	Unique categories	See the proportions of your categories through both size and hierarchical orientation.	Create a chart using a string field.

If you want to see the relative proportions of categories in your data spatially, use the following map types:

Icon	Chart type	Requirements	Description	How to create it
	Map with column chart symbols	Multiple categories for a single feature	See the proportions of categorical data within a feature.	Create a map using a string field and change the symbol type to **Columns**. Display the columns by stacked percent.
	Map with pie chart symbols	Multiple categories for a single feature	See the proportions of categorical data within a feature.	Create a map using a string field and change the symbol type to **Pies**.

Make a map

If you have a spatial dataset, you're ready to make a map.

Icon	Map type	Requirements	Description	How to create it
	Location map	Location field only	Create a location map to see where your point, line, or area features are located.	Create a map using a location field.
	Aggregation map	Two spatial datasets • One dataset with boundaries • One dataset that will be aggregated into the boundaries	Create a spatial aggregation map to generalize your data and see big picture patterns.	Use Spatial Aggregation.
	Binned map	Points	Create a binned map to see a quick, aggregated representation of how your data is distributed.	Create a map and change the **Symbol type** to **Bins**.

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Icon	Map type	Requirements	Description	How to create it
	Unique value map	Unique categories	Create a unique values map to see where point, line, or area features are located and what type they are.	Create a map using a string field.
	Choropleth map	Proportions, rates, or ratios	Create a choropleth map to see distributions of ratios or proportional data.	Create a map using a rate/ratio field, or using a number and normalizing the data.
	Density map	Points	Create a density map to determine the density distribution of your point data.	Use Calculate Density.
	Flow map	Two location fields in the same dataset	Create a flow map to see the magnitude and direction of relationships between different locations.	Create a link map with direction.
	Heat map	Points	Create a heat map to visualize areas with the most point features as the hottest.	Create a map and change the **Symbol type** to **Heat Map**.
	Graduated symbol map	Numbers	Create a graduated symbol map to show symbols of graduated sizes to indicate numeric values.	Create a map using a number field.
	Spider lines map	Either of the following: • One dataset with two location fields • Two datasets with location fields	Create a spider lines map to see the connections between different locations.	Create a link map without direction, or use Find Nearest.
	Map with column chart symbols	Multiple categories for a single feature	See the distribution or proportion of categorical data within a feature and between features.	Create a map using a string field and change the symbol type to **Columns**.

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Icon	Map type	Requirements	Description	How to create it
	Map with pie chart symbols	Multiple categories for a single feature	See the proportions of categorical data within a feature.	Create a map using a string field and change the symbol type to **Pies**.

Make a chart

You can make a chart with any dataset, whether it's spatial or nonspatial.

Icon	Chart type	Requirements	Description	How to create it
	Box plot	Numbers	Create a box plot to see the distribution and basic statistics for your numerical data.	Create a chart using a number field.
	Bubble chart	Unique categories	Create a bubble chart to compare the quantities of your categorical data.	Create a chart using a string field.
	Bar and column chart	Unique categories	Create a bar or column chart to see an overview of your categorical data.	Create a chart using a string field.
	Combo chart	Two datasets with the same unique categories	Create a combo chart to see both quantities and trends for the same categorical variable.	Create a line graph and a column chart on the same card.
	Chord diagram	Two unique categories	Create a chord diagram to see directed relationships between categories.	Create a chart using two string fields.
	Data clock	Time data or categories	Create a data clock to see trends in your data over different periods of time.	Create a chart using two date/ time subfields.
	Donut chart	Unique categories	Create a donut chart to see the proportions of your categorical data.	Create a chart using a string field.

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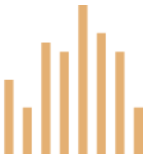
Icon	Chart type	Requirements	Description	How to create it
	Heat chart	Two unique categories	Create a heat chart to see trends in the intersection of your categorical data.	Create a chart using two string fields.
	Histogram	Numbers	Create a histogram to see the frequency and distribution of your numeric data.	Create a chart using a number field.
	Key Performance Indicator (KPI) card	Unique categories or numbers	Compare the measure of a key indicator to a target value.	Create a chart using a number, rate/ratio, or string field.
	Line graph	Unique categories	Create a line graph to see trends between categories in your data.	Create a chart using a string field.
	Link chart	Two unique categories	Create a link chart to identify the interactions and relationships with your data.	Create a chart using two string fields.
	Scatter plot	Two numbers	Create a scatter plot to analyze the relationship and correlation between two numeric variables.	Create a chart using two number fields.
	Scatter plot matrix	Two or more numbers	Create a scatter plot to analyze the relationship and correlation between multiple numeric variables.	Create a chart using three to five number fields.
	Stacked bar chart and stacked column chart	Two unique categories	Create a bar or column chart to see an overview of your categorical data, including subgroups.	Create a chart using two string fields.
	Time series graph	Time-enabled data	Create a time series graph to see trends in your data over time.	Create a chart using a rate/ratio field.
	Treemap	Unique categories	Create a treemap to see the proportions of your categorical data through both size and hierarchical orientation.	Create a chart using a string field.

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Perform analysis

Displaying data on a map can give you insight into the patterns, distributions, and relationships inherent in your data. However, many patterns and relationships aren't obvious by looking at a map. Often, there's too much data to sift through and present coherently as raw data. The way you display the data on the map can change the patterns you see. Analysis allows you to quantify patterns and relationships in the data and display the results as maps, tables, and charts. Analysis also empowers you to answer questions and make important decisions using more than a visual analysis.

Action button

The spatial and nonspatial analysis capabilities in Insights are found in the **Analytics** pane, which is accessed using the **Action** button on a map, chart, or table card.

The **Action** button on a map card opens the **Analytics** pane on the **Spatial analysis** tab, where the spatial analysis capabilities are quickly accessible. You can navigate to the **Find answers** tab to find spatial and nonspatial analysis capabilities grouped by common questions. The **Action** button on a chart or table card opens the **Analytics** pane to the analysis questions from the **Find answers** tab.

If you don't see the **Action** button, click a card on your page to activate it. The card toolbar and the **Action** button appear.

Spatial analysis tab

The **Spatial analysis** tab is available only from a map card and gives access to Buffer/Drive Times, Spatial Aggregation, Spatial Filter, Enrich Data, Calculate Density, Find Nearest, Calculate Density Ratio, Find K-Means Clusters, and Find Spatial Mean.

For more information on spatial analysis, including required privileges and overviews of the analysis capabilities, see Spatial analysis.

Find answers tab

The **Find answers** tab organizes your analytical activity based on key questions that involve mapping, spatial analysis, and other visualizations.

The following table summarizes the capabilities as they are organized in the **Find answers** tab:

Question	Sample questions	Analysis capability
How is it distributed?	Where are the largest camps of internally displaced people?	Spatial Aggregation
	Where are asthma hospitalizations most concentrated in the city?	Calculate Density
	Do obesity rates among adolescents show a normal distribution?	View Histogram
	How should graduated symbols or choropleth map features be distributed on the map?	Classification
	Which crime types and police districts have the highest crime frequency?	View Heat Chart

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Question	Sample questions	Analysis capability
	How is the cost of car insurance distributed in each city?	View Box Plot
	How does the crime rate in a certain district compare to the mean?	Calculate Z-Score
	Where are the clusters of caribou habitat?	Find K-Means Clusters
How is it related?	What are the habits and lifestyles of people who live in this area?	Enrich Data
	What is the relationship between the sales of men's apparel and the total sales for the year?	View Scatter Plot
	How do obesity rates differ between urban and rural residents?	Calculate Ratio
	How does the number of migrants to each state compare to the number of migrants from each state?	View Chord Diagram
	What is the rate of migration between countries?	View Link Chart
	Which variables have the most effect on the total sales at each store location?	Regression Model
	What are the expected future levels of carbon emissions based on trends in vehicle usage, renewable energy uptake, and economic growth?	Predict Variable
	Do certain neighborhoods have a higher occurrence of cancer than others, relative to their population?	Calculate Density Ratio
What's nearby?	Which rivers are within 10 miles of a pipeline?	Buffer/Drive Times
	What is the median household income for neighborhood residents over the age of 65?	Attribute Filter
	Which lakes in the region have the highest fish counts?	Spatial Filter
	What is the proximity of drug crimes to elementary and high schools?	Find Nearest
How has it changed?	Does the number of traffic accidents increase or decrease over time?	Time Series
	What is the percentage of losses or gains for each commodity?	Calculate % change
	What is the number of sales for each month and year?	View Data Clock
	How does seasonality affect air quality?	Temporal Decomposition
	What are the predicted air quality values for the next two years?	Forecast

Temporal analysis

The **Temporal analysis** tab is available only from a time series graph and gives access to Moving Average, Temporal Decomposition, and Forecast.

For more information on temporal analysis, including required privileges and overviews of the analysis capabilities, see Temporal analysis.

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Next steps

Use the following resources to learn more about analysis:

- Spatial analysis
- Nonspatial analysis
- Analysis capabilities

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Rerun your analysis

ArcGIS Insights automatically captures every step of your analysis in the analysis view for your workbook page. The steps can be shared as a model and then added to an Insights workbook and rerun using the same or different data.

Update your page

If you have already run analysis on your page, you can rerun the analysis from the analysis view by updating the data in the model, or by changing the parameters in your spatial analysis.

Complete the following steps to update the data and rerun the analysis on an existing page:

1. If necessary, add the dataset you want to use to rerun the analysis.
2. Click the **Analysis view** button .
   The Insights page changes to show the analysis steps in order, starting with the datasets used in your analysis.
3. Click **Update** on the dataset bubble you want to update.
   The **Replace data** pane appears.
4. Update the **Choose a dataset** parameter to use the new dataset. If necessary, under the **Replace fields** parameter, update the replacement field for each original field.
5. Click **Update**.
   The analysis runs using the updated dataset.
6. Update the remaining datasets, if necessary.
7. Click **Page view** to return to your cards.

Complete the following steps to update the parameters and rerun the analysis on an existing page:

1. Click the **Analysis view** button , if you're not already in the analysis view.
2. Click a step in the model that represents a spatial analysis capability, such as **Spatial Aggregation**.
   The side toolbar appears next to the step in the model.
3. Click **Edit** .
   The panel appears. You can't choose a different map layer for the spatial analysis, but you can adjust other parameters.
4. Change the parameters as necessary.
5. Click **Update**.
   The analysis runs and overwrites the previous results in the data pane.
6. Click the **Page view** button to see the updated map on your page.

Run a model

If you want to use a shared model, you must add the model to your page, as well as the data you want to use for your analysis.

Note:
If you did not create the model, the owner of a model must share the model item with you before you can use it.

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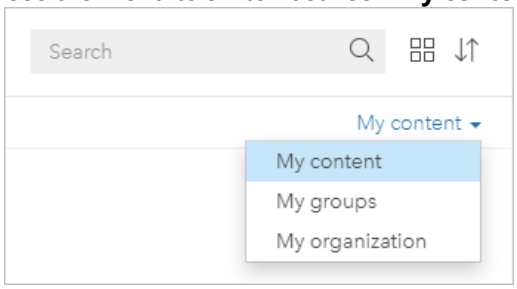
Run a model from an open workbook

Complete the following steps to run a model in an open workbook:

1. Click the **Add to page** button to open the **Add to page** window.
2. If necessary, choose your data.
3. Under **Add to page**, click the **Models** tab.
4. To add your own model or a model from your organization, complete the following steps:
   a. Click the tab for your organization.
   b. Use the menu to switch between **My content**, **My groups**, and **My organization**, if necessary.



Tip:

If you are unsure where to find the model, choose **My organization**. All models from your content and groups are also available from **My organization**.

The available models are listed in the content pane.

5. To add a publicly shared model from ArcGIS Online, complete the following steps:
   a. Click the **ArcGIS public** tab.
   b. Use the menu to switch between **Public content** and **Public groups**, if necessary.
   The available models are listed in the content pane.
6. If you want more information about a model in the list, such as a description, click **View details**.
7. Choose the model and click **Add**.
   Placeholder cards are added to your page in place of the cards from the original page.

Note:

This workflow assumes you are using **Page view**. If you prefer to use **Analysis view**, continue with the steps in Update your page.

8. Click the name of one of the datasets on a placeholder card.
   The **Dataset** pane appears.
9. Update the **Choose a dataset** parameter to use the new dataset. If necessary, under the **Replace fields** parameter, update the replacement field for each original field.
10. Click **Update**.
    The analysis runs using the updated dataset.
11. Update the remaining datasets, if necessary.

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Run a model in a new workbook

Complete the following steps to run a model in a new workbook:

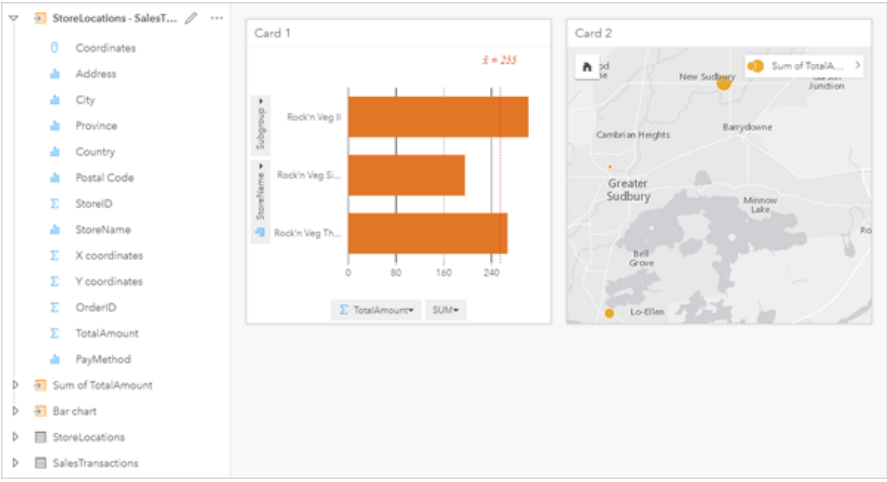
1. Open Insights and sign in to access the home page.
2. Click the **Models** tab .
3. Find the model you want to open. Use the search bar, filter button , **View items** button , and **Sort** button , if necessary.
4. Click the name of the model.
   A new workbook is created and the **Add to page** window opens with the model selected.
5. Click the **Data** tab.
6. Select the data you want to use in the model and click **Add**.
   Placeholder cards are added to your page in place of the cards from the original page.

   Note:
   This workflow assumes you are using **Page view** . If you prefer to use **Analysis view** , continue with the steps in Update your page.

7. Click the name of one of the datasets on a placeholder card.
   The **Dataset** pane appears.
8. Update the **Choose a dataset** parameter to use the new dataset. If necessary, under the **Replace fields** parameter, update the replacement field for each original field.
9. Click **Update**.
   The analysis runs using the updated dataset.
10. Update the remaining datasets, if necessary.

Model example

Below is the page view of a weekly sales-by-store analysis that visualizes results as a bar chart and a graduated symbol map.



Below is a model of the analysis from the analysis view:

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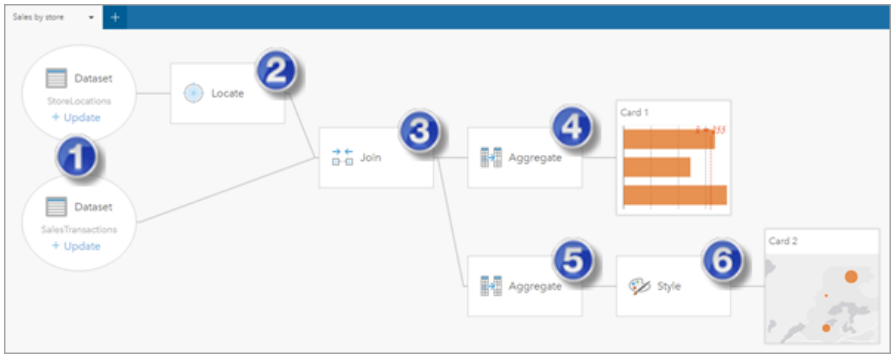

This model shows the steps that were involved in creating the results shown in the page view:

1. Add two datasets to your page.
2. Enable location in the first dataset.
3. Create a relationship to join the two datasets.
4. Aggregate the data by categories to create a bar chart.
5. Aggregate the data by geography to create a graduated symbol map.
6. Style the map according to the chosen field. This happens automatically when a map is created.

Note:

Although the model indicates that a join (step 3) was performed on the two datasets, it shows them as separate dataset bubbles. You can switch between the datasets to select the fields from either dataset to rerun the analysis.

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Result datasets

Performing analysis often generates a result dataset in the data pane. You can visualize data from your results as other maps, charts, and tables or use the dataset in analysis.

Result datasets appear in the data pane listed below the dataset that is used to perform the analysis, which will help you to keep track of your result datasets. If more than one result was created from the same dataset, the results will appear in reverse chronological order, meaning the most recent results will appear at the top of the list.

Note:
Not all operations create a result dataset. For example, enabling location on a dataset and calculating a field will update the original dataset rather than creating a new dataset. Only charts that perform attribute aggregation, such as bar charts and donut charts, will create a result dataset.

If you're unhappy with your results, you can rerun your spatial analytics using different parameters from the **Analysis view** or undo your action using the **Undo** button.

Note:
If an error occurs while performing analysis on the data, you can undo the analysis and revert to the original dataset. In some cases, such as field calculations, this means that any calculated fields done on that dataset view will be lost as the data is reverted to its original state.

Spatial results

A result dataset is created when you run most of the spatial analysis capabilities. The result datasets can be used in both spatial and nonspatial analysis, and can be used to create maps, charts, and tables.

Enrich Data and Find K-Means Clusters do not create result datasets. Instead, the result fields are appended to the input dataset. The appended data is available within the Insights workbook and the original dataset is not modified. You can share the dataset to create a feature layer and access the appended data in other workbooks.

Nonspatial results

A result dataset is created when you run Create Regression Model or Predict Variable, or create a chart that performs an aggregation or a calculation. Results from Create Regression Model, Predict Variable or Find K-Means Clusters can be used in spatial analysis or to create maps if the original dataset had a location field. All nonspatial result datasets can be used for nonspatial analysis and to create charts and tables.

Nonspatial analysis can be accessed from the **Action button** on a chart or table. If the chart created a result dataset, then both the result and the original dataset can be used as inputs for the analysis.

Temporal results

A result dataset is created when you run Temporal Decomposition or Forecast. These result datasets can be used to update the output charts or create new charts and tables.

Moving Average does not create result datasets. Instead, the result fields are appended to the input dataset. The appended data is available within the Insights workbook and the original dataset is not modified. You can share the dataset to create a feature layer and access the appended data in other workbooks.

Temporal analysis can be accessed from the **Action button** on a time series graph.

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Card filter results

A result dataset is created when a card level filter is added to a map, chart, or table. The result dataset includes all the fields from the original dataset and a filter applied to it at the dataset level.

Note:
If new cards are created using the result dataset from a card filter, then all of the cards will reference the dataset filter on the result dataset and the card filter will be removed from the original card. Since the original card also references the result dataset, there will be no change to the data being displayed.

Troubleshoot result datasets

Insights follows the maximum record count parameter when creating maps, charts, and tables that require aggregation (for example, bar charts and summary tables) for the following types of datasets:

- Map image layers.
- Remote feature layers with supportsPaginationOnAggregatedQueries set to false in the REST endpoint.

The default maximum record count is 1,000. If the aggregation results in more than 1,000 features, a warning icon will appear in the data pane beside the result dataset with the following message: **The maximum record count has been exceeded. Update the MaxRecordCount parameter or copy the source dataset to your workbook.**

There are two ways to resolve this issue:

- Update the maxRecordCount parameter for the source dataset — If the source dataset is owned by a member of your ArcGIS organization, an administrator can update the maxRecordCount parameter in the REST endpoint. After the maxRecordCount is updated, you must refresh the page to update the datasets and remove the warning. For more information on updating the maxRecordCount parameter, see How To: Update the maximum record count for feature services in ArcGIS Online (https://support.esri.com/en/technical-article/000012383).

  Note:
  The maxRecordCount specifies how many records can be returned by the server to a client for any given query operation. Specifying a large number of records to be returned by the server can slow the performance of client applications consuming your web layer, such as web browsers, and your GIS server. Therefore, the maximum recommended maxRecordCount is 5,000.

- Copy the source dataset to your workbook — If you are not able to update the maxRecordCount, you can copy the dataset to your workbook then update your model to replace the source dataset with the copied dataset. The copied dataset does not use the maxRecordCount parameter, so the limits will not apply to any visualizations created with the copy.

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Function datasets

Function datasets are created as an output of Create Regression Model. A function dataset contains the equation and statistics of a regression model.

Use a function dataset

Function datasets are used as the input regression model for Predict Variable. You can open Predict Variable by dragging a function dataset to a map card.

A point chart showing the coefficients and confidence intervals for the intercept and each explanatory variable can be created by expanding a function dataset in the data pane and clicking **View confidence intervals**.

Tip:

Drag a function dataset onto the point chart created from a different regression model to compare the confidence intervals for the explanatory variables between models.

Statistics

Function datasets store the equation and statistics from a regression model. Statistics can be viewed by expanding the function dataset in the data pane or by opening the data table.

The following statistics are available in the data pane:

Statistic	Description
Regression equation	The regression equation is in the following format: `y=b0+b1x1+b2x2+...+bnxn` where y is the dependent variable, bn represents the calculated parameters, and xn represents the explanatory variables.
R2	The R2 value, also known as the coefficient of determination, is a number between 0 and 1 that measures how well the line of best fit models the data points, with values closer to 1 indicating more accurate models.
Adjusted R2	Adjusted R2 is also a measure between 0 and 1, but it accounts for more additional predictors that may cause a better fit in a model based on chance alone. Therefore, it is best to use the Adjusted R2 value when the model has a large number of predictors, or when comparing models with different numbers of predictors.
Durbin-Watson	The Durbin-Watson test measures autocorrelation in residuals from a regression analysis on a scale of 0 to 4. On this scale, 0 to 2 is positive autocorrelation, 2 is no autocorrelation, and 2 to 4 is negative autocorrelation. It is best to have low autocorrelation in a regression model, meaning Durbin-Watson test values closest to 2 are more favorable. **Note:** The Durbin-Watson test calculation is dependent on the order of your data. It is important that your data be ordered sequentially, especially if the data is related to time. If your data is not ordered properly, then the value of the Durbin-Watson test may not be accurate.
Residual standard error	The residual standard error measures the accuracy with which the regression model can predict values with new data. Smaller values indicate a more accurate model. The value of the residual degrees of freedom is also given with the residual standard error.

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Statistic	Description
F statistic	The F statistic is used to determine the predictive capability of your regression model by determining if the coefficients are significantly different from 0. The F statistic is given as a value greater than or equal to 0 and includes two values for degrees of freedom, the first being the degrees of freedom for explanatory variables, and the second being the degrees of freedom for the residuals.
p-value	The p-value for the F statistic is a test of global significance for your regression model. A p-value is given as a value between 0.0 and 1.0. Values between 0 and 0.05 indicate that your global model is statistically significant.

The following statistics are available in the data table:

Statistic	Description
Variable	The intercept and the names of the explanatory variables.
Coefficient	The b-values for the regression equation, which correspond to the y-intercept and the slope for each explanatory variable.
Standard error	The standard error measures the variation in each of the predictors used in the model. Smaller values indicate more accurate predictors.
t-value	The t-value is used to determine the predictive capability of each regression coefficient by determining if the coefficients are significantly different from 0.
p-value	The p-value is related to the t-value and tests local significance for the coefficients in your regression model. A p-value is given as a value between 0.0 and 1.0. Values between 0.0 and 0.05 indicate that the coefficient is statistically significant.
Confidence interval	Confidence intervals give the upper and lower limits within which you can have a certain degree of certainty that the coefficient falls within the range. For example, if the lower 95 percent confidence interval is 10 and the upper 95 percent confidence interval is 15, you can have 95 percent confidence that the true value of the coefficient is between 10 and 15. The following confidence intervals are given in the data table: • Lower 90 percent • Upper 90 percent • Lower 95 percent • Upper 95 percent • Lower 99 percent • Upper 99 percent
Standardized coefficients	Standardized coefficients are calculated by standardizing the data so that the variance of the dependent and explanatory variables is equal to 1. Standardized coefficients are particularly useful for comparing coefficient values with different units of measure.

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Statistic	Description
Standardized confidence intervals	Standardized confidence intervals give the upper and lower limits within which you can have a certain degree of certainty that the standardized coefficient falls within the range. The following standardized confidence intervals are given in the data table: • Lower 90% • Upper 90% • Lower 95% • Upper 95% • Lower 99% • Upper 99%

For more information on how to use and interpret the statistical outputs in a function dataset, see Regression analysis.

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Spatial references

A spatial reference describes where features are located in the world. Most spatial references will be either geographic (using a geographic coordinate system) or projected (using a projected coordinate system). A geographic coordinate system uses a three-dimensional ellipsoidal model of the earth's surface to define locations using degrees of latitude and longitude. A projected coordinate system uses information from a geographic coordinate system and translates it to a flat surface. Each projection will preserve certain aspects of the data (area, direction, shape, or distance) at the expense of the other aspects. Therefore, it is important to choose projections carefully based on what aspects of your map are most important. A projected coordinate system usually defines locations using x- and y-coordinates in feet or meters.

Each spatial reference includes a spatial reference identifier (SRID). The most commonly used spatial references in web mapping are 4326 - World Geodetic System 1984 (WGS 84) and 3857 - Web Mercator. WGS 84 is the geographic coordinate system used by the Global Positioning System (GPS), which makes it one of the most commonly used spatial references. Web Mercator is the standard projected coordinate system used in web mapping, in part because it displays direction accurately, making it useful for navigation. However, the size and shape of features will appear distorted on a Web Mercator map, especially near the polar regions.

Enable location

Enabling location is a way to add spatial information to a dataset. One of the methods for enabling location uses coordinates (either latitude and longitude or x-coordinate and y-coordinate). A spatial reference must be chosen to enable location with coordinates so that the coordinate information can be applied correctly to the data. If the dataset uses latitudes and longitudes (numbers between -90 and 90 or -180 and 180), WGS 84 will be chosen as the default spatial reference. If the dataset uses x- and y-coordinates (generally large positive or negative numbers representing meters or feet), no default spatial reference will be chosen. In this case, the spatial reference that the data uses will have to be selected from a list of available spatial references.

Basemaps

The basemaps included with Insights use the Web Mercator projection as their spatial reference. All datasets will be displayed in the spatial reference of the basemap, but the underlying data will not be changed or transformed. Therefore, all analysis will be completed in the spatial reference of the dataset, rather than the spatial reference of the basemap.

Some datasets, such as result datasets from Buffer/Drive Times or binned maps, may appear distorted on a Web Mercator basemap, depending on the latitude of the data. The Web Mercator projection distorts latitudes based on their distance from the equator. As long as your data does not use a spatial reference with a similar distortion, the analysis itself will remain accurate regardless of how it appears on the basemap.

Custom basemaps can also be created for your organization and can use a spatial reference of your choice. A custom basemap could be beneficial for your organization if you have a standard spatial reference that is used for the data in your organization or if your data is located in the polar regions.

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Spatial analysis

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Spatial analysis

Spatial analysis can be accessed using the **Action** button on a map card.

The administrator of your organization needs to grant you certain privileges to perform spatial analysis. The necessary privileges are included in the Publisher and Administrator roles.

Certain capabilities need additional privileges, such as ArcGIS Online network analysis services and the ArcGIS GeoEnrichment Service. See Configure ArcGIS Enterprise to support Insights for more information.

Note:
Credits are consumed when running certain spatial analysis processes in Insights in ArcGIS Enterprise when ArcGIS Online utility services are used (for example, network analysis service or GeoEnrichment).

An analysis process will cause a time-out error if it takes more than 60 seconds to complete. Processing time is dependent on specifications in your ArcGIS Enterprise setup, such as memory and CPU resources.

The following table provides an overview of each spatial analysis capability:

Analysis capability	Description	Example questions
Buffer/Drive Times	Buffer/Drive Times creates a zone around a point or line feature measured in units of distance or time. You can use the resulting buffer layer to perform spatial aggregation on point features and to calculate statistics such as a sum of revenue. **Note:** The Geometry utility service is required to dissolve buffer areas. Travel modes must also be configured to create drive time areas, such as walking time or trucking distance. Inputs: One point, line, or area layer	What's nearby? How many crimes occurred within one kilometer of each police station? Which land parcels are within a quarter-mile of a light rail stop?
Spatial Aggregation	Spatial Aggregation works with a layer of point features and a layer of area features. It first determines which points fall within each area. After determining this point-in-area spatial relationship, statistics regarding all points in the area are calculated and assigned to the area. The most basic statistic is the count of the number of points within the area, but you can get other statistics as well. Inputs: • One point, line, or area layer • One area layer	How is it distributed? How many crimes occurred within one kilometer of each police station? Which counties have the most damage caused by tornadoes?
Spatial Filter	Spatial Filter uses area features to filter overlapping features from another layer. The filter type can be **Intersects**, **Doesn't Intersect**, **Contains**, or **Doesn't Contain**. Only features with the correct spatial relationship to the area features or layer will be included in the result dataset. Inputs: • One point layer • One area layer	What's nearby? How many crimes occurred in District 13?

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Analysis capability	Description	Example questions
Enrich Data	Enrich Data provides new information to your point or area data by getting facts about the people, places, and businesses that surround your data locations. Enrich Data allows you to answer new questions about locations that you can't answer with maps alone; for example: What kind of people live here? What do people like to do in this area? What are their habits and lifestyles? What kind of businesses are there in this area? The GeoEnrichment privilege (included with Publisher and Administrator roles) is required to use Enrich Data. Inputs: One point, line, or area layer	How is it related? Do neighborhoods with higher income levels experience more break-ins? What is the median age in the neighborhood surrounding each library branch?
Calculate Density	Calculate Density creates a density map from point features by spreading known quantities of some phenomenon (represented as attributes of the points) across the map. The result is a layer of cells indicating the density at each location. Inputs: One point layer	How is it distributed? What is the number of drug crimes in a police district per square mile compared to different parts of the city? What is the density of a bird species across North America?
Calculate Density Ratio	Calculate Density Ratio creates a relative risk surface using the ratio of two density surfaces (one for cases and one for controls). Inputs: Two point layers	How is it related? Where is the rate of crime higher than expected? Where is the rate of disease higher than expected?
Find Nearest	Find Nearest measures and finds the nearest features between input layers using a straight-line distance. There are options to limit the number of nearest features to find or the search range in which to find them. Inputs: Two point, line, or area layers	What's nearby? What is the proximity of drug crimes to elementary and high schools? Which fire stations should be the primary and secondary responders for each school?
Find K-Means Clusters	Find K-Means Clusters categorizes your data into groups or clusters that maximize the similarities within each cluster while maximizing the difference between clusters. **Note:** Find K-Means Clusters can be used to create clusters based on location (spatial analysis), or attribute values (nonspatial analysis). Inputs: One point, line, or area layer	How is it distributed? Where are the clusters of caribou habitat? Where are the clusters of disease occurrence?
Find Spatial Mean	Find Spatial Mean locates the geographic center or center of concentration for a set of features. Inputs: One point layer	How is it distributed? Do crimes take place in the same areas during the day as at night? Where is a central pickup location for CSA (Community Supported Agriculture) members?

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Note:

You can add boundary layers from the **Boundaries** tab of the **Add to page** window for your spatial analytics. Boundaries are helpful when your data does not include area locations. For example, if you want to summarize the number of votes for an electoral district, you can use the electoral district geography in your analysis. You can also use custom boundaries, such as police districts, if you've added custom boundaries to your workbook.

Tip:

The most commonly used spatial analysis capabilities, Spatial Aggregation and Spatial Filter, can be accessed by dragging a layer onto an existing map and dropping it in one of the available drop zones. For the **Spatial aggregation** and **Filter by selected feature** drop zones to appear, the combination of data on the map and in the selected dataset must be compatible with the two tools (for example, a map of points and a boundary layer).

Next steps

Use the following resources to learn more about analysis:

- Analysis capabilities
- Nonspatial analysis
- Link analysis
- Regression analysis

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Buffer/Drive Times

The Buffer/Drive Times analysis capability creates areas around input point, line, or area features to a specified distance, or uses Esri Service Areas to calculate the area that can be reached within a specified travel time or travel distance of point features along a street network based on travel mode.

Note:
The Service Area (Asynchronous) service and Routing Utilities service must be configured to create drive time areas using travel modes in Insights in ArcGIS Enterprise. The Network Analysis privilege (included in the Publisher and Administrator default roles) is also required.

Examples

A local reporter is working on a story about response times to fires in her city. She wants to determine how much of the city is within a four-minute drive time of the city's fire stations. Buffer/Drive Times can be used to determine how far a fire truck can drive within the city in four minutes.

A development company is looking to make some money by creating a mixed-use development in an urban center. The development will have to be conveniently located within a quarter mile of shops, restaurants, or a light rail stop. Buffer/Drive Times can be used to determine which locations are appropriate for the new development.

Use the Buffer/Drive Times capability

Buffer/Drive Times can be run on maps with point, line, or area layers.

Complete the following steps to run the Buffer/Drive Times analysis capability:

1. If necessary, click the map card to activate it. A card is active when the toolbar and **Action** button appear.
2. Click the **Action** button, then choose **Buffer/Drive Times**.
3. For **Choose which layer to buffer**, select the layer for which you want to create buffers or drive times.
4. For **Set distance and units**, select the distance option (a fixed distance or travel mode, depending on your data type), distance, and units. See Usage notes for more information.
5. For **Choose buffer style**, select **Overlap** or **Dissolve**.
6. If you are creating a fixed-distance buffer, check **Preview buffer**, then adjust the buffer distance if necessary.
7. Click **Run**.

Usage notes

An input point, line, or area layer can be chosen from the **Choose which layer to buffer** drop-down menu. The drop-down menu includes all layers that have been added to the map card.

The **Set distance and units** parameter is used to determine the type and size of the buffer or drive time. The distance units will be based on the default units for your account. If your input features are lines or areas, only the **Fixed Distance** option will be available. If your input features are points, the following options may be available:

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Buffer type	Description
Fixed Distance	Uses a straight-line distance to create a buffer around points, lines, or areas.
Walking Time	Follows paths and roads that allow pedestrian traffic and finds solutions that optimize travel time. The default walking speed is set to 5 kilometers per hour.
Rural Driving Distance	Models the movement of cars and other similar small automobiles, such as pickup trucks, and finds solutions that optimize travel distance. Travel obeys one-way roads, avoids illegal turns, and follows other rules that are specific to cars but does not discourage travel on unpaved roads.
Driving Time	Models the movement of cars and other similar small automobiles, such as pickup trucks, and finds solutions that optimize travel time. Travel obeys one-way roads, avoids illegal turns, and follows other rules that are specific to cars.
Driving Distance	Models the movement of cars and other similar small automobiles, such as pickup trucks, and finds solutions that optimize travel distance. Travel obeys one-way roads, avoids illegal turns, and follows other rules that are specific to cars.
Walking Distance	Follows paths and roads that allow pedestrian traffic and finds solutions that optimize travel distance.
Rural Driving Time	Models the movement of cars and other similar small automobiles, such as pickup trucks, and finds solutions that optimize travel time. Travel obeys one-way roads, avoids illegal turns, and follows other rules that are specific to cars but does not discourage travel on unpaved roads.
Trucking Time	Models basic truck travel by preferring designated truck routes and finds solutions that optimize travel time. Routes must obey one-way roads, avoid illegal turns, and so on.
Trucking Distance	Models basic truck travel by preferring designated truck routes and finds solutions that optimize travel distance. Routes must obey one-way roads, avoid illegal turns, and so on.

If you choose a buffer or travel mode based on distance, you can choose meters, kilometers, feet, or miles as your unit.

If you choose a travel mode based on time, you can choose seconds, minutes, or hours as your unit.

Choose a buffer style is used to determine the way intersecting buffers are displayed. The two options are **Overlap** (default) and **Dissolve**.

Option	Description
Overlap	Creates circular buffers with distinct boundaries that can overlap each other. This option is the default.
Dissolve	Creates buffers that may appear irregular in shape. Adjacent buffer boundaries dissolve rather than overlap, combining into irregular-looking areas.

You can use the **Preview buffer** check box for all features when a **Fixed Distance** buffer is being created. The preview can be used to adjust the size of the buffer by dragging an edge of the square around the buffer to increase or decrease the buffer diameter.

Note:
Buffer calculations on database datasets are performed using the native distance calculations available within the database. Therefore, distance calculations will vary based on database type and spatial type. Database datasets are available in Insights in ArcGIS Enterprise and Insights desktop.

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Limitations

Travel modes can only be used when the input dataset contains point features.

Buffer/Drive Times is not supported for read-only connections to Snowflake and database platforms that are not supported out-of-the-box.

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Spatial Aggregation

Spatial Aggregation calculates statistics in areas where an input layer overlaps a boundary layer.

Example

A business analyst for a consortium of colleges is doing research for a marketing campaign in states with high-value colleges and wants to know which state has the most colleges with a high return on investment (ROI). Spatial Aggregation can be used to aggregate the colleges into states to find the number of colleges with above average ROI.

Use the Spatial Aggregation capability

Spatial Aggregation can be run on maps with two layers: one area layer with the boundaries that will be used for aggregation (for example, counties, census tracts, or police districts) and one layer to aggregate.

Complete the following steps to run the Spatial Aggregation analysis capability:

1. If necessary, click the map card to activate it. A card is active when the toolbar and **Action** button appear.
2. Click the **Action** button, then choose **Spatial Aggregation**.
3. For **Choose area layer**, select the boundary layer. For **Choose layer to summarize**, select the layer to aggregate.
4. For **Style by**, select the field or statistic that you want to calculate and display. Use **Additional options** to select additional fields and statistics, if necessary.
5. Click **Run**.

Tip:

Spatial Aggregation can also be run by dragging a dataset onto the **Spatial aggregation** drop zone on an existing map.

Usage notes

The **Choose area layer** and **Choose layer to summarize** parameters are used to select the boundary layer and the layer that will be summarized. For the **Choose area layer** parameter, only layers with area features will be available.

The **Style by** parameter can be used to change the statistic being calculated. The default statistic depends on the type of layer being summarized. The drop-down menu can be used to select a different style option. The following table summarizes the **Style by** options for each layer type:

Summary layer type	Default style option	Other style options
Point	Count	Number or rate/ratio field (sum, minimum, maximum, average, or mode) String fields (mode)

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Summary layer type	Default style option	Other style options
Line	Number (sum) or rate/ratio (average) field	Number or rate/ratio field (sum, minimum, maximum, average, or mode) String fields (mode) Sum of length (meters, kilometers, feet, or miles)
Area	Number (sum) or rate/ratio (average) field	Number or rate/ratio field (sum, minimum, maximum, average, or mode) String fields (mode) Sum of area (square meters, square kilometers, square feet, or square miles)

Note:
It is best practice to use numbers rather than rate/ratios when calculating statistics for lines and areas so that the proportional calculations make logical sense. For more information, see How Spatial Aggregation works.

The **Additional options** parameter can be expanded and extra statistics can be assigned. Each time a field is added to the list of summary statistics, a new field will appear below it.

Limitations

When you perform spatial aggregation or spatial filtering on data from the same database connection, you must ensure that all the data is stored in the same spatial reference system. For datasets from SQL Server, the data must also have the same data type (geography or geometry).

The following limitations apply for Google BigQuery, Snowflake, and database platforms that are not supported out-of-the-box:

- Spatial Aggregation using line and area features as the **Choose a layer to summarize** parameter is not supported for read-only connections.
- Both input layers must be from the same database connection.

Google BigQuery does not support mode calculations.

How Spatial Aggregation works

Average statistics are calculated using weighted mean for line and area features. The following equation is used to calculate weighted mean:

$$\bar{x}_w = \frac{\sum_{i=1}^{N} w_i \cdot x_i}{\sum_{i=1}^{N} w_i}$$

```
where:
N = number of observations
xi = observations
Wi = weights
```

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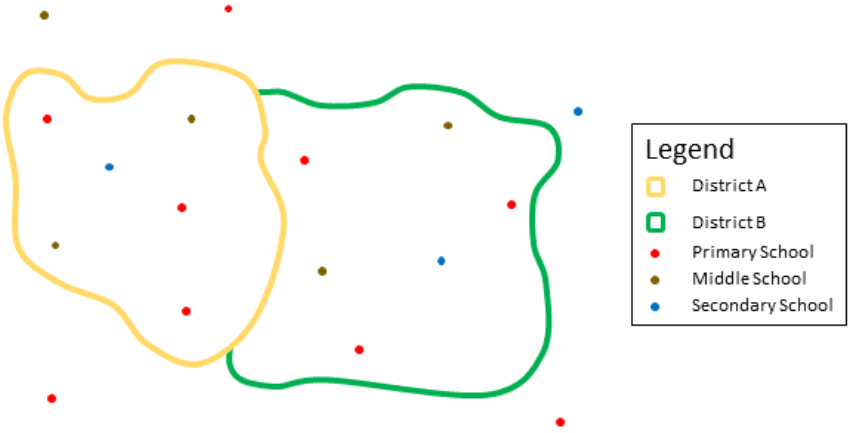
Points

Point layers are summarized using only the point features within the input boundary. Therefore, none of the calculations are weighted.

The figure and table below explain the statistical calculations of a point layer within a hypothetical boundary. The `Population` field was used to calculate the numeric statistics (count, sum, minimum, maximum, and average) and the `Type` field was used for mode.



ObjectID	District	Type	Population
1	A	Primary School	280
2	A	Primary School	408
3	A	Primary School	356
4	A	Middle School	361
5	A	Middle School	450
6	A	Secondary School	713
7	B	Primary School	370
8	B	Primary School	422
9	B	Primary School	495
10	B	Middle School	607
11	B	Middle School	574
12	B	Secondary School	932

Field	Statistic	Result District A	Result District B
`Population`	Count	6	6
	Sum	`280 + 408 + 356 + 361 + 450 + 713` `= 2,568`	`370 + 422 + 495 + 607 + 574 + 932` `= 3,400`

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Field	Statistic	Result District A	Result District B

	Minimum	Minimum of:
		`[280 408 356 361 450 713]`
		`= 280`
			Minimum of:
			`[370 422 495 607 574 932]`
			`= 370`

	Maximum	Maximum of:
		`[280 408 356 361 450 713]`
		`= 713`
			Maximum of:
			`[370 422 495 607 574 932]`
			`= 932`

	Average	`2,568/6` `= 428`	`3,400/6` `= 566.67`
Type	Mode	Primary School	Primary School

A real-life scenario in which this analysis could be used is in determining the total number of students in each school district. Each point represents a school. The `Type` field gives the type of school (elementary, middle school, or secondary) and a student population field gives the number of students enrolled at each school. The calculations and results are given in the table above. From the results you can see that District A has 2,568 students and District B has 3,400 students.

Lines

Line layers are summarized numerically using only the proportions of the line features that are within the input boundary. When summarizing lines, use fields with counts and amounts rather than rates or ratios so proportional calculations make logical sense in your analysis. The results are displayed using graduated symbols.

The mode for line layers is based on the count of features that intersect the boundary. Lines do not have to be completely contained within a boundary to be counted toward the mode and each line is counted as one feature, regardless of the proportion that is contained within the boundary. The results are displayed using unique symbols.

The figure and table below explain the statistical calculations of a line layer within a hypothetical boundary. The volume was used to calculate the statistics (sum, minimum, maximum, and average) for the layer. The statistics are calculated using only the proportion of the lines that are within the boundary. The mode is calculated for the type of water feature.

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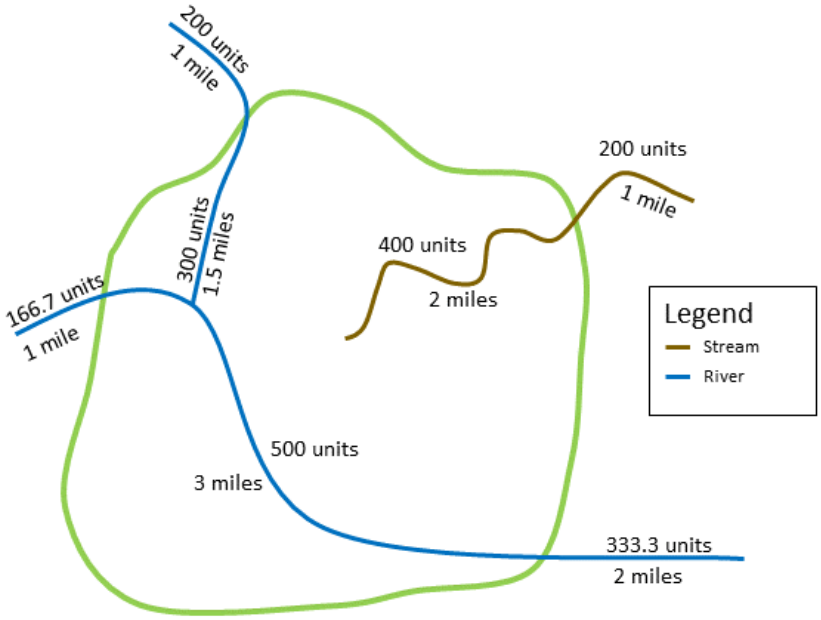

Statistic	Field	Result
Sum of length	Length	`2 miles + 3 miles + 1.5 miles = 6.5 miles` **Note:** Length can also be calculated in feet, meters, and kilometers.
Sum	Volume	`400 + 500 +300 = 1,200`
Minimum		Minimum of: `[400 500 300] = 300`
Maximum		Maximum of: `[400 500 300] = 500`
Average		`((2*400)+(3*500) + (1.5*300))/(2+3+1.5)` `= 423.08`
Mode	Type	River

A real-life scenario in which this analysis could be used is in determining the total volume of water in rivers within the boundaries of a state park. Each line represents a river that is partially located inside the park. From the results, you can see that there are 6.5 miles of rivers within the park and the total volume is 1,200 units.

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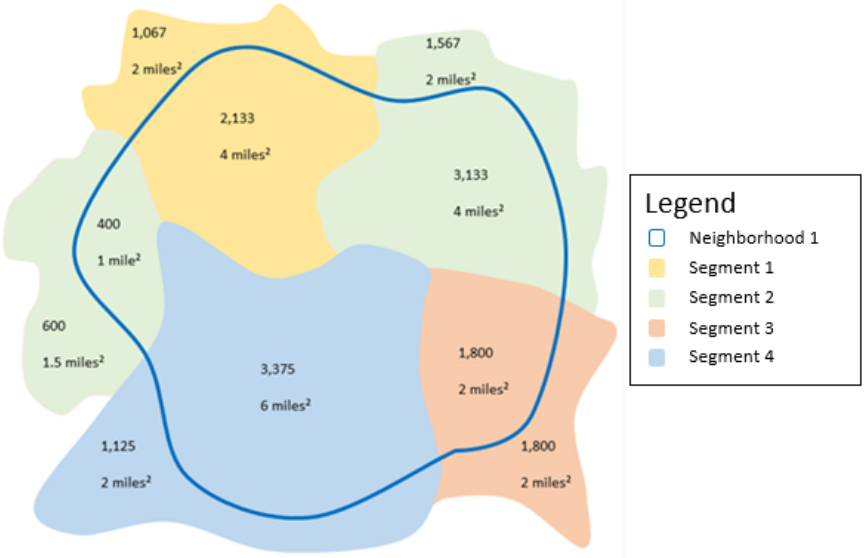
Areas

Area layers are summarized using only the proportions of the area features that are within the input boundary. When summarizing areas, use fields with counts and amounts rather than rates or ratios so proportional calculations make logical sense in your analysis. The results are displayed using graduated colors.

The mode for area layers is based on the count of features that intersect the boundary. Areas do not have to be completely contained within a boundary to be counted toward the mode and each area is counted as one feature, regardless of the proportion that is contained within the boundary. The results are displayed using unique symbols.

The figure and table below explain the statistical calculations of an area layer within a hypothetical boundary. The populations were used to calculate the statistics (sum, minimum, maximum, and average) for the layer. The statistics are calculated using only the proportion of the area that is within the boundary. The mode is calculated using the tapestry segment designation for each area.



Statistic	Field	Result
Sum of area	Area	`4 mi2 + 4 mi2 + 1 mi2 + 6 mi2 + 2 mi2 = 17 mi2` **Note:** Area can also be calculated in square feet, square meters, and square kilometers.
Sum	Population	`2,133 + 3,133 + 400 + 3,375 + 1,800 = 10,841`
Minimum		Minimum of: `[2,133 3,133 400 3,375 1,800] = 400`

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Statistic	Field	Result
Maximum		Maximum of: `[2,133 3,133 400 3,375 1,800] = 3,375`
Average		`((4*2,133)+(4*3,133)+(2*1,800)+(6*3,375)+(1*400))/(4+4+2+6+1) = 2,665.53`
Mode	Segment	Segment 2

A real-life scenario in which this analysis could be used is in determining the population in a city neighborhood. The blue outline represents the boundary of the neighborhood and the smaller areas represent census blocks. From the results, you can see that there are 10,841 people in the neighborhood and an average of approximately 2,666 people per census block.

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Spatial Filter

Spatial Filter can be used to create a result dataset that contains a copy of the features on your map that meet a series of criteria based on a spatial query.

Example

A city's police department is conducting an analysis to determine if there is a relationship between violent crimes and unemployment rates. An expanded summer job program will be implemented for high schools in areas where there is high violent crime and high unemployment. Spatial Filter can be used to copy high schools within the remediation areas.

Use the Spatial Filter capability

Spatial Filter can be run on maps with two layers (points, lines, or areas).

1. If necessary, click the map card to activate it. A card is active when the toolbar and **Action** button appear.
2. Click the **Action** button, then choose **Spatial Filter**.
3. For **Choose layer to filter**, select the layer you want to filter.
4. For **Choose layer to filter by**, select the layer with which you want to filter the first layer.
5. For **Choose type of filter**, select the spatial relationship you want to use for the filter. See Usage notes for more information.
6. Click **Run**.

Tip:

Spatial Filter can also be run by dragging a dataset onto the **Filter by selected feature** drop zone on an existing map.

Usage notes

The **Choose layer to filter** parameter is the input point, line, or area layer that you want to filter. The result dataset will be a subset of this layer.

The **Choose layer to filter by** parameter is the input point, line, or area layer that will be used to filter the first layer.

Tip:

You can use selected features in Spatial Filter. For example, if you have a dataset of store locations across the United States but you only want to analyze stores in California, you can select **California** in your layer of **US States**, drag the selected feature to your map of store locations, and drop the selected feature in the **Filter by selected feature** drop zone.

The **Choose type of filter** parameter is used to specify the relationship between the two input datasets. The following filter types are available in Insights:

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Filter type	Description
Intersects	If a feature in the first layer intersects a feature in the second layer, the feature in the first layer is included in the output.
Doesn't Intersect	If a feature in the first layer intersects a feature in the second layer, the feature in the first layer is excluded from the output.
Contains	If a feature in the first layer contains a feature in the second layer, the feature in the first layer is included in the output.
Doesn't Contain	If a feature in the first layer contains a feature in the second layer, the feature in the first layer is excluded from the output.

Limitations

When you perform spatial aggregation or spatial filtering on data from the same database connection, you must ensure that all the data is stored in the same spatial reference system. For datasets from Microsoft SQL Server, the data must also have the same data type (geography or geometry).

SAP HANA does not support ST_Contains for geographic ("round-earth") coordinate systems. Spatial filtering using the **Contains** and **Doesn't Contain** filter types will fail for SAP HANA datasets with a geographic coordinate system.

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Enrich Data

Enrich Data uses the Esri GeoEnrichment Service from ArcGIS Online to give you demographic and landscape data for the people, places, and businesses associated with your point, line, or area data locations.

Note:
The GeoEnrichment Service must be configured to use Enrich Data in Insights in ArcGIS Enterprise. The GeoEnrichment privilege (included in the Publisher and Administrator default roles) is also required.

Examples

An analyst has crime counts for hexagon grid cells overlaying her city. To create a crime rate, she uses Enrich Data to obtain the number of people living within each hexagon.

Library staff want to ensure that program offerings at each library branch effectively serve local communities. By using Enrich Data to gather information about the people living in neighborhoods surrounding each library, they get a clear picture of who the potential branch patrons are. The demographic data allows them to more effectively design their program offerings to match local community needs.

Use the Enrich Data capability

Enrich Data can be run with point, line, or area layers.

Complete the following steps to run the Enrich Data analysis capability:

1. If necessary, click the map card to activate it. A card is active when the toolbar and **Action** button appear.
2. Click the **Action** button and choose **Enrich Data**.
3. For **Choose layer to enrich**, select the layer you want to enrich with demographic or landscape data.
4. Click **Open data browser**.
5. Change the **Country or area** parameter to the location where your data is located, if necessary.
6. Select the variables you want to add to your dataset by browsing through the categories or using the search bar.
7. Click **Apply**.
   The variables you selected appear in the **Enrich Data** pane.
8. If your data is points or lines, enter a distance and units in **Set distance value to expand search area**. This parameter is not used for area features.
9. Click **Run**.

Usage notes

Use the **Choose a layer to enrich** parameter to add data to a selected layer from the map. The data can be point, line, or area features.

The **Select lifestyle and demographic data** parameter includes a button to open the data browser. In the data browser, you can select the country or area where your data is located as well as one or more variables from categories such as **Population**, **Education**, and **Spending**.

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You can use the search bar within the data browser to search for variables. The search function finds variables or categories of variables that match the search criteria. If a category matches the search then all variables within the category are returned. The search returns exact string matches only and is not case sensitive.

If your input features are points or lines, a third parameter, **Set distance value to expand search area**, will be available. A search distance in meters, kilometers, feet, or miles must be entered to run Enrich Data for points and lines. The distance units will be based on the default units for your account.

Enrich Data uses the ArcGIS Online GeoEnrichment service. Running Enrich Data will use credits from your ArcGIS Online organization.

Limitations

For Insights in ArcGIS Enterprise users, your portal must be configured with the GeoEnrichment utility service for Enrich Data to be available in Insights.

You must have GeoEnrichment privileges to use Enrich Data. GeoEnrichment is included in the Publisher and Administrator roles.

Enrich Data does not work when Portal for ArcGIS is installed on Windows and configured with Security Assertion Markup Language (SAML) authentication. This is an issue for environments that deploy the portal in disconnected mode.

Enrich Data is not supported for read-only connections to Google BigQuery, Snowflake, and database platforms that are not supported out of the box.

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Calculate Density

Calculate Density uses input point features to calculate a density map within an area of interest. Calculate Density uses a Kernel density calculation to create a density surface from your point features.

Examples

Bird counts can be used to calculate species densities. The densities can then be compared to land-cover data to determine which habitats each species prefers.

Use the Calculate Density capability

Calculate Density can be run on maps with point layers.

Complete the following steps to run the Calculate Density analysis capability:

1. If necessary, click the map card to activate it. A card is active when the toolbar and **Action** button appear.
2. Click the **Action** button and choose **Calculate Density**.
3. For **Choose a point layer**, select the layer for which you want to calculate density.
4. Expand **Additional options** and enter values for the **Weight**, **Search radius (bandwidth)**, and **Cell size** parameters, if necessary. See Usage notes for more information.
5. Click **Run**.

Usage notes

The **Choose a point layer** parameter is used to select a dataset to calculate densities. Only point features are available in the drop-down menu.

Expand **Additional options** to reveal the **Weight**, **Search radius (bandwidth)**, and **Cell size** parameters. The following table summarizes these parameters, including their default values:

Parameter	Description	Default value
Weight	A field denoting the value of each feature. For example, if you have a dataset for retail locations that includes a field for revenue, you could use the revenue field as the weight to create a density surface based on sales amount rather than locations.	All features are weighted as 1 (in other words, the density surface is based solely on the location of the features).
Search radius (bandwidth)	A distance (in miles, feet, kilometers, or meters) that is used to find input features within the same neighborhood as the focal feature.	An appropriate search distance is calculated for the input dataset using Silverman's Rule-of-thumb formula.
Cell size	The size of the output features that create the density surface.	An appropriate cell size is calculated for the input dataset based on the extent of the dataset and number of features.

The result dataset is styled by **Counts and amounts (Color)** using a default equal interval classification with 10 classes.

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The **Flip card** button is used to view information on the back of the card, including the values for the search radius and bandwidth.

Limitations

Densities can only be calculated for point features.

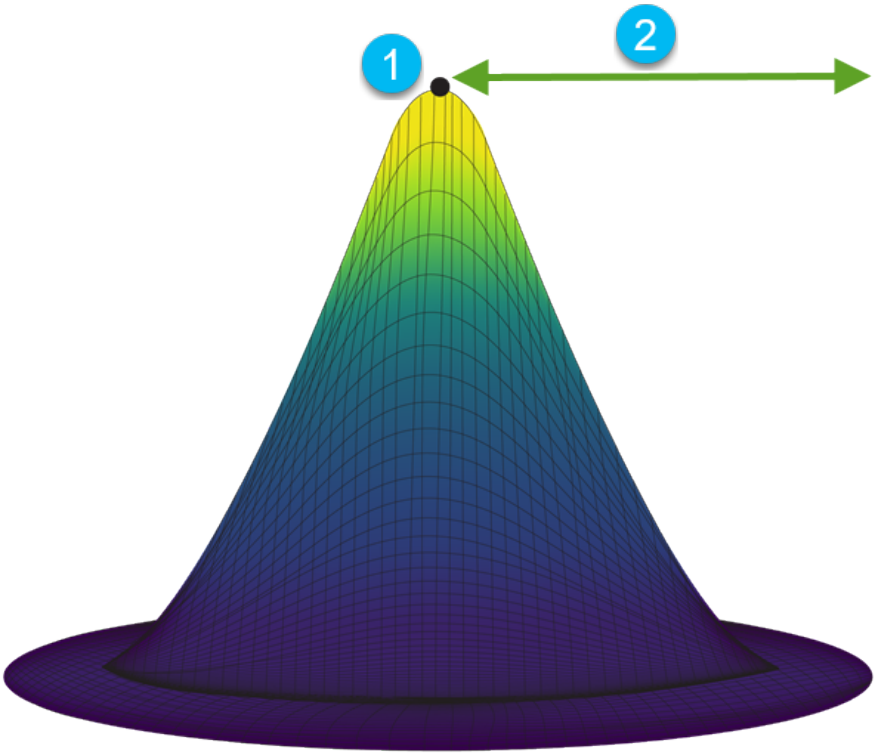
Calculate Density is not supported for read-only connections to Google BigQuery, Snowflake, and database platforms that are not supported out-of-the-box.

How Calculate Density works

Calculate Density uses a Kernel density calculation to create a density surface. The following sections explain the Kernel density calculation, as well as the default calculations for **Search radius (bandwidth)** and **Cell size**.

Kernel density

Kernel density calculates the density of features within a circular neighborhood surrounding each output cell using a Gaussian function. Conceptually, a smooth curved surface is fitted over each point. The surface value is highest at the location of the point and diminishes with increasing distance from the point, reaching zero when the distance from the point equals the search distance.



1	One of the points in the dataset.
2	A distance equal to the search radius (bandwidth).

Each surface also includes volume. The volume for the surface is equal to the **Weight** parameter for each feature, or 1 if no value is specified. The weight determines how many times a point is counted in the density formula.

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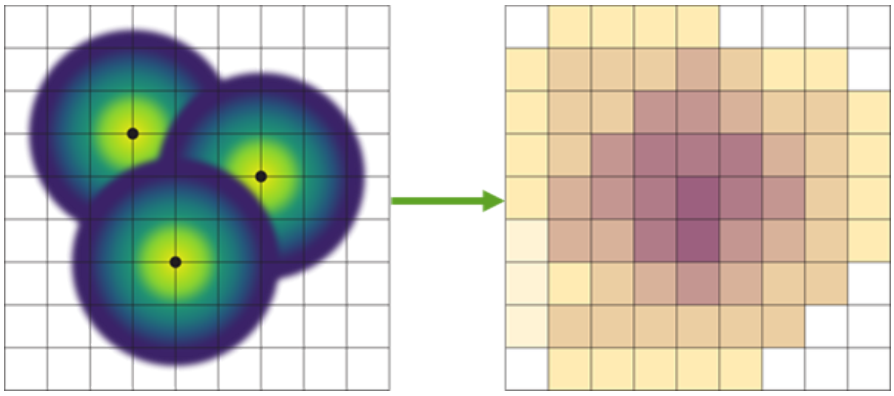
The density for each cell is calculated by adding the values of all the kernel surfaces where they overlay the output cell center. The kernel function is based on the Quartic kernel function described in Silverman (1986, p. 76, Equation 4.5).



The following formula is used to calculate density at (x,y) location:

$$\rho = \frac{1}{(r)^2}\sum_{i=1}^{n}\left[\frac{3}{\pi} * W_i\left(1-\left(\frac{d_i}{r}\right)^2\right)^2\right]$$

where:

- ρ = The density at (x,y) location.
- r = The search radius (bandwidth).
- i = 1, ..., n input points. Only points within the search radius of the (x,y) location are included.
- Wi = The weight of point i. If a weight field is not specified, the weight will be 1 for all points.
- di = The distance between point i and the (x,y) location. The distance must be less than the search radius.

Search radius (bandwidth)

The default search radius applies an algorithm to your data based on both the extent of your data and the density of the points. The **Search radius (bandwidth)** field appears blank because the default radius is not calculated until the analysis begins. When you leave the **Search radius (bandwidth)** field blank, the default radius is applied.

If you prefer to specify your own search radius, consider that the larger the search radius, the more generalized the pattern. A smaller search radius shows more local variation but may miss the broader picture.

Cell size

If a cell size is not provided, the cell size will be calculated based on formulas described in Hengl (2006). The formulas are dataset dependent and are chosen based on the number of features and the extent or scale of the input dataset to optimize both performance and output resolution.

Distance calculations

Calculate Density can be run using either a projected coordinate system (projected data) or a geographic coordinate system (nonprojected data). When projected data is used, a Euclidean distance (a straight-line distance measured on a flat surface) is calculated. When nonprojected data is used, a geodesic distance (a line drawn on a sphere representing the curvature of the earth) is calculated. The geodesic distance calculation is based on Haversine's formula.

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References

Silverman, B. W. (1986). Density Estimation for Statistics and Data Analysis. Chapman and Hall.

Hengl, T. (2006). Finding the right pixel size. Computers & Geosciences, 32(9), 1283-1298. https://doi.org/10.1016/j.cageo.2005.11.008

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Calculate Density Ratio

Calculate Density Ratio uses two input point datasets to calculate a spatial relative risk surface. The numerator in the ratio represents cases, such as number of crimes or number of patients, and the denominator represents the control, such as the total population.

Calculate Density Ratio uses the same calculations to create density surfaces as Calculate Density. The outputs of Calculate Density and Calculate Density Ratio may appear similar; however, the output of Calculate Density Ratio is normalized, meaning it displays a proportional value, whereas the output of Calculate Density is not. Use a density ratio when the phenomenon being analyzed requires a control, such as total population.

The individual density surfaces are calculated using Kernel density before the ratio is calculated.

Example

An epidemiologist is studying the occurrences of a disease to determine if high occurrences in certain areas could be linked to environmental factors. The density ratio is calculated using the disease occurrences as the numerator and the total population as the denominator. The result surface shows the density of disease occurrence normalized by population density, which makes it possible to determine where the disease occurrences are higher than expected.

Use the Calculate Density Ratio capability

You can run Calculate Density Ratio on maps with point layers. Two separate datasets are required as input.

Complete the following steps to run the Calculate Density Ratio analysis capability:

1. Click the map card to activate it, if necessary.
   A card is active when the toolbar and **Action** button appear.
2. Click the **Action** button and choose **Calculate Density Ratio**.
3. For **Choose point layers**, select the layers you want to use for the numerator and denominator.
4. Expand **Additional options** and enter values for the **Weight** (numerator and denominator), **Search radius (bandwidth)** (numerator and denominator), and **Cell size** parameters, if necessary.
5. Click **Run**.

Usage notes

The **Choose point layers** parameter is used to select datasets to calculate densities for the numerator and denominator. Only point features are available as inputs.

Expand **Additional options** to reveal the **Weight**, **Search radius (bandwidth)**, and **Cell size** parameters. The following table summarizes these parameters, including their default values:

Parameter	Description	Default value
Weight	A field denoting the value of each feature. For example, if you have a dataset for retail locations that includes a field for revenue, you could use the revenue field as the weight to create a density surface based on sales amount rather than locations. The **Weight** fields are applied to the numerator and denominator separately.	All features are weighted as 1 (in other words, the density surface is based solely on the location of the features).

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Parameter	Description	Default value
Search radius (bandwidth)	A distance (in miles, feet, kilometers, or meters) that is used to find input features within the same neighborhood as the focal feature. The **Search radius (bandwidth)** fields are applied to the numerator and denominator separately.	An appropriate search distance is calculated for the input dataset using Silverman's Rule-of-thumb formula. The search distance is calculated separately for the numerator and denominator.
Cell size	The size of the output features that will create the density ratio surface.	An appropriate cell size is calculated based on the extent and number of features in the input datasets.

The result dataset is styled by **Counts and amounts (Color)** using a default equal interval classification with 10 classes.

The **Flip card** button is used to view information on the back of the card, including the values for the search radius (numerator and denominator) and bandwidth.

Limitations

Density ratios can only be calculated for point features.

Calculate Density Ratio is not supported for read-only connections to Google BigQuery, Snowflake, and database platforms that are not supported out-of-the-box.

How Calculate Density Ratio works

Calculate Density Ratio uses Kernel density calculations to create density surfaces; it then calculates a ratio between each surface.

The ratio is calculated between the density surfaces using the following equation:

```
r(x, y)= c(x, y)/p(x, y)
```

Where:

- r(x,y) = Ratio at location (x,y).
- c(x,y) = Density of cases (numerator) at location (x,y).
- p(x,y) = Density of control (denominator) at location (x,y).

For more information about Kernel density calculations, including the default calculations for **Search radius (bandwidth)** and **Cell size**, see How Calculate Density works.

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Find Nearest

Find Nearest uses a line distance to measure between input features and near features. For each input feature, the specified number of near features is ranked by distance from the input feature.

Example

The director of Safety Services wants to determine which fire stations in the city are closest to each of the schools. The director wants to use this information, which can be collected using Find Nearest, to set primary and secondary responder stations for each school in case of an emergency.

Use the Find Nearest capability

Find Nearest can be run on maps with two layers (point, lines, or areas).

Use the following steps to run the Find Nearest analysis capability:

1. If necessary, click the map card to activate it. A card is active when the toolbar and **Action** button appear.
2. Click the **Action** button, then choose **Find Nearest**.
3. For **Choose layer containing features to search near**, select the layer you want to use to find the nearest features.
4. For **Choose layer with features you wish to find**, select the layer you want to search for in relation to the first layer.
5. If necessary, change the limit to the number of near features that will be returned and the search distance.
6. Click **Run**.

Usage notes

The **Choose layer containing features to search near** parameter contains the input point, line, or area dataset with features that will be used to find the nearest features.

The **Choose layer with features you wish to find** parameter contains the input point, line, or area dataset with features that will be searched for in relation to the first parameter.

The **For each location in the input layer** parameter contains two options: **Limit the number of nearest locations** and **Limit the search range**.

Option	Default	Description
Limit the number of nearest locations	1	When checked, Find Nearest will return up to the number of features specified for each feature in the first input parameter. When not checked, there will be no limit to the number of features returned.
Limit the search range	100 miles or 100 kilometers **Note:** The units of the search range will be based on the default units for your account.	When checked, Find Nearest will only return features within the specified distance of the features it is searching near. When not checked, there will be no limit to the search range. The search range can be specified in meters, kilometers, feet, or miles.

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The output of Find Nearest will be lines connecting features from the two input layers. Features from either layer that are not connected to any other features (for example, features that are not within 100 miles of any features in the other layer) will be removed from the map.

How Find Nearest works

When area features are used as an input, the nearest location is found using the distance from or to the centroid of the feature. Other ArcGIS products, such as ArcGIS Online or ArcGIS Pro, measure the distance from the edge of the area boundary. Therefore, results using Find Nearest may differ between products.

Find Nearest calculations on database datasets are performed using the native distance calculations available within the database. Therefore, distance calculations will vary based on database type and spatial type.

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Find K-Means Clusters

Find K-Means Clusters finds natural clusters of features based on either location or attribute values using the K-Means algorithm. The algorithm works to classify the features so that the features within a cluster are as similar as possible, while the clusters are as different as possible.

Examples

A nongovernmental organization collects data on abandoned fishing gear and other large offshore debris. The location of the debris can be analyzed to find clusters of debris, which can help the organization determine the main sources of the abandoned equipment and debris.

Customers of a retail location can be analyzed based on their demographic characteristics and buying patterns. Clusters based on properties such as disposable income and spending can be used to design a marketing strategy for the store.

Use the Find K-Means Clusters capability

Find K-Means Clusters can be run on map, chart, or table cards using point, line, or area features.

Complete the following steps to run the Find K-Means Clusters analysis capability:

1. Click the card to activate it, if necessary.
   A card is active when the toolbar and **Action** button appear.
2. Click the **Action** button and do one of the following:
   - For a map card, on the **Spatial analysis** tab, click **Find K-Means Clusters**.
   - For chart and table cards, click **How is it distributed** and click **Find K-Means Clusters**.
3. For **Choose a layer**, select the layer for which you want to find clusters.
4. For **Analysis fields**, choose one of the following options:
   - To run **Find K-Means Clusters** spatially, select a location field.
   - To run **Find K-Means Clusters** nonspatially, select one or more number fields.
5. Expand **Additional options** and enter a value for the **Number of clusters** parameter, if necessary.
6. Click **Run**.

Usage notes

The **Choose a layer** parameter is used to select a dataset in which to find clusters. The dataset can have point, line, or area features, or it can be a nonspatial table (available when using the capability from a chart or table).

The **Analysis fields** parameter is used to select the field on which the clusters will be based. The field can be either a location field, in which case the clusters will be based on geographic location, or one or more number or rate/ratio fields, in which case the clusters will be based on similarity between attributes. A combination of location and number or rate/ratio fields is not supported.

You can expand **Additional options** to reveal the **Number of clusters** parameter. If a specific number of clusters is required for your analysis, enter that value in the **Number of clusters** parameter. If no value is entered, a number of clusters will be calculated using the Davies-Bouldin index described in Davies & Bouldin (1979) that will optimize the similarities within a cluster and the differences between clusters.

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Limitations

Find K-Means Clusters is not supported for read-only connections to Google BigQuery, Snowflake, and database platforms that are not supported out-of-the-box.

Cross filters and predefined filters can be applied to the results of Find K-Means Clusters, but will not rerun the tool each time the filter is changed.

References

Davies, D. L., & Bouldin, D. W. (1979). A Cluster Separation Measure. IEEE Transactions on Pattern Analysis and Machine Intelligence, PAMI-1(2), 224 - 227. https://doi.org/10.1109/TPAMI.1979.4766909.

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Find Spatial Mean

Find Spatial Mean calculates the geographic center of a set of point features. The output will be a single point feature (or a point feature for each group in the dataset) located at the geographic center or the center of concentration of the points.

Example

A crime analyst is analyzing the location of crime incidents based on the time of day when the incidents occurred. Comparing the spatial mean of daytime crimes to that of nighttime crimes allows the police department to reallocate their resources more effectively.

Use the Find Spatial Mean capability

Find Spatial Mean can be run on maps with point layers.

Complete the following steps to run the Find Spatial Mean analysis capability:

1. If necessary, click the map card to activate it. A card is active when the toolbar and **Action** button appear.
2. Click the **Action** button and choose **Find Spatial Mean**.
3. For **Choose a layer**, select the layer for which you want to calculate the spatial mean.
4. Expand **Additional options** and enter values for the **Weight**, **Group by**, and **Add statistics to summarize** parameters, if necessary.
5. Click **Run**.

Usage notes

The **Choose a layer** parameter is used to select the dataset for which to calculate spatial mean. Only point features are available in the drop-down menu.

You can expand **Additional options** to reveal the **Weight**, **Group by**, and **Add statistics to summarize** parameters. The following table summarizes these parameters, including their default values:

Parameter	Description	Default value
Weight	A number field denoting the value of each feature that is used to calculate a weighted mean based on relative importance. For example, stores in a retail chain can be weighted by total sales.	None. The spatial mean is based only on location.
Group by	A string field used to group features for separate spatial mean calculations based on shared values. A separate spatial mean is calculated for each value in the field. For example, wildlife observations in a national park can be grouped by species to determine optimal locations for sightings.	None. The spatial mean is calculated for all features.
Add statistics to summarize	One or more number, rate/ratio, or string fields used to calculate summary statistics for the dataset. For number and rate/ratio fields, the sum, minimum, maximum, average, and mode can be calculated. For string fields, the mode can be calculated. If a **Group by** field is used, the summary statistics are calculated separately for each group.	None. The count of features is included in the output dataset.

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Limitations

Find Spatial Mean is not supported for read-only connections to Google BigQuery, Snowflake, and database platforms that are not supported out-of-the-box.

Google BigQuery does not support mode calculations.

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Nonspatial analysis

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Nonspatial analysis

Nonspatial analysis can be accessed using the **Action** button on a map, chart, or table card.

The following table provides an overview of each nonspatial analysis capability:

Analysis capability	Description	Example questions
Calculate Ratio	Calculate Ratio uses a simple division equation to determine the relationship between two number variables. Inputs: Two number or rate/ratio fields	How is it related? How do obesity rates differ between urban and rural residents?
Calculate % Change	Calculate % Change uses initial values and final values to calculate change over time. Inputs: Two number or rate/ratio fields	How has it changed? What is the percentage of losses or gains for each commodity?
Calculate Z-Score	Calculate Z-Score returns the z-score values for each feature in a dataset based on a chosen field. The z-score is a measure of the distance of each value from the mean, using standard deviation. Inputs: One number field	How is it distributed? How does the crime rate in a certain district compare to the mean?
Create Regression Model	Create Regression Model is used to model the relationship between two or more explanatory variables and a response variable by fitting a linear equation to observed data. Inputs: • Dependent variable: One number or rate/ratio field • Explanatory variables: One or more number or rate/ratio fields	How is it related? Which variables have the most effect on the total sales at each store location?
Predict Variable	Predict Variable uses the linear model created through regression analysis to predict new values in a dataset. Input: One regression model	How is it related? What are the expected future levels of carbon emissions based on trends in vehicle usage, renewable energy uptake, and economic growth?
Find K-Means Clusters	Find K-Means Clusters categorizes your data into groups or clusters that maximize the similarities within each cluster while maximizing the difference between clusters. **Note:** Find K-Means Clusters can be used to create clusters based on location (spatial analysis), or attribute values (nonspatial analysis). Inputs: One or more number field	How is it distributed? How are customers clustered by income level? How are universities and colleges clustered by cost?

Next steps

Use the following resources to learn more about analysis:

- Analysis capabilities

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- Spatial analysis
- Link analysis
- Regression analysis

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Calculate Ratio

Calculate Ratio uses a simple division equation to determine the relationship between two number variables. Calculating ratios is a form of normalization, which makes it especially useful for comparing areas that are not uniform in size or population.

Note:
You can also calculate a ratio using the data table.

Example

A business analyst for a consortium of colleges wants to know which states have colleges with the highest return on investment. Calculate Ratio can be used to create a ratio between the average earnings after graduation and the average cost of college.

Use the Calculate Ratio capability

Use the following steps to run the Calculate Ratio analysis capability:

1. Create a map, chart, or table using the dataset with which you want to calculate a ratio.
2. Click the **Action** button .
3. Do one of the following:
   - If your card is a chart or table, click **How is it related?** in the **Analytics** pane.
   - If your card is a map, click the **Find answers** tab and click **How is it related?**.
4. Click **Calculate Ratio**.
5. For **Choose a layer**, select the dataset with which you want to calculate a ratio.
6. For **Choose number fields**, choose the fields you want to use for the numerator and denominator. The fields must be a number or rate/ratio.
7. For **Name the result field**, enter a name for the new field.
8. Click **Run**.

A new rate/ratio field is added in the chosen dataset.

Usage notes

Calculate Ratio can be found using the **Action** button under **How is it related?** in the **Find answers** tab. The input layer can be a point, line, or area layer.

Two number fields must be chosen as the numerator and the denominator:

- Numerator—The number that will be divided in a ratio. In the case of average household income, total income would be the numerator.
- Denominator—The number that will be used to divide the numerator in a ratio. In the case of per capita crime rate, total population would be the denominator.

Calculate Ratio adds a new rate/ratio field to the input layer. You must include a new field name to run the calculation.

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Calculate % Change

When you calculate percent change, you are calculating the change in numerical values over time. Calculating change as a percentage is a form of normalization, which makes it especially useful for comparing areas that are not uniform in size or population.

Note:
You can also calculate percent change using the data table.

Example

A crime analyst is studying the effects of a city's crime reduction strategy. Calculate % Change can be used to determine the effectiveness of the strategy in different districts by using the crime rate before the program started and the crime rate after the program's implementation.

Use the Calculate % Change capability

Use the following steps to run the Calculate % Change analysis capability:

1. Create a map, chart, or table using the dataset with which you want to calculate percent change.
2. Click the **Action** button .
3. Do one of the following:
   - If your card is a chart or table, click **How has it changed?** in the **Analytics** pane.
   - If your card is a map, click the **Find answers** tab and click **How is it changed?**.
4. Click **Calculate % Change**.
5. For **Choose a layer**, select the dataset with which you want to calculate percent change.
6. For **Choose number fields**, choose the fields you want to use for the initial value and final value. The fields must be a number or rate/ratio.
7. For **Name the result field**, enter a name for the new field.
8. Click **Run**.

A new rate/ratio field is added in the chosen dataset.

Usage notes

Calculate % Change can be found using the **Action** button under **How has it changed?** in the **Find answers** tab. The input layer can be a point, line, or area layer.

Two number fields must be chosen as the initial value and the final value. The number fields will be used in the equation: `(final_value-initial_value)/initial_value*100`

Calculate % Change adds a new rate/ratio field to the input layer. You must include a new field name to run the calculation.

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Calculate Z-score

A z-score refers to the number of standard deviations each data value is from the mean, with a z-score of zero indicating the exact mean. Z-scores are useful for analyzing numbers in the context of the rest of the field.

Example

A GIS analyst for a nongovernmental organization is analyzing a disease outbreak. Calculate Z-score can be used to determine the areas in which the outbreak is concentrated.

Use the Calculate Z-score capability

Use the following steps to run the Calculate Z-score analysis capability:

1. Create a map, chart, or table using the dataset with which you want to calculate the z-score.
2. Click the **Action** button .
3. Do one of the following:
   - If your card is a chart or table, click **How is it distributed?** in the **Analytics** pane.
   - If your card is a map, click the **Find answers** tab and click **How is it distributed?**.
4. Click **Calculate Z-score**.
5. For **Choose a layer**, select the dataset with which you want to calculate the z-score.
6. For **Choose number field**, choose the field you want to use to calculate the z-score. The field must be a number or rate/ratio.
7. Expand **Additional options** and enter values for **Mean** and **Standard Deviation**, if necessary. If no values are entered, the mean and standard deviation will be calculated for you.
8. For **Name the result field**, enter a name for the new field.
9. Click **Run**.

Usage notes

Calculate Z-score can be found using the **Action** button under **How is it distributed?** on the **Find answers** tab. The input layer can be a point, a line, or an area layer.

A number field must be chosen as the field to calculate the z-score. The number field will be used in the equation `(number-average)/standard_deviation`.

Optionally, you can enter mean and standard deviation values. If you don't enter values, the mean and standard deviation will be calculated for you.

Calculate Z-score adds a new number field to the input layer. The field name is automatically populated in the **Calculate Z-score** pane, but you can change it before running the calculation.

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Create Regression Model

Create Regression Model is used to model the relationship between two or more explanatory variables and a response variable by fitting a linear equation to observed data. Every value of the independent variable (x) is associated with a value of the dependent variable (y).

Create Regression Model uses Ordinary Least Squares (OLS) as the regression type.

Example

An environmental organization is studying the cause of greenhouse gas emissions by country from 1990 to 2015. Create Regression Model can be used to create an equation that can estimate the amount of greenhouse gas emissions per country based on explanatory variables such as population and gross domestic product (GDP).

Use the Create Regression Model capability

Use the following steps to run the Create Regression Model analysis capability:

1. Create a map, chart, or table using the dataset with which you want to create a regression model.
2. Click the **Action** button .
3. Do one of the following:
   - If your card is a chart or table, click **How is it related** in the **Analytics** pane.
   - If your card is a map, click the **Find answers** tab and click **How is it related**.
4. Click **Create Regression Model**.
5. For **Choose a layer**, select the dataset with which you want to create a regression model.
6. For **Choose a dependent variable**, choose the field you want to explain with your model. The field must be a number or rate/ratio.
7. Click **Select explanatory variables** to display a menu of available fields.
8. Select the fields to use as explanatory variables (also called independent variables).
9. Click **Select** to apply the explanatory variables.
10. Click the **Visualize** button to view a scatter plot or scatter plot matrix of the dependent and explanatory variables, if available. The scatter plots can be used as part of the exploratory analysis for your model.

    Note:
    The **Visualize** button is unavailable if five or more explanatory variables are chosen.

11. Click **Run**.

The regression model is created for your chosen dependent and explanatory variables. You can now use the outputs and statistics to continue verifying the model validity with exploratory and confirmatory analysis.

Usage notes

Create Regression Model can be found using the **Action** button under **How is it related** on the **Find answers** tab.

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One number or rate/ratio field can be chosen as the dependent variable. The dependent variable is the number field that you are trying to explain with your regression model. For example, if you are creating a regression model to determine the causes of child mortality, the child mortality rate is the dependent variable.

Up to 20 number or rate/ratio fields can be chosen as explanatory variables. Explanatory variables are independent variables that can be chosen as part of the regression model to explain the dependent variable. For example, if you are creating a regression model to determine the causes of child mortality, explanatory variables may include poverty rates, disease rates, and vaccination rates. If the number of explanatory variables chosen is four or fewer, a scatter plot or scatter plot matrix can be created by clicking **Visualize**.

The following output values are given under **Model statistics**:

- Regression equation
- R2
- Adjusted R2
- Durbin-Watson test
- p-value
- Residual standard error
- F statistic

The outputs and statistics can be used to analyze the accuracy of the model.

After you create the model, a new function dataset is added to the data pane. The function dataset can be used in the Predict Variable capability. Create Regression Model also creates a result dataset that includes all the fields from the input plus `estimated`, `residual`, and `standardized_residual` fields. The fields contain the following information:

- `estimated`—The value of the dependent variable as estimated by the regression model
- `residual`—The difference between the original field value and the estimated value of the dependent variable
- `standardized_residual`—The ratio of the residual and the standard deviation of the residual

How Create Regression Model works

An Ordinary Least Squares model can be created if the following assumptions are met:

- The model must be linear in the parameters.
- The data is a random sample of the population.
- The independent variables are not too strongly collinear.
- The independent variables are measured precisely such that measurement error is negligible.
- The expected value of the residuals is always zero.
- The residuals have constant variance (homogeneous variance).
- The residuals are normally distributed.

Create Regression Model often runs successfully even if one or more of the assumptions are not met. Therefore, the assumptions for OLS should be tested before using Create Regression Model. If the assumptions are not met, the model may not be valid.

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A model cannot be created if the third assumption—the independent variables are not too strongly collinear—is not met. In that case, the message **Two or more explanatory variables are related. Remove one of the collinear variables and try again** appears. You can determine which variables are collinear using a scatter plot or scatter plot matrix. The collinear variables will have a linear relationship and one of the variables will have a strong dependency on the other. Remove the dependent collinear variable from the model.

For more information on the assumptions of OLS models, see Regression analysis.

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Predict Variable

Predict Variable uses a regression model to predict new values in a dataset. Predict Variable must be used in conjunction with Create Regression Model.

Example

An environmental organization is trying to predict the future greenhouse gas emissions by country until 2050. An analyst from the organization created a regression model using population and gross domestic product (GDP) with Create Regression Model. The analyst can then use the model and projected population and GDP values to predict the future greenhouse gas emissions per country.

Use the Predict Variable capability

Use the following steps to run the Predict Variable analysis capability:

1. Create a map, chart, or table using the dataset with which you want to predict a variable.
2. Click the **Action** button .
3. Do one of the following:
   - If your card is a chart or table, click **How is it related?** in the **Analytics** pane.
   - If your card is a map, click the **Find answers** tab and click **How is it related?**.
4. Click **Predict Variable**.
5. For **Choose a layer**, select the dataset with which you want to predict a variable.
6. For **Choose the regression model layer**, select the function dataset you want to use as a model. A function dataset must be created using Create Regression Model.
7. For **Map variables**, select the fields in your input layer that correspond to the explanatory variables in the regression model.
8. Click **Run**.

A dataset is created with the estimated values based on your regression model and input variables.

Tip:

You can also open the **Predict Variable** pane by dragging a function dataset onto a map card.

Usage notes

Predict Variable can be found using the **Action** button under **How is it related?** on the **Find answers** tab. You can also open the **Predict Variable** pane by dragging a function dataset onto a map card.

You must choose a regression model in the form of a function dataset to use Predict Variable. A model can be created using Create Regression Model. The equation and statistics for the model are given on the dialog box.

The **Map variables** parameter is used to match explanatory variables from the regression model to fields in the input dataset.

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Temporal analysis

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Temporal analysis

Temporal analysis can be accessed using the **Action** button on a time series graph. Some temporal capabilities are also available from the **Find answers** tab on a map, chart, or table card.

The following table provides an overview of each temporal analysis capability:

Analysis capability	Description	Example questions
Moving Average	Moving Average calculates average values for a specified window and plots the values on a time series graph. Inputs: One date/time field and one number or rate/ratio field	How has it changed? What are the trends in the data? What is the average value for a given number of days? What are the estimated values for missing data?
Temporal Decomposition	Temporal Decomposition splits a time series graph into trend, seasonal, and remainder components using the STL method. Inputs: One date/time field	How has it changed? What are the trends in the data? How does seasonality affect the values?
Forecast	Forecast uses STL to predict future values for the seasonal and seasonally adjusted components. Inputs: One date/time field	How has it changed? How will the values change in the future?

Next steps

Use the following resources to learn more about analysis:

- Analysis capabilities
- Spatial analysis
- Nonspatial analysis
- Link analysis
- Regression analysis

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Moving Average

Moving Average calculates average values for a specified window and plots the values on a time series graph. A moving average creates a smoothing effect and reduces noise from daily fluctuations. Moving Average can also be used to impute missing data with estimated values.

Examples

A stock market analyst is analyzing the value of different stocks. The analyst calculates moving average to track the trends in the stock prices and determine which stocks are growing in value and which stocks are losing value.

An epidemiologist is studying an outbreak of an infectious disease, but her dataset is missing values for several dates. A central moving average is used to calculate estimated values for the missing dates.

Use the Moving Average capability

Moving Average can only be run using a time series graph with a numeric field on the y-axis.

Complete the following steps to run the Moving Average analysis capability:

1. Create a time series chart using one of the following data combinations:
   - One date/time field and one or more number or rate/ratio fields
   - One or more date/time fields and one number or rate/ratio field
2. If necessary, click the time series card to activate it. A card is active when the toolbar and **Action** button appear.
3. Click the **Action** button and choose **Moving Average**.
4. For **Choose number field** or **Choose date/time field**, select the number or date/time field with which you want to calculate moving average. This parameter is only available if the time series graph was created with multiple number fields or multiple date/time fields.
5. For **Moving average period**, enter the number of days to use in the moving average calculation and adjust the slider if necessary. See Usage notes for more information.
6. Expand **Additional options** and change the **Daily aggregation** parameter if necessary.
7. Click **Run**.

Usage notes

The **Choose a number field** parameter is available on time series charts created using two or more numbers on the y-axis. The **Choose date/time field** parameter is available when two or more date/time fields are used on the time series. These parameters determine which field to use when calculating moving average.

The **Moving average period** parameter determines how many days are included in the moving average calculation. For example, if you want to calculate a one-week moving average, use a period of seven days. The period must be an odd number. The default period is three days.

The slider in the **Moving average period** parameter determines which days are used in the calculation. The most common uses of moving average place the calculated value (labeled as day 0 on the slider) as either the endpoint (trailing moving average) or the midpoint (central moving average). By default, Moving Average calculates a central moving average, meaning there is an equal number of data points before and after the value being calculated.

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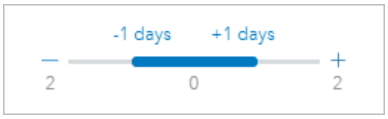
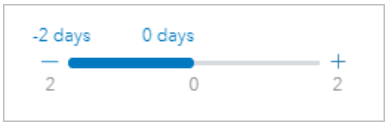


You can move the slider to change which days are used in the calculation. Moving the slider to the negative end changes the calculation to a trailing moving average. For example, using the default period of three creates a trailing moving average where the date being calculated and the preceding two days are used in the calculation.



You can also use the slider to create a moving average calculation with a custom number of days before and after the day being calculated, rather than using a central or trailing moving average.

Moving average is calculated using a single data point for each day. The **Daily aggregation** parameter determines how multiple values from a single day are aggregated into a single data point. The aggregation options include average, minimum, and maximum. The default aggregation is average.

The moving average line is added to the time series graph. A new field named `n-day moving average` (where n is the value of the **Moving average period** parameter) is added to the input dataset. You can run Moving Average multiple times on the same dataset. Each result will be added to the time series graph and appended to the input dataset.

Limitations

Moving Average can only be run from a time series graph created using at least one number field.

The **Moving average period** parameter must be an odd number between 3 and 999.

How Moving Average works

Moving Average uses a day-based simple moving average (SMA) calculation. The **Moving average period** parameter and the corresponding slider are used to determine which days are used in the calculation.

The moving average calculation applies the moving average period to dates in your dataset, not calendar days. If a date is missing from your dataset, the next closest date in the dataset will be used, rather than using the consecutive calendar date. Therefore, datasets with large ranges of missing dates may result in inaccurate calculations near the beginning and end of the missing dates.

Dates containing null or missing data are included in the period but subtracted from the value of n (see the equation below). If you do not want to include null or missing data, you can apply a filter to the dataset before running Moving Average. For example, you want to calculate moving average based on business days and exclude null values for weekends. You can apply a filter based on the `Day of week` subfield for your input date/time field to remove values for Saturday and Sunday.

The data for each day is aggregated using the statistic in the **Daily aggregation** parameter and then applied to the following formula:

MA0 = (d1+...+dn-1+dn)/(n-x)

where

- MA0 = The moving average for the current date. This date can correspond to any position in the equation (d1 to dn).
- d = The aggregated daily value.

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- n = The number of daily values in the moving average calculation (the moving average period).
- x = The number of aggregated daily values within the moving average range that are null. This value can range from 0 to n-1 in a valid calculation. If x = n, moving average will not be calculated for that day.

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Temporal Decomposition and Forecast

Temporal Decomposition and Forecast split a time series graph into trend, seasonal, and remainder components.

Temporal Decomposition and Forecast apply the Seasonal-Trend decomposition using LOESS (STL) method to calculate the components of the time series.

Example

An environmental organization is studying changes in air quality over time. Temporal Decomposition can be used to determine how seasonality affects air quality and whether air quality is improving or worsening over time. Forecast can be used to predict future air quality values.

Use the Temporal Decomposition capability

Complete the following steps to run the Temporal Decomposition analysis capability:

1. Create a map, chart, or table using the dataset with which you want to perform temporal decomposition.
2. Click the **Action** button .
3. Do one of the following:
   - If your card is a time series graph, remain on the **Temporal analysis** tab.
   - If your card is a different chart type or a table, click **How has it changed** in the **Analytics** pane.
   - If your card is a map, click the **Find answers** tab and click **How has it changed**.
4. Click **Temporal Decomposition**.
5. For **Choose a layer**, select the dataset with which you want to perform temporal decomposition.
6. For **Choose a date/time field**, select the date/time field you want to use for your timeline.
7. Expand **Additional options** and enter values for the **Choose a number field**, **Adjust for seasonality**, and **Select window size** parameters, if necessary. See Usage notes for more information.
8. Optionally, select **Show forecast** to include forecasted values on your timeline. If **Show forecast** is selected, you can also adjust the **Set forecast horizon cycles** parameter to determine how many cycles are included in the forecast. The default number of cycles is two.
9. Click **Run**.

Use the Forecast capability

Complete the following steps to run the Forecast analysis capability:

1. Create a map, chart, or table using the dataset with which you want to perform temporal decomposition.
2. Click the **Action** button .
3. Do one of the following:
   - If your card is a time series graph, remain on the **Temporal analysis** tab.
   - If your card is a different chart type or a table, click **How has it changed** in the **Analytics** pane.
   - If your card is a map, click the **Find answers** tab and click **How has it changed**.
4. Click **Forecast**.

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5. For **Choose a layer**, select the dataset with which you want to perform forecasting.
6. For **Choose a date/time field**, select the date/time field you want to use for your timeline.
7. Expand **Additional options** and enter values for the **Choose a number field**, **Adjust for seasonality**, and **Select window size** parameters, if necessary. See Usage notes for more information.
8. Adjust the **Set forecast horizon cycles** parameter to determine how many cycles are included in the forecast. The default number of cycles is two.
9. Click **Run**.

Usage notes

Temporal Decomposition and Forecast can be found using the **Action** button under **How has it changed** on the **Find answers** tab or on the **Temporal analysis** tab on a time series graph. The input must be a dataset that includes a date/time field and must have a minimum of one year's worth of data. For more information, see How Temporal Decomposition and Forecast work.

Use the **Choose a date/time field** parameter to select the date/time field that will have temporal decomposition applied.

Expand **Additional options** to reveal the **Choose a number field**, **Adjust for seasonality**, and **Select window size** parameters. The following table summarizes these parameters, including their default values:

Parameter	Description	Default value
Choose a number field	A field denoting the value of each observation on the time series. For example, when decomposing a time series of average global temperatures over time, use the temperature field for the **Choose a number field** parameter.	None. The value for each point is based on the count.
Adjust for seasonality	The seasonality is used to determine how the seasonal component is calculated. The following seasonality options are available: • Weekly • Monthly • Quarterly • Yearly	None. An appropriate seasonality is chosen based on your data.
Select window size	The window size determines the percentage of data points used in the smoothing calculation.	50%.

For Temporal Decomposition, select **Show forecast** to create an output time series showing predicted future values based on the seasonal component and the seasonally adjusted component. The number of cycles in the forecast is based on the **Set forecast horizon cycles** parameter. The default value is 2. The **Show forecast** parameter is not available for Forecast because it is always enabled.

The results for Temporal Decomposition and Forecast include two datasets: one called `STL` and one called `Forecast - STL` (only included for Temporal Decomposition if **Show forecast** is enabled).

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The `STL` dataset includes fields for the raw data (based on either the count or the number field used to decompose the time series), four components (Seasonal, Trend, Remainder, and Seasonally Adjusted), and the original date/time field.

The `Forecast - STL` dataset includes the original date/time field, plus fields for the raw data (based on either the count or the number field used to decompose the time series), estimate, and upper and lower prediction intervals (80% and 95%).

How Temporal Decomposition and Forecast work

Temporal Decomposition and Forecast use the STL method to decompose a time series into its seasonal, trend, and remainder components. The data requirements in the STL algorithm are based on the seasonality used to describe the seasonal component.

Seasonality

Seasonality (also called periodicity) is used in STL to adjust for seasonal effects in a time series. For example, air quality tends to follow a yearly cycle with improved air quality in winter months and decreased air quality in summer months. Therefore, air quality data can be decomposed using monthly seasonality to adjust the time series for the recurring cycle of improved and reduced air quality to get a better idea of the overall trend in air quality over time.

Seasonality can be weekly, monthly, quarterly, or yearly. The data requirements for Temporal Decomposition and Forecast depend on which seasonality is used.

For all of the seasonality options, the data is split into subseries. There must be at least one occurrence of every subseries in the dataset to use Temporal Decomposition or Forecast.

The following table summarizes the seasonality options and the subseries and data requirements for each.

Seasonality	Subseries	Data requirements
Weekly	Weeks 1 through 52. For example, January 1–January 7 is week 1, January 8–January 14 is week 2, and so on.	A minimum of 52 weeks' worth of data with at least one data point for each week.
Monthly	Months January through December.	A minimum of 12 months' worth of data with at least one data point for each month.
Quarterly	Quarters 1 through 4.	A minimum of four quarters' worth of data with at least one data point for each quarter.
Yearly	Individual years. For example, if your dataset includes data starting in 2015 and ending in 2020, the subseries would be 2015, 2016, 2017, 2018, 2019, and 2020.	A minimum of four years' worth of data with at least one data point for each year.

Example

You want to run Temporal Decomposition or Forecast using weekly seasonality for a dataset with data collected daily from January 2015 through December 2020. However, the system to collect data is shut down each year from January 1 through January 10 for updates and maintenance, so no data is collected during that period. To use weekly seasonality, your data must include at least one data occurrence for every week. Since week 1 (January 1 through January 7) is missing completely from your data, you cannot use weekly seasonality on the dataset. All

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other seasonality options are compatible with the dataset because it fits the minimum data requirements and has at least one occurrence for each monthly, quarterly, and yearly subseries.

To make the dataset compatible with weekly seasonality, the scheduled shutdown is changed to January 2 starting in 2021. The data collected on January 1, 2021, is part of the week 1 subseries, so the dataset now has at least one data point for each subseries.

Note:
The requirement for one data point per subseries is an overall requirement, not a yearly requirement. That's why the January 2, 2021, data point fulfills the requirement even though there is no data available for week 1 in 2015 through 2020.

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Scripting

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Scripting in Insights

Note:
Jupyter Kernel Gateway connections can be disabled for an Insights in ArcGIS Enterprise organization during the installation process. Contact your administrator if the Jupyter Kernel Gateway connections are not available. For more information, see Install Insights in ArcGIS Enterprise.

Scripting is an important method of extending and customizing existing software to fit the needs of your organization. In ArcGIS Insights, scripting can be done using Python or R as the programming language. Both programming languages will enable users to expand the available spatial and statistical analysis capabilities within an Insights workbook.

Scripting in Insights is enabled using a connection to a Jupyter Kernel Gateway. The kernel gateway provides access to the required kernels, or programming languages, that execute the code written in the scripting environment. The gateway allows access to both Python and R kernels.

The following general steps must be followed to enable scripting in Insights:

1. Set up a Jupyter Kernel Gateway that contains a Python kernel, an R kernel, or both. See the Insights Scripting Guide (https://links.esri.com/insights-scripting-guide) for more information.
2. Create a connection to the Jupyter Kernel Gateway in Insights.
3. Open the scripting environment.
4. Create and execute scripts in Python or R.

Capabilities of Python scripting

Python scripting can be used to do the following:

- Manipulate and prepare data.
- Create custom charts and graphs.
- Integrate machine learning analysis into Insights.
- Automate data updates and analysis.
- Convert a dataset to a Pandas, GeoPandas, Koalas, or Spark DataFrame.
- Convert a Pandas, GeoPandas, Koalas, or Spark DataFrame to a dataset and add it to the data pane.
- Connect to databases that are not supported in Insights.
- Perform data analysis.

Capabilities of R scripting

R scripting can be used to do the following:

- Manipulate and prepare data.
- Create custom charts and graphs.
- Perform advanced statistical analysis.
- Convert a dataset to an R data frame.

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- Convert an R data frame to a dataset and add it to the data pane.
- Connect to databases that are not supported in Insights.
- Perform data analysis.

Resources

Use the following resources to learn more about scripting in Insights:

- Insights Scripting Guide (https://links.esri.com/insights-scripting-guide)
- Connect to a kernel gateway.
- Use the scripting environment.

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Connect to a kernel gateway

Note:
Jupyter Kernel Gateway connections can be disabled for an Insights in ArcGIS Enterprise organization during the installation process. Contact your administrator if the Jupyter Kernel Gateway connections are not available. For more information, see Install Insights in ArcGIS Enterprise.

A Jupyter Kernel Gateway connection allows you to access kernels within the Insights scripting environment, where you can create and execute Python and R scripts. The connections you create will persist on a single workbook page. A connection has to be created or applied to each page of a workbook where scripting will be used. Saving the workbook will save the connections on the pages.

You must set up a Jupyter Kernel Gateway before you can create a connection to the gateway. For more information, see the Insights scripting guide (https://links.esri.com/insights-scripting-guide).

Create a connection

In Insights in ArcGIS Enterprise, kernel gateway connections can be created on either the home page or within a workbook.

Complete the following steps to create a new kernel gateway connection on the home page:

1. From the home page, click the **Connections** tab.
2. Click **New connection**.
   A menu displays the types of connections that can be created.
3. Choose **Kernel Gateway** as the connection type.
   The **Kernel Gateway connection** window appears.
4. Enter the name you want to give the kernel gateway connection (for example, the name of the machine that the connection was created on) and the URL for the kernel gateway. The **Web socket** field will be automatically populated when a valid URL is entered.
5. Click **Save**.

The Jupyter Kernel Gateway connection is added to the **Connections** page.

Complete the following steps to create a new kernel gateway connection inside a workbook:

1. Click the **Scripting** button on the workbook toolbar.
   The **Kernel Gateway connection** window opens on the **Select a Kernel Gateway** tab.
2. Click the **Add new** tab.
3. Enter the name you want to give the kernel gateway connection (for example, the name of the machine that the connection was created on) and the URL for the kernel gateway. The **Web socket** field will be automatically populated when a valid URL is entered.
4. Click **Connect**.

The Insights scripting environment connects to the Jupyter Kernel Gateway. The kernel gateway connection is also added to the **Connections** tab on the home page.

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Edit a connection

If you've already created a connection in your current session, click the **Scripting** button to open the **Jupyter Kernel Gateway** window. You can connect to a different gateway using the **Switch Connections** button.

If you are using an Insights in ArcGIS Enterprise deployment built on ArcGIS Enterprise 10.8 or higher, you can also edit an existing kernel gateway connection from the **Connections** tab of the home page by clicking the name of the connection, updating the connection parameters, and clicking **Save**.

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Use the scripting environment

Note:
Jupyter Kernel Gateway connections can be disabled for an Insights in ArcGIS Enterprise organization during the installation process. Contact your administrator if the Jupyter Kernel Gateway connections are not available. For more information, see Install Insights in ArcGIS Enterprise.

After a connection is made to a Jupyter Kernel Gateway, the scripting environment can be accessed and used to create and run scripts in Python and R. The scripting environment consists of an **In[ ]** cell, where scripts are loaded or written; an **Out[ ]** cell, where results are displayed; and a toolbar.

Open the scripting environment

To use the scripting environment, you must first set up a Jupyter Kernel Gateway (https://links.esri.com/insights-scripting-guide) and create a connection to the gateway. Once the gateway connection is created, complete the following steps to open the scripting environment and start writing scripts:

1. Open a workbook. Add data to your workbook, if necessary.

   Tip:
   You can also load data from within the scripting environment.

2. Click the **Scripting** button on the workbook toolbar.
3. If a connection wasn't used in the workbook previously, the **Kernel Gateway connection** window opens and you can select an existing kernel gateway connection from the **Environment name** menu. You can also create a new connection on the **Add new** tab. See Connect to a kernel gateway for more information.
   The scripting environment opens and a **Scripts** heading is added to the data pane.
4. Use the **Select Kernel** menu to choose which kernel to use for scripting. Depending on the kernel gateway connection you are using, the options will be Python, R, or both.
   The scripting environment updates to include an **In[ ]** cell, as well as a toolbar.

The scripting environment is now ready to create, load, and run scripts.

Your script is automatically saved under the **Scripts** heading in the data pane with the name **Insights Script**. The script can be renamed using the **Rename script** button.

The following options are also available for the script using the **Dataset options** button:

- Open—Load the script into an **In[ ]** cell.
- Run—Run the script without opening the scripting environment.
- Download—Download the script as a Jupyter Notebook file (`.ipynb`).
- Share—Share the script to create an Insights script item.
- Remove—Remove the script from the data pane.

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Edit a script

Scripts can be edited from the **In[ ]** cells, even after the cell has been executed. To edit a script, click in the cell, make the edits, then run the cell. A new **Out[ ]** cell is created with the edited results.

Export a script

Scripts that are written in the scripting environment can be exported and saved as a `.py` script for Python, or a `.R` script for R. A script can be exported from the scripting environment by selecting one or more cells and clicking the **Export** button.

The following export options are available when you save a script:

- **Download Selected Cell(s)**—Saves only the script in the selected **In[ ]** cells.
- **Download History**—Saves the script from all **In[ ]** cells in the scripting environment as a Jupyter Notebook file (`.ipynb`).

Exported scripts will be saved in the default download folder on your computer.

Load a script

Scripts can be created directly in the scripting environment by typing in the **In[ ]** cell. Existing scripts can also be loaded into the scripting environment using the following steps:

1. Open the scripting environment, if necessary, and choose the correct kernel for the script you will be running.
2. Click the **Import file** button on the scripting environment toolbar.
3. Browse to and open the script you want to run.
   The script is opened in the **In[ ]** cell.
4. Click the **Run** button on the scripting environment toolbar.

The script runs and the results appear in the **Out[ ]** cell.

Scripts that are saved in the data pane can also be loaded into the scripting environment. To load a script from the data pane, use the following steps:

1. Expand the **Scripts** heading in the data pane.
2. Click the **Dataset options** button for the script you want to load.
3. Click **Open**.
   The script is opened in the **In[ ]** cell.

Create an image card

Scripting results, such as charts, can be exported from an **Out[ ]** cell to create an image card on your Insights page. To export a cell, you must run your script using the **Run** button, highlight the **Out[ ]** cell, and then click the **Create Card** button to move the image from the most recent **Out[ ]** cell to an image card.

Note:
Image cards created from scripts are static and do not have the same interactive capabilities of map, chart, and table cards created in Insights.

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Save your script to a model

The script in your scripting environment can be added to your model as an Insights script using the **Add To Model** button . The Insights script can be edited from the **Analysis view** . For more information on updating a model in Insights, see Rerun your analysis.

Clear or close the scripting environment

The script, including all **In[ ]** and **Out[ ]** cells, can be cleared using the **Restart** button . Clearing the scripting environment cannot be undone.

The scripting environment is closed by clicking the close button or browsing to a different page within Insights.

If you need to switch between the Insights page and the scripting environment, it is best practice to minimize the environment using the minimize button — rather than closing it, so you will not lose your scripts.

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Analysis concepts

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Link analysis

Link analysis is an analysis technique that focuses on relationships and connections in a dataset. Link analysis gives you the ability to calculate centrality measures—namely degree, betweenness, closeness, and eigenvector—and see the connections on a link chart or link map.

About link analysis

Link analysis uses a network of interconnected links and nodes to identify and analyze relationships that are not easily seen in raw data. Common types of networks include the following:

- Social networks that show who talks to whom
- Semantic networks that illustrate topics that are related to each other
- Conflict networks indicating alliances of connections between players
- Airline networks indicating which airports have connecting flights

Examples

A crime analyst is investigating a criminal network. Data from cell phone records can be used to determine the relationship and hierarchy between members of the network.

A credit card company is developing a new system to detect credit card theft. The system uses the known patterns of transactions for each client, such as the city, stores, and types of transactions, to identify anomalies and alert the client of a potential theft.

A public health analyst is researching the opioid crisis in North America. The analyst uses data on prescriptions and demographics to identify new patterns that are emerging as the crisis spreads.

How link analysis works

The following table provides an overview of the terminology in link analysis:

Term	Description	Examples
Network	A set of interconnected nodes and links.	An online social network that uses a network of profiles and relationships to connect users. Airline networks that use a network of airports and flights to transport travelers from their origin to their destination.
Node	A point or vertex that represents an object, such as a person, place, crime type, or tweet. The node may also include associated properties.	The profiles in a social network. Associated properties may include the user's name, home town, or employer. The airports in an airline network. Associated properties may include the airport name.
Link	The relationships or connections between nodes. The link may also include associated properties.	The relationship between profiles in the network, such as friend, follower, or connection. Associated properties may include the length of the relationship. The flights between airports in an airline network. Associated properties may include the number of flights between airports.

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Centrality

Centrality is a measure of importance for nodes in a network.

Overall centrality is used for the following purposes:

- To evaluate the influence of a node over other nodes in the network. For example, which user will reach the most other users when sharing a piece of news or a job opportunity?
- To identify the nodes that are most influenced by other nodes. For example, which airport will be most affected by canceled flights from a storm in a different region?
- To observe the flow or spread of something throughout the network, including information, objects, or phenomena. For example, how does a package move from the warehouse to the delivery address?
- To understand which nodes spread phenomena through the network most efficiently. For example, which newspaper or channel should be contacted so the story reaches the most people?
- To locate nodes that can block or prevent the spread of phenomena. For example, where should vaccination clinics be located to stop the spread of a virus?

There are four ways to measure centrality in Insights: degree centrality, betweenness centrality, closeness centrality, and eigenvector centrality.

Calculations for betweenness, closeness, and eigenvector centralities can be weighted or unweighted.

Degree centrality

Degree centrality is based on the number of direct connections a node has. Degree centrality should be used when you want to determine which nodes have the most direct influence. For example, in a social network, the users with the most connections have a higher degree centrality.

Degree centrality of node x is calculated using the following equation:

```
degCentrality(x)=deg(x)/(NodesTotal-1)
```

where:

- NodesTotal = The number of nodes in the network
- deg(x) = The number of nodes connected to node x

If the links are directed, meaning that information flows between nodes in one direction only, the degree centrality can be measured either as indegree or outdegree. In the case of a social network, the indegree would be based on the number of profiles the user is following, whereas the outdegree would be based on the number of followers the user has.

Indegree centrality is calculated using the following equation:

```
indegCentrality(x)=indeg(x)/(NodesTotal-1)
```

where:

- NodesTotal = The number of nodes in the network
- indeg(x) = The number of nodes connected to node x with flow directed toward node x

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Outdegree centrality is calculated using the following equation:

```
outdegCentrality(x)=outdeg(x)/(NodesTotal-1)
```

where:

- NodesTotal = The number of nodes in the network
- outdeg(x) = The number of nodes connected to node x with flow directed away from node x

For directed graphs, Insights sizes nodes by outdegree centrality by default.

Betweenness centrality

Betweenness centrality is based on the extent a node is part of the shortest path between other nodes. Betweenness centrality should be used when you want to determine which nodes are used to connect other nodes to each other. For example, a user in a social network with connections to multiple groups of friends will have a higher betweenness centrality than users with connections in only one group.

Betweenness centrality of node x is calculated using the following equation:

```
btwCentrality(x)=Σa,bϵNodes(pathsa,b(x)/pathsa,b)
```

where:

- Nodes = All the nodes in the network
- pathsa,b = The number of shortest paths between all nodes a and b
- pathsa,b(x) = The number of shortest paths between nodes a and b that connect through node x

The betweenness centrality equation above does not account for the size of the network, so large networks will tend to have greater betweenness centrality values than small networks. To allow comparisons between networks of different sizes, the betweenness centrality equation must be normalized by dividing by the number of node pairs in the chart.

The following equation is used to normalize an undirected chart:

```
1/2(NodesTotal-1)(NodesTotal-2)
```

where:

- NodesTotal = The number of nodes in the network

The following equation is used to normalize a directed chart:

```
(NodesTotal-1)(NodesTotal-2)
```

where:

- NodesTotal = The number of nodes in the network

Closeness centrality

Closeness centrality is based on the average of the shortest network path distance between nodes. Closeness centrality should be used when you want to determine which nodes are most closely associated to the other nodes

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in the network. For example, a user with more connections in the social network will have a higher closeness centrality than a user who is connected through other people (in other words, a friend of a friend).

Note:
The distance between nodes refers to the number of links separating them, not the geographical distance.

Closeness centrality of node x is calculated using the following equation:

```
closeCentrality(x)=(nodes(x,y)/(NodesTotal-1))*(nodes(x,y)/dist(x,y)Total)
```

where:
- NodesTotal = The number of nodes in the network
- nodes(x,y) = The number of nodes that are connected to node x
- dist(x,y)Total = The sum of the shortest path distances from node x to other nodes

Eigenvector centrality

Eigenvector centrality is based on important nodes being connected to other important nodes. Eigenvector centrality should be used when you want to determine which nodes are part of a cluster of influence. For example, a user in a social network with many connections to other users with many connections will have a higher eigenvector centrality than a user with few connections, or who is connected to other users with few connections.

Eigenvector centrality of node x is calculated using power iteration to find the largest eigenvector using the following equation:

```
Ax=λx
```

where:
- λ = The eigenvalue
- x = The eigenvector
- A = The matrix describing the linear transformation

Edge weight

Calculations for closeness, betweenness, and eigenvector centralities can be weighted or unweighted. An unweighted centrality calculation sets edges to a uniform weight with a value of 1, whereas a weighted calculation uses field values to assign a value to each edge.

Note:
Undefined weights are given a value of 1. It is best practice to assign a field without null or missing values for the edge weight.

For eigenvector centrality, weights are used to determine the strength of the connection between nodes. Since eigenvector centrality measures the importance of nodes within the network, higher weight values correspond to higher values for their connecting nodes.

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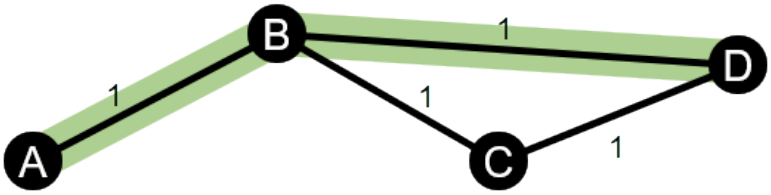
For closeness and betweenness centralities, weight values signify the distance between nodes. Higher edge weights mean a larger distance between nodes and reduce the likelihood of the edge being used in the shortest path. If a higher number in the desired weight field indicates increased importance (for example, the number of messages sent between members in a social network indicates how connected members are), a new field must be calculated with inverse values. Use the following equation to calculate a field of inverse values:

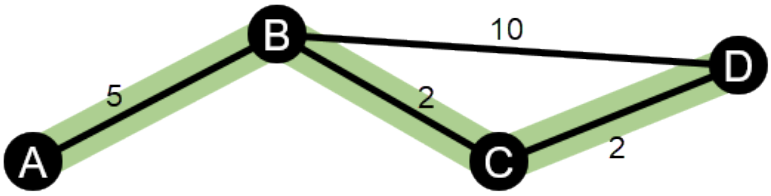
```
weight=ABS(field-MAX(field))+IF(MIN(field)<0, ABS(MIN(field)), MIN(field))
```

For an unweighted closeness or betweenness calculation, the shortest path is the path that uses the least number of links. The example below shows a network with four nodes (A, B, C, and D) and uniform weights. There are two paths that join node A to node D: A-B-D or A-B-C-D. Since A-B-D has fewer links, it is the shortest path.



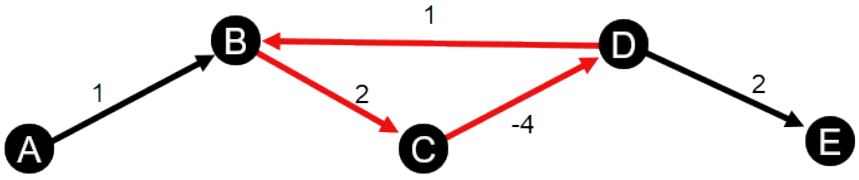
A weighted calculation applies weights to each edge based on field values. Weighted closeness and betweenness centralities use the Bellman-Ford algorithm to find the shortest paths between nodes.

The example below shows a network with four nodes and weighted edges. Path A-B-D has a value of 15 and path A-B-C-D has a value of 9. Since A-B-C-D has the lowest edge value, it is the shortest path.

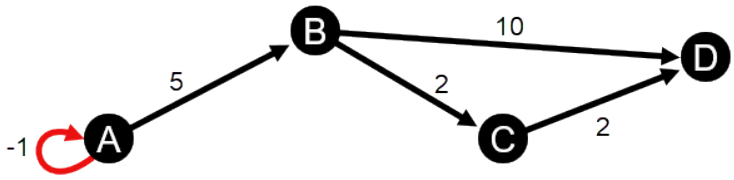


Weighted closeness and betweenness centrality calculations do not support negative weight cycles. If a negative weight cycle is detected, all centrality values are set to 0. A negative weight cycle can occur in the following circumstances:

- The graph contains a negative cycle.



- The graph contains a negative self-loop.



- The graph is undirected and contains a negative edge.

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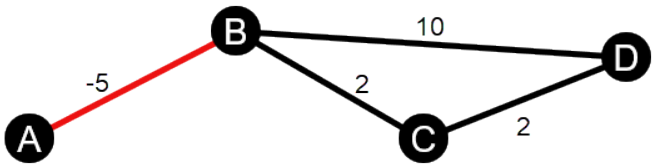

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Regression analysis

Regression analysis is an analysis technique that calculates the estimated relationship between a dependent variable and one or more explanatory variables. With regression analysis, you can model the relationship between the chosen variables as well as predict values based on the model.

Regression analysis overview

Regression analysis uses a chosen estimation method, a dependent variable, and one or more explanatory variables to create an equation that estimates values for the dependent variable.

The regression model includes outputs, such as R2 and p-values, to provide information on how well the model estimates the dependent variable.

Charts, such as scatter plot matrices, histograms, and point charts, can also be used in regression analysis to analyze relationships and test assumptions.

Regression analysis can be used to solve the following types of problems:

- Determine which explanatory variables are related to the dependent variable.
- Understand the relationship between the dependent and explanatory variables.
- Predict unknown values of the dependent variable.

Examples

An analyst for a small retail chain is studying the performance of different store locations. The analyst wants to know why some stores are having an unexpectedly low sales volume. The analyst creates a regression model with explanatory variables like median age and income in the surrounding neighborhood, as well as distance to retail centers and public transit, to determine which variables are influencing sales.

An analyst for a department of education is studying the effects of school breakfast programs. The analyst creates a regression model of educational attainment outcomes, such as graduation rate, using explanatory variables like class size, household income, school budget per capita, and proportion of students eating breakfast daily. The equation of the model can be used to determine the relative effect of each variable on the educational attainment outcomes.

An analyst for a nongovernmental organization is studying global greenhouse gas emissions. The analyst creates a regression model for the latest emissions for each country using explanatory variables like gross domestic product (GDP), population, electricity production using fossil fuels, and vehicle usage. The model can then be used to predict future greenhouse gas emissions using forecasted GDP and population values.

Ordinary Least Squares

Regression analysis in ArcGIS Insights is modeled using the Ordinary Least Squares (OLS) method.

The OLS method is a form of multiple linear regression, meaning the relationship between the dependent variables and the independent variables must be modeled by fitting a linear equation to the observed data.

An OLS model uses the following equation:

$$y_i=\beta_0+\beta_1x_1+\beta_2x_2+...+\beta_nx_n+\varepsilon$$

where:

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- yi=the observed value of the dependent variable at point i
- β0=the y-intercept (constant value)
- βn=the regression coefficient or slope for explanatory variable N at point i
- xn=the value of variable N at point i
- ε=the error of the regression equation

Assumptions

Each regression method has several assumptions that must be met for the equation to be considered reliable. The OLS assumptions should be validated when creating a regression model.

The following assumptions should be tested and met when using the OLS method:

- The model must be linear.
- The data must be randomly sampled.
- The explanatory variables must not be collinear.
- The explanatory variables must have negligible error in measurement.
- The residuals have an expected sum of zero.
- The residuals have homogeneous variance.
- The residuals are normally distributed.
- Adjacent residuals must not show autocorrelation.

The model must be linear

OLS regression can only be used to create a linear model. Linearity can be tested between the dependent variable and the explanatory variables using a scatter plot. A scatter plot matrix can test all the variables, provided there are no more than five variables in total.

The data must be randomly sampled

The data being used in regression analysis should be sampled in such a way that the samples themselves are not dependent on any external factor. Random sampling can be tested using the residuals from the regression model. The residuals, which are an output from the regression model, should have no correlation when plotted against the explanatory variables on a scatter plot or scatter plot matrix.

The explanatory variables must not be collinear

Collinearity refers to a linear relationship between explanatory variables, which creates redundancy in the model. In some cases, the model can be created with collinearity. However, if one of the collinear variables seems to be dependent on the other, you may want to consider dropping that variable from the model. Collinearity can be tested using a scatter plot or scatter plot matrix of the explanatory variables.

The explanatory variables must have negligible error in measurement

A regression model is only as accurate as its input data. If the explanatory variables have large margins of error, the model cannot be accepted as accurate. When performing regression analysis, it is important to only use datasets from known and trusted sources to ensure that the error is negligible.

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The residuals have an expected sum of zero

Residuals are the difference between observed and estimated values in a regression analysis. Observed values that fall above the regression curve will have a positive residual value, and observed values that fall below the regression curve will have a negative residual value. The regression curve should lie along the center of the data points; therefore, the sum of residuals should be zero. The sum of a field can be calculated in a summary table.

The residuals have homogeneous variance

The variance should be the same for all residuals. This assumption can be tested using a scatter plot of the residuals (y-axis) and the estimated values (x-axis). The resulting scatter plot should appear as a horizontal band of randomly plotted points across the plot.

The residuals are normally distributed

A normal distribution, also called a bell curve, is a naturally occurring distribution, where the frequency of a phenomenon is high near the mean and tapers off as the distance from the mean increases. A normal distribution is often used as the null hypothesis in a statistical analysis. The residuals must be normally distributed to show that the line of best fit is optimized centrally within the observed data points, not skewed toward some and away from others. This assumption can be tested by creating a histogram with the residuals. The normal distribution curve can be overlaid and the skewness and kurtosis measures are reported on the back of the histogram card.

Adjacent residuals must not show autocorrelation

This assumption is based on time-ordered data. If the data is time ordered, each data point must be independent of the preceding or subsequent data point. Therefore, it is important to make sure that your time-ordered data is organized in the correct order when performing a regression analysis. This assumption can be calculated using a Durbin-Watson test.

The Durbin-Watson test is a measure of autocorrelation in residuals in a regression model. The Durbin-Watson test uses a scale of 0 to 4, with values 0 to 2 indicating positive autocorrelation, 2 indicating no autocorrelation, and 2 to 4 indicating negative autocorrelation. Therefore, values near 2 are required to meet the assumption of no autocorrelation in the residuals. In general, values between 1.5 and 2.5 are considered acceptable, whereas values less than 1.5 or greater than 2.5 indicate that the model does not fit the assumption of no autocorrelation.

Model validity

The accuracy of a regression equation is an important part of regression analysis. All models will include an amount of error, but understanding the statistics will help you determine if the model can be used in your analysis, or if adjustments need to be made.

There are two techniques for determining the validity of a regression model: exploratory analysis and confirmatory analysis.

Exploratory analysis

Exploratory analysis is a method of understanding your data using a variety of visual and statistical techniques. Throughout the course of your exploratory analysis, you will test the assumptions of OLS regression and compare the effectiveness of different explanatory variables. Exploratory analysis will allow you to compare the effectiveness and accuracy of different models, but it does not determine whether you should use or reject your model. Exploratory analysis should be performed before confirmatory analysis for each regression model and reiterated to make comparisons between models.

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The following charts and statistics can be used as part of exploratory analysis:

- Scatter plot and scatter plot matrix
- Histogram and normal distribution
- Regression equation and predicting new observations
- Coefficient of determination, R2 and Adjusted R2
- Residual standard error
- Point chart

Exploratory analysis should begin while you are choosing explanatory variables and before you create a regression model. Since OLS is a method of linear regression, one of the main assumptions is that the model must be linear. A scatter plot or scatter plot matrix can be used to assess linearity between the dependent variable and the explanatory variables. A scatter plot matrix can display up to four explanatory variables along with the dependent variable, making it an important tool for large-scale comparisons between all variables. A single scatter plot only displays two variables: one dependent and one independent or explanatory. Viewing a scatter plot of the dependent variable and a single explanatory variable allows you to make a more acute assessment of the relationship between the variables. Linearity can be tested before you create a regression model to help determine which explanatory variables will create an acceptable model.

Several statistical outputs are available after you create a regression model, including the regression equation, R2 value, and Durbin-Watson test. Once you've created a regression model, you should use the outputs and necessary charts and tables to test the remaining assumptions of OLS regression. If your model meets the assumptions, you can continue with the remaining exploratory analysis.

The regression equation gives valuable information about the influence of each explanatory variable on the predicted values, including the regression coefficient for each explanatory variable. The slope values can be compared to determine the relative influence of each explanatory variable on the dependent variable; the further the slope value is from zero (either positive or negative), the larger the influence. The regression equation can also be used to predict values for the dependent variable by entering values for each explanatory variable.

The coefficient of determination, symbolized as R2, measures how well the regression equation models the actual data points. The R2 value is a number between 0 and 1, with values closer to 1 indicating more accurate models. An R2 value of 1 indicates a perfect model, which is highly unlikely in real-world situations given the complexity of interactions between different factors and unknown variables. Therefore, you should strive to create a regression model with the highest R2 value possible, while recognizing that the value may not be close to 1.

When performing regression analysis, there is a risk of creating a regression model that has an acceptable R2 value by adding explanatory variables that cause a better fit based on chance alone. The adjusted R2 value, which is also a value between 0 and 1, accounts for additional explanatory variables, reducing the role that chance plays in the calculation. Adjusted R2 should be used for models using many explanatory variables, or when comparing models with different numbers of explanatory variables.

The residual standard error measures the accuracy with which the regression model can predict values with new data. Smaller values indicate a more accurate model; therefore, when multiple models are compared, the model with the smallest value will be the model that minimizes residual standard error.

Point charts can be used to analyze your explanatory variables for patterns like clustering and outliers, which may affect the accuracy of the model.

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Confirmatory analysis

Confirmatory analysis is the process of testing your model against a null hypothesis. In regression analysis, the null hypothesis is that there is no relationship between the dependent variable and the explanatory variables. A model with no relationship would have slope values of 0. If the elements of your confirmatory analysis are statistically significant, you can reject the null hypothesis (in other words, statistical significance indicates that a relationship does exist between the dependent and explanatory variables).

The following statistical outputs are used to determine significance as part of confirmatory analysis:

- F statistic and its associated p-value
- t statistics and their associated p-values
- Confidence intervals

The F statistic is a global statistic returned from an F-test, which indicates the predictive capability of the regression model by determining if all the regression coefficients in the model are significantly different from 0. The F-test analyzes the combined influence of the explanatory variables, rather than testing the explanatory variables individually. The F statistic has an associated p-value, which indicates the probability that the relationships in your data are happening by chance. Since p-values are based on probabilities, the values are given on a scale from 0.0 to 1.0. A small p-value, usually 0.05 or less, is required to determine that the relationships in the model are real (in other words, not happening by chance) and to reject the null hypothesis. In that case, the probability that the relationships in the model are happening by chance is 0.05, or 1 in 20. Alternatively, the probability that the relationships are real is 0.95, or 19 in 20.

The t statistic is a local statistic returned from a t-test, which indicates the predictive capability of each explanatory variable individually. Like the F-test, the t-test analyzes if the regression coefficients in the model are significantly different from zero. However, since a t-test is performed on each explanatory variable, the model will return a t statistic value for each explanatory variable, rather than one per model. Each t statistic has an associated p-value, which indicates the significance of the explanatory variable. Like the p-values for the F-test, the p-value for each t-test should be 0.05 or less to reject the null hypothesis. If an explanatory variable has a p-value greater than 0.05, the variable should be discarded and a new model should be created, even if the global p-value was significant.

Confidence intervals show the regression coefficient for each explanatory variable and the associated 90, 95, and 99 percent confidence intervals. Therefore, the confidence intervals can be used alongside the p-values from the t-tests to assess the null hypothesis for individual explanatory variables. The regression coefficients must not be equal to 0 if you are to reject the null hypothesis and continue using the model. Therefore, for each explanatory variable, the regression coefficient and the associated confidence intervals should not overlap with 0. If a 99 or 95 percent confidence interval for a given explanatory variable overlaps with 0, the explanatory variable has failed to reject the null hypothesis. Including such a variable in your model may have an effect on the overall significance of your model. If only the 90 percent confidence interval overlaps with 0, the explanatory variable may be included in the model provided the other global statistics are significant. Ideally, the confidence intervals for all explanatory variables should be far from 0.

Other outputs

Other outputs, such as estimated values and residuals, are important for testing the assumptions of OLS regression. In this section, you will learn more about how these values are calculated.

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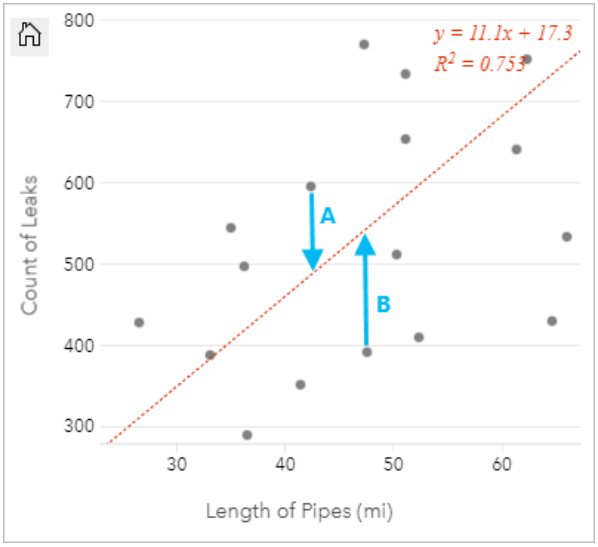
Estimated values

The estimated values are calculated using the regression equation and the values for each explanatory variable. Ideally, the estimated values would be equal to the observed values (in other words, the actual values of the dependent variable).

Estimated values are used with the observed values to calculate residuals.

Residuals

The residual values in a regression analysis are the differences between the observed values in the dataset and the estimated values calculated with the regression equation.



The residuals A and B for the relationship above would be calculated as follows:

```
residualsA = observedA - estimatedA
residualsA = 595 - 487.62
residualsA = 107.38
```

```
residualsB = observedB - estimatedB
residualsB = 392 - 527.27
residualsB = -135.27
```

Residuals can be used to calculate error in a regression equation as well as to test several assumptions.

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Seasonal-Trend decomposition using LOESS

Seasonal-Trend decomposition using LOESS (STL) is a robust method of time series decomposition often used in economic and environmental analyses. The STL method uses locally fitted regression models to decompose a time series into trend, seasonal, and remainder components.

About STL

You can apply STL to any dataset, but meaningful results are only returned if a recurring temporal pattern exists in the data (for example, air quality decreasing during warmer months or online shopping increasing in the fourth quarter of every year). The pattern is displayed in the STL results as the seasonal component.

The STL algorithm performs smoothing on the time series using LOESS in two loops; the inner loop iterates between seasonal and trend smoothing and the outer loop minimizes the effect of outliers. During the inner loop, the seasonal component is calculated first and removed to calculate the trend component. The remainder is calculated by subtracting the seasonal and trend components from the time series.

The three components of STL analysis relate to the raw time series as follows:

```
yi = si + ti + ri
```

where:

- yi = The value of the time series at point i.
- si = The value of the seasonal component at point i.
- ti = The value of the trend component at point i.
- ri = The value of the remainder component at point i.

Examples

A meteorologist is studying the effect of climate change on the frequency of tornados in the United States. She uses STL to decompose a time series of tornado counts to determine how seasonality affects the frequency of tornados and whether the frequency of tornados increased over time. The meteorologist can then compare the trends in tornados to other climate trends, such as mean global temperature, to determine if climate change is a factor in increasing frequency of tornados.

An economist is tracking gas prices in his region and looking for overall trends in prices over time. He knows that gas prices tend to increase in summer months, so he uses STL analysis to decompose the time series of gas prices and analyze the trend separately from the seasonal component.

Seasonal component

The seasonal component of an STL output shows the recurring temporal pattern present in the data based on the chosen seasonality. If a seasonal pattern exists, it normally takes the shape of an oscillating or wave pattern.

Smoothing for the seasonal component is performed for each subseries (week, month, quarter, or year) separately. For example, if using STL with monthly seasonality on a dataset with data collected daily from January 2015 to December 2020, the smoothing is performed first on all data collected in January for all years, then February for all years, and so on until all months have had smoothing performed. The subseries are then recombined to create the seasonal component.

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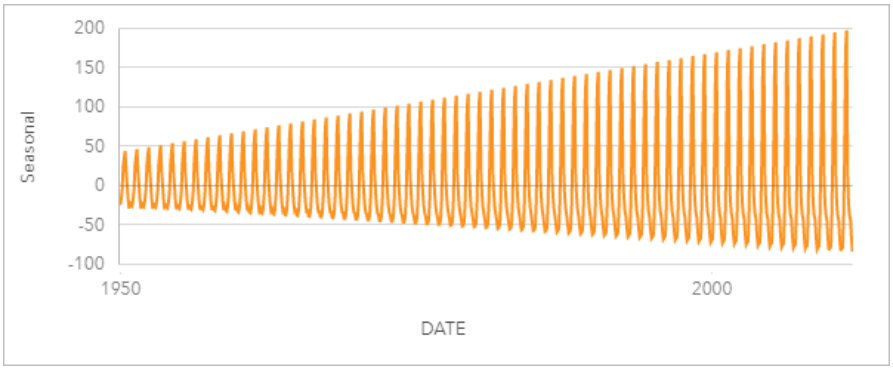
Example

The following example shows the seasonal component of an STL analysis using tornado incidents across the United States. The component was calculated using monthly seasonality and oscillates between a high count in June and a low count in January. The oscillations increase in amplitude over time, which indicates that the seasonal variation in tornado frequency is increasing over time.

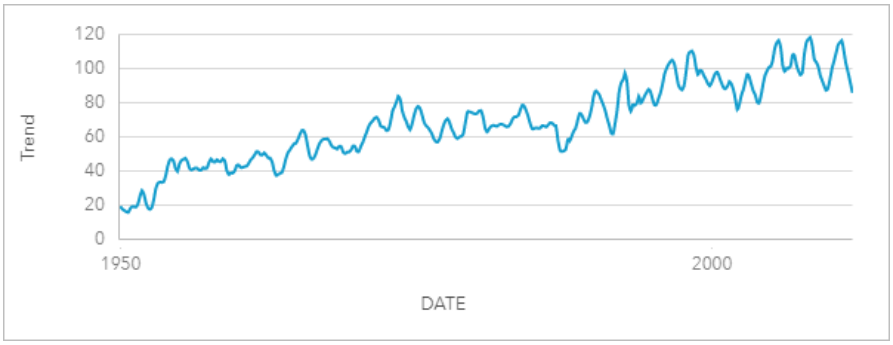


Trend component

The trend component is the second component calculated during the inner loop. The values for the seasonal component are subtracted from the raw data, eliminating seasonal variation from the time series. A smoothed trend line is then created by applying LOESS to the remaining values.

Example

The following example shows the trend component of an STL analysis using tornado incidents across the United States. The result shows an overall positive trend, meaning that the number of tornado incidents in the United States is increasing over time.



Remainder component

The remainder component is calculated by subtracting the values of the seasonal and trend component from the time series. Remainder values indicate the amount of noise present in the data. Values close to zero indicate that the seasonal and trend components are accurate in describing the time series, whereas larger remainder values indicate the presence of noise.

You can also use the remainder component to identify outliers in the data, which appear as relatively large positive or negative values compared to the other remainder values.

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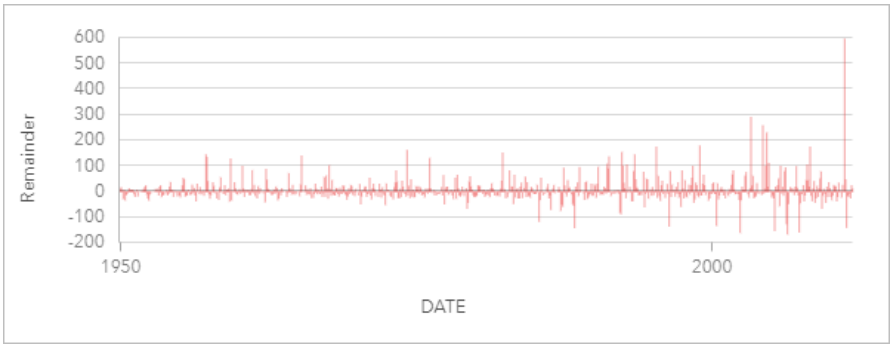
Example

The following example shows the remainder component of an STL analysis using tornado incidents across the United States. The remainder values begin relatively small and become larger in later years, which indicates that the amount of noise in the data increased over time. The plotted remainder values also show a clear outlier in April 2011.



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Present

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Share

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Share your work

When you explore your data in Insights and perform processes like adding new datasets and creating workbooks, items are created that are accessible only to you. Depending on your sharing privileges, you can share these items with others. Some items are created automatically, whereas other items, like Insights model and page items, can only be created through sharing.

The following table provides a description of Insights item types that you can create and share:

Item type	Description
Workbook	A workbook collects or associates all data and analytical activity for a project in a single place, capturing and maintaining relationships such as data locations, and storing result layers, models, pages, and cards. Workbook items can only be opened in Insights. For more information, see Share a workbook.
Workbook package	A workbook package is a file containing all aspects of an Insights workbook. Workbook package items can be used to store, share, and distribute workbook package files. Workbook package items cannot be opened to view the workbook. You must download the workbook package from the item details page, then import the package into Insights. For more information, see Package a workbook.
Model	A model records your analysis steps on a workbook page, including adding and joining datasets, spatial analytics (such as spatial filtering), data analytics (such as attribute aggregation), and styling. You can edit, use, and share a model to automate common analytical tasks. Model items can only be opened in Insights. For more information, see Share a model.
Script	A script item is created by sharing code written or imported into the Insights scripting environment. Script items can only be opened in Insights.
Relational database connection	A relational database connection allows you to view, query, and analyze the contents of databases in Insights. Relational database connection items can only be used in Insights. Connections can only be shared from the home page. For more information, see Share a database connection.
OneDrive connection	OneDrive accounts are specific to each individual user. Therefore, OneDrive connections cannot be shared.
SharePoint connection	A SharePoint connection is used to access files stored in your SharePoint account. SharePoint connection items can only be used in Insights. Connections can only be shared from the home page. For more information, see Share a connection.
Feature Layer	Sharing your data as a feature layer allows others to use your value-added data in their own analysis process. For example, you may want to share data you added from Excel, or results from analytical operations, such as spatial aggregation. Feature layers created from data in Insights can be used in other applications, such as Map Viewer Classic and ArcGIS Pro. For more information, see Share your data.

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Item type	Description
Page	Sharing your page allows others to interact with the cards on your page in a separate read-only Insights viewer. Page items can be viewed in the Insights Page Viewer or embedded in web sites and ArcGIS StoryMaps. For more information, see Share a page.
Theme	Sharing a theme allows you to save and reapply custom settings from your page. Settings that can be saved include background color, text, images and other media, and card placement. Theme items can only be used in Insights. For more information, see Share a theme.

Share items from the home page

Insights items can be shared, unshared, or have the shared status changed from the home page.

Note:
Some Insights content must be shared from within the workbook before it will be available as an item on the home page. Model, script, page, and theme items, as well as some feature layer items, are created through sharing.

Complete the following steps to share an item:

1. If a workbook is open in Insights, save your work and click the **Home** button to return to the home page. If you are signing in to Insights you will be brought to the home page automatically.
2. Click on the tab for the item type you want to share.
3. Find the item you want to share. Use the search bar, filter button, **View items** button, and **Sort** button, if necessary.
4. Do one of the following:
   - Hover over an item. A list of icons appears for the item.
   - Click multiple items to select them. A list of icons appears below the title of the page.
5. Click the **Share** button.
   The **Share with** window opens.
6. For shared page and workbook items, choose whether to allow viewers to export data or images from cards on your page or workbook with the **Enable viewers to export as** parameter. For more information, see View the back of a card.
7. Choose who you want to share the item with. The options are the members of your organization, groups within the organization, or everyone. You can also unshare the item by unselecting the options.
8. Click **Share**.

The item is shared with the chosen users. If you are sharing a page from Insights desktop, a new window will appear giving you the ability to view your shared page, view the page item in your organization, or copy the `<iframe>` to embed the page in ArcGIS StoryMaps or a web page.

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Share your data

Sharing your data is often a necessary step when collaborating with colleagues or communicating the results of your analysis. Sharing your data can include creating a new feature layer from a dataset, such as a result dataset, or updating the shared status of an existing feature layer so that it can be accessed by other Insights users.

Share a dataset

Sharing your data as a feature layer allows others to use your value-added data in their own analysis process. For example, you may want to share data you added from Excel, or results from analytical operations, such as spatial aggregation. Sharing your data will create a new feature layer item.

Note:
You can't share data as feature layers (**Share** is disabled) for the following:

- A database dataset that has more than one location field.
- Remote feature layers.
- Layers that were shared with you. The exception is users with administrator privileges, who can share datasets owned by other members of their organization.

Complete the following steps to share a dataset from ArcGIS Insights:

1. From the data pane, next to the dataset you want to share, click the **Dataset options** button ⋯.
2. Click **Share**.
   The **Share data** window appears.

   Note:
   If **Share** is disabled, the dataset you have selected does not qualify to be shared.

3. Add a description and tags, or change the title of the dataset if desired.
4. Choose who you want to share the dataset with. You can share the dataset with your organization, select groups, or everyone.
5. Click **Share**.

A new Feature Layer item is created.

Note:
Datasets with multiple location fields can only be used in Insights. If you share a dataset with multiple location fields, it will be saved as a feature service with multiple feature layers.

Change the shared status

A Feature Layer item is created when you share a dataset from the Insights data pane, create a new feature layer from the home page, or publish a feature layer to your organization. The shared status of a feature layer item can be changed using the **Share** button for the item on the home page.

For more information, see Share your work.

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Advanced tip

Sharing your data is a way to grant access to your data to other users, but it can also be a way to give yourself access to your data across ArcGIS. When you create result datasets in Insights by performing analysis, the datasets are stored inside your workbook and cannot be accessed through other applications. If you share your dataset, you create a feature layer item. The feature layer can then be opened in Map Viewer Classic, or you can sign in to your organization through ArcGIS Pro to access your feature layer. Sharing your data from Insights can help you connect your Insights analysis across ArcGIS, giving you access to even more capabilities and processes for analyzing your data.

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Share a connection

Data connections are one of the ways to access data in Insights. Database connections and SharePoint connections can be shared to allow you to collaborate with colleagues and share data with other Insights users.

Note:
OneDrive accounts are specific to each individual user. Therefore, OneDrive connections cannot be shared.

Relational database connections

Note:
Database connections cannot be shared through a distributed collaboration. A new connection to the database must be made in each portal to access data.

A relational database connection allows you to view, query, and analyze the contents of databases in Insights. A database connection can be shared so that the tables it stores are available to other members of your organization.

A relational database connection item is created automatically when a database connection is created. You can change the status of the relational database connection item using the **Share** button for the item on the home page.

For more information, see Share your work.

SharePoint connections

A SharePoint connection allows you to access shared content from your Microsoft SharePoint account, including shapefiles, Excel workbooks, and SharePoint files (subsites, document libraries, and lists).

A SharePoint connection item is created automatically when a SharePoint connection is created. You can change the status of the SharePoint connection item using the **Share** button for the item on the home page.

For more information, see Share your work.

See also

See the following topics to learn more about connections:

- Create a database connection
- Create a SharePoint connection
- Create a OneDrive connection
- Supported databases

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Share a page

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Share a page

Shared pages are a read only view of your maps, charts, and tables at the time that your page was shared. Who can view your page will depend on who the page is shared with and how it is distributed. Insights licenses are not required to view a shared page, but the viewer may be required to have an account in your ArcGIS organization.

Share your page

Pages can be shared to create Insights page items. Insights page items can be opened in the interactive Page Viewer.

Follow these steps to share your page:

1. Click the **Share and edit page** button ▾ on the page that you want to share.
2. Click **Share**. The **Share as** window appears.
3. Change **Type** to **Page**.
4. Add a title, description, and additional tags if desired. If you have already shared the page, the fields will be automatically updated for you. You can still edit any of the fields before sharing.
5. For **Enable viewers to export as**, choose which export formats are available to people viewing your page. If enabled, viewers can export compatible cards on the page as a dataset or image.
   For more information, see View the back of a card.
6. Choose who you want to share your page with. You can share the page with your organization, select groups from your organization, or share the page with the public.
7. Click **Share** or **Update**.
   The **Page shared successfully** window appears. You can use the window to view your shared page, view the page item in your ArcGIS organization, copy an iframe code to embed your shared page, or schedule updates to your page.
8. Optional: Configure the iframe for your shared page.
   For more information, see Configure iframes to embed shared pages.
9. Optional: Schedule automatic updates to your shared page, if available.
   For more information, see Schedule updates for shared pages.
10. Close the **Page shared successfully** window.

Once the window is closed, the Insights page item will continue to be available from the **Pages** tab on the home page.

Page items

When you share a page, an Insights Page item is created. When accessed, the page item opens a separate read-only viewer that allows others to interact with cards by making selections and viewing pop-ups.

The Page Viewer can be accessed by anyone with an ArcGIS account, even without an Insights license. Users without an ArcGIS account can also access the Page Viewer to see public pages if they have access to the URL for the item. The Page Viewer is interactive, but does not allow editing functions, such as adding or deleting cards, or performing spatial analysis.

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Who can see your page

Page visibility is based on who the page is shared with and how the page is being viewed. The following chart summarizes who can see a shared page based on the sharing parameters and the viewing method.

Share with:	Page Viewer	<iframe>
None	You, members of your organization with administrator privileges.	ArcGIS StoryMaps: You. Web page: Shared page will not be visible.
Organization	To see a page shared with the organization in the Page Viewer, the following specifications about the user's account must be true: • Any user type applied* • Member of the organization	ArcGIS StoryMaps: To see a page shared with the organization in a story, the following specifications about the user's account must be true: • Any user type applied* • Member of the organization **Note:** The story and Insights page must be made in the same organization for both the page and story to be accessible by the same users. Web page: Shared page will not be visible.
Groups	To see a page shared with specific groups in the Page Viewer, the following specifications about the user's account must be true: • Any user type applied* • Member of the organization and the specified group	ArcGIS StoryMaps: To see a page shared with specific groups in a story, the following specifications about the user's account must be true: • Any user type applied* • Member of the organization and the specified group **Note:** The story and Insights page must be made in the same organization for both the page and story to be accessible by the same users. Web page: Shared page will not be visible.
Everyone	Everyone who can access the items, or who has access to the Page Viewer URL. For Insights in ArcGIS Enterprise users, access may also be limited based on firewalls and other security features.	ArcGIS StoryMaps: All users who can view the story (organization, groups, or public). Web page: All members of the public.

*The Storyteller user type is supported for viewing content in Insights in ArcGIS Enterprise deployments using ArcGIS Enterprise 10.9.1 and Insights in ArcGIS Online.

Change the shared status

Shared pages are saved as Insights Page items. The status of the Page item can be changed using the **Share** button for the item on the home page.

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For more information, see Share your work.

Print your page

Pages can be printed to create reports and handouts. Follow these steps to print your page:

1. Click the **Share and edit page** button ▾ on the page that you want to print.
2. Click **Print**.
3. From the **Print** window, choose the print destination and configure the page to use the correct layout and color options.
4. Click **Print**.

Data on shared pages

Shared pages include a snapshot of the data at the time the shared page was created. Therefore, you must reshare the page to view updates to your datasets or analysis. Data will be displayed live in the following exceptions:

- A cross filter is applied to a card.
- A predefined filter is used on the page.

In situations where pages are displayed live, the data on the page must also be shared to the same viewers who can see the page (for example, the data must be shared publicly when the page is public).

Note:
Shared pages with data from ArcGIS organizations that are secured with web-tier authentication (for example, PKI or IWA) require credentials to view the page, even when shared publicly.

Cross filters

Cross filters are enabled on shared pages for cards that have the **Enable cross filters** button activated.

For more information on cross filters, see Filter data.

Limitations

Selections between link maps and charts may not work properly on shared pages using a snapshot of data. The interactions will work on pages with live data (meaning a cross filter or predefined filter is applied on the page).

Resources

Use the following resources to learn more about sharing pages:

- Schedule updates for shared pages
- Blog: Share your Insights analysis using ArcGIS StoryMaps (https://links.esri.com/insights-story-maps)
- Example story: In search of refuge: Mapping forced displacement from 1951 to 2020 (https://links.esri.com/in-search-of-refuge)
- Example story: Where do they go?: Exploring bird population and migration with ArcGIS Insights (https://links.esri.com/where-do-they-go)
- Administer Insights in ArcGIS Enterprise
- Licensing

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Configure iframes to embed shared pages

You can embed shared Insights pages into HTML code using the `<iframe>` tag. An inline frame (iframe) allows you to embed an HTML document into another document (page). You can configure an iframe in two ways: optimize an iframe to embed in ArcGIS StoryMaps or customize an iframe that can be embedded in websites or other ArcGIS apps.

Configure an iframe

An iframe is generated when you share a page.

Complete the following steps to configure an iframe:

1. Follow the steps to share a page.
2. In the **Page shared successfully** window, under **Embed**, click the **Options** button to display the iframe options. Choose **ArcGIS StoryMaps** or **Custom iFrame**.
3. Under **Size**, open the menu and choose a size.
   For **ArcGIS StoryMaps**, the size options are **Default** and **Custom**. For **Custom iFrame**, the size options are **Small**, **Medium**, **Large**, and **Custom**.
4. Click the **Copy** button to copy the iframe.

You can copy the iframe into HTML code or into an app that supports embedding iframes.

ArcGIS StoryMaps iframes

You can optimize shared pages to embed them in StoryMaps.

The **Embed** block in the story builder has three size options: small, medium, and large. Iframes that are optimized for StoryMaps fill the width of the block. For best results, adjust the size of the **Embed** block and the width of the Insights page as follows:

Embed block size	Maximum Insights page width
Small	Two cards at the default size
Medium	Three cards at the default size
Large	Four cards at the default size

If the size of the Insights page is wider than the **Embed** block, scroll bars appear.

The following iframe sizes are available for ArcGIS StoryMaps iframes:

Size	Dimensions	Description
Default	Width = 100 percent Height = 100 percent	The iframe is sized to fit the default dimensions of an **Embed** block (small, medium, or large) in the story builder.
Custom	Width = 100 percent Height = Height of the cards on the page	The iframe is sized to the width of the **Embed** block (small, medium, or large) and the height of the cards on the Insights page. The height of a custom iframe can be edited and supports both pixels and percentages.

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Custom iframes

Custom iframes can be embedded into most HTML code, including websites and ArcGIS products such as ArcGIS Experience Builder, ArcGIS Dashboards, and ArcGIS Hub.

Note:
It is recommended that you use a single card in a small iframe when embedding Insights content in Experience Builder to optimize viewing on small and medium devices.

The following iframe sizes are available for custom iframes:

Size	Dimensions	Description
Small	Width = 420 pixels Height = 420 pixels	The size of a single map, chart, or table card at the default size. If the shared page is larger than the iframe dimensions, scroll bars appear.
Medium	Width = 830 pixels Height = 830 pixels	The size of four cards at the default size, organized as two rows of two cards. If the shared page is larger than the iframe dimensions, scroll bars appear.
Large (default)	Width = 100 percent Height = 100 percent	The full size of the iframe element in the HTML code.
Custom	Width = Width of the cards on the page Height = Height of the cards on the page	The dimensions of the cards, in pixels, on the page so that the full page is visible with no scroll bars. The height and width of a custom iframe can be edited and supports both pixels and percentages.

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Schedule updates for shared pages

Shared pages show a snapshot of your data and analysis at the time that the page was shared. However, some datasets may be updated regularly with new data or edits to existing data. In these situations, it may be important to update the analysis on your shared page. Updates can be scheduled to take place on an hourly, daily, weekly, or monthly basis. Scheduled updates rerun the analytical processes to incorporate updates to data and update the shared page.

Note:
Scheduled updates incorporate updated data into the existing shared page, rather than resharing the page from your workbook. Therefore, if you make changes to the page in the workbook (for example, creating a new map or editing text), you must reshare the page for those updates to be visible.

Some datasets and cards are not updated in Insights if the source files are edited. The following files and cards must be updated manually rather than scheduling regular updates:

- Uploaded files, such as Excel files, shapefiles, and files from OneDrive and SharePoint connections.
- Cards created through the Insights scripting environment.

Note:
Some processes in Insights consume credits. Credits are consumed each time a qualifying process is run during scheduled updates. Credit consumption should be taken into account when determining how often scheduled updates will occur.

Create a schedule to update a shared page

A schedule can be created when you share a page or applied to a page that was already shared. You must be the page owner to schedule a previously shared page. A schedule can be modified or deleted by the page owner or a member of the organization with Administrator privileges.

Use the following steps to schedule updates to your page:

1. Do one of the following:
   - If your page has not been shared, follow the steps to share your page. In the **Page shared successfully** window, click the **Schedule updates** button .
   - If the page is already shared, find the page item in the **Pages** tab on the home page. Click the **Schedule** button .
2. In the **Schedule updates** window, set your page to update hourly, daily, weekly, or monthly.
3. Click **Apply**.

Scheduling options

A schedule can be created to update your page hourly, daily, weekly, or monthly.

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Note:
An end date and time are required for every schedule. You can schedule updates for up to 100 years in the future.

Time zones are only available in standard time. If you want to schedule your updates based on daylight saving time or summer time, you can subtract one hour from the standard time in your same time zone. For example, to schedule an update for 5:00 a.m. in eastern daylight saving time, set the schedule to update at 4:00 a.m. eastern standard time.

Hourly

An hourly schedule updates once every hour beginning at the designated start time. The date and time that the schedule starts and stops can be edited, as well as the time zone.

- **Time zone**—The time zone used to determine when the schedule runs. The default time zone is Coordinated Universal Time. Other time zones can be selected from the menu. All time zones are based on standard time.
- **Starts on**—The date and time when the scheduled updates should start. By default, the schedule will start at 12:00 a.m. on the current date. You can choose a different start date using the calendar button. The start time can be selected from a menu or entered manually.
- **Ends on**—The date and time when the scheduled updates should end. By default, the schedule will end at 12:00 a.m. on the day after the current date. You can choose a different end date using the calendar button. The end time can be selected from a menu or entered manually.

Daily

A daily schedule updates once per day at a specified time. The time of the update, the date and time that the schedule starts and stops, and the time zone can all be edited.

- Update time (**At** parameter)—The time when the scheduled page will begin to update. By default, the page will update at 12:00 a.m. A different time can be selected from the menu or entered manually.
- **Time zone**—The time zone used to determine when the schedule runs. The default time zone is Coordinated Universal Time. Other time zones can be selected from the menu. All time zones are based on standard time.
- **Starts on**—The date and time when the scheduled updates should start. By default, the schedule will start at 12:00 a.m. on the current date. You can choose a different start date using the calendar button. The start time can be selected from a menu or entered manually.
- **Ends on**—The date and time when the scheduled updates should end. By default, the schedule will end at 12:00 a.m. on the day after the current date. You can choose a different end date using the calendar button. The end time can be selected from a menu or entered manually.

Weekly

A weekly schedule updates one or more times per week on the specified days and time. You can select one or more days (for example, Monday, Wednesday, and Friday). The time of the update, the date and time that the schedule starts and stops, and the time zone can all be edited.

- Day of the week—The days of the week when the schedule will update. You must choose one or more days of the week to create the schedule.
- Update time (**At** parameter)—The time when the scheduled page will begin to update. By default, the page will update at 12:00 a.m. A different time can be selected from the menu or entered manually.

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- **Time zone**—The time zone used to determine when the schedule runs. The default time zone is Coordinated Universal Time. Other time zones can be selected from the menu. All time zones are based on standard time.
- **Starts on**—The date and time when the scheduled updates should start. By default, the schedule will start at 12:00 a.m. on the current date. You can choose a different start date using the calendar button. The start time can be selected from a menu or entered manually.
- **Ends on**—The date and time when the scheduled updates should end. By default, the schedule will end at 12:00 a.m. on the day after the current date. You can choose a different end date using the calendar button. The end time can be selected from a menu or entered manually.

Monthly

A monthly schedule updates one or more times per month on the specified days of the month and time. You can select one or more days of the month (for example, 1 and 15). The time of the update, the date and time that the schedule starts and stops, and the time zone can all be edited.

- Day of the month—The days of the month when the schedule will update. You must choose one or more days of the month to create the schedule. Only days of the month that exist in all months (1 to 28) are available.
- Update time (**At** parameter)—The time when the scheduled page will begin to update. By default, the page will update at 12:00 a.m. A different time can be selected from the menu or entered manually.
- **Time zone**—The time zone used to determine when the schedule runs. The default time zone is Coordinated Universal Time. Other time zones can be selected from the menu. All time zones are based on standard time.
- **Starts on**—The date and time when the scheduled updates should start. By default, the schedule will start at 12:00 a.m. on the current date. You can choose a different start date using the calendar button. The start time can be selected from a menu or entered manually.
- **Ends on**—The date and time when the scheduled updates should end. By default, the schedule will end at 12:00 a.m. on the day after the current date. You can choose a different end date using the calendar button. The end time can be selected from a menu or entered manually.

Active schedules

Shared pages with active schedules update regularly based on the settings used to create the schedule. A schedule is considered active until it is paused or deleted, or the number of failed updates surpasses the maximum number of allowable failures.

There is a maximum number of active schedules allowed per user. If you reach the maximum number of active schedules, you must pause or delete an existing schedule before creating a new one.

The default number of schedules allowed per Insights in ArcGIS Enterprise user is 20, including both Insights pages and ArcGIS Notebooks.

Pause or delete a schedule

You can pause or delete a schedule if updates are no longer required on the page. You can resume a paused schedule manually at a later date, whereas a deleted schedule is removed permanently.

Paused or deleted schedules do not count toward the number of active schedules allowed for a single user or for an organization.

Complete the following steps to pause or delete scheduled updates:

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1. Do one of the following:
   - Follow the steps to share your page. In the **Page shared successfully** window, click the **Schedule updates** button.
   - Find the page item in the **Pages** tab on the home page. Click the **Schedule** button.
2. Click the **Pause** button or the **Delete** button.
   If you delete the schedule, a message appears telling you that the action cannot be undone. Click **OK** to continue and delete the schedule. The **Schedule updates** window closes automatically.
3. If you paused the schedule, click **Apply**.

To resume a paused schedule, repeat the steps and click the **Resume** button.

Viewing a page with scheduled updates

Shared pages will not refresh automatically while they are being viewed, either in the Page Viewer or as an iframe. If a shared page is open when a scheduled or manual update takes place, the page will continue displaying the previous version until an interaction is made with the page, such as clicking on a feature on the map. Once an interaction is made, a window appears indicating there is a newer version available. Click the **Refresh** button to load the updated page. The page will refresh automatically after 30 seconds.

Troubleshooting failed updates

Information about previous updates, including the start and end time and status, is displayed in the **Past updates** tab of the **Schedule updates** window after the first update has taken place.

If a scheduled update fails, the shared page reverts to the latest successful update. If your schedule reaches the maximum number of allowable failures, the updates are paused. You must manually resume the scheduled updates when the issue causing the failures is resolved.

The following issues can cause your scheduled updates to fail or pause your scheduled updates:

- Some processes, such as enabling location by address (geocoding) and using Enrich Data, use credits. If you have scheduled a page that uses a credit-consuming process, credits may be consumed each time you update the page. If your organization does not have enough credits, or if you do not have enough credits assigned to your account to complete the processes, the scheduled update fails.
- Secured services are web services that require credentials for added security. Secure services must have credentials stored with the service item to be compatible with scheduled updates.
- Feature layers from ArcGIS public do not support scheduled updates. Any scheduled updates to pages with ArcGIS public data will fail.

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Share a theme

Themes are collections of settings on your ArcGIS Insights page, including colors, text, media, and card types. Themes can be saved, shared, and applied to new pages. Using themes can help you apply a consistent standard to your Insights pages.

Theme items are stored in your ArcGIS organization but can only be used in Insights.

Share your theme

Themes can be shared to create an **Insights Theme** item.

Complete the following steps to share your theme:

1. Click the **Share and edit page** button .
2. Click **Share**. The **Share as** window appears.
3. Change **Type** to **Theme**.
4. Optionally add a title, a description, and tags. You can update an existing theme shared from the same page by choosing the theme from the **Title** menu.
5. Choose how you want to share your theme. You can share the theme with the public, with your organization, or with select groups from your organization. If you don't make a selection, the theme will only be available to your account.
6. Click **Share** or **Update**.

Change the shared status

Shared themes are saved as items. The status of the item can be changed using the **Share** button for the item on the home page.

For more information, see Share your work.

Apply a theme to your page

A theme that you created and shared or that was shared with you can be applied to your Insights pages. Complete the following steps to apply a theme to your page:

1. Open the **Add to page** window using one of the following options:
   - Create a workbook. The **Add to page** window appears when the workbook is created.
   - Click the **Add to page** button above the data pane in an existing workbook.
   - Create a page in an existing workbook. The **Add to page** window appears when the page is created.
2. Click the **Themes** tab .
3. To add your own theme or a theme from your organization, complete the following steps:
   a. Click the tab for your organization.
   b. Use the menu to switch between **My content**, **My groups**, and **My organization**, if necessary.

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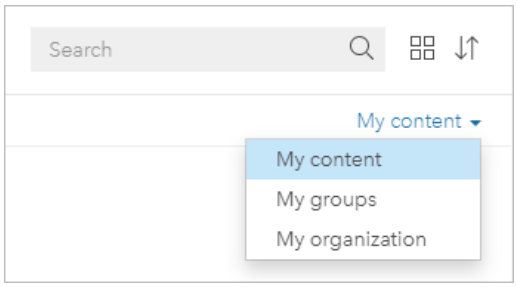

Tip:

If you are unsure where to find the theme, choose **My organization**. All themes from your content and groups are also available from **My organization**.

The available themes are listed in the content pane.

4. To add a publicly shared theme from ArcGIS Online, complete the following steps:
   a. Click the **ArcGIS public** tab.
   b. Use the menu to switch between **Public content** and **Public groups**, if necessary.
      The available themes are listed in the content pane.
5. Optionally click **View details** if you want more information about a theme in the list, such as a description.
6. Choose the theme and click **Add**.
   The theme is applied to your page.

For more information about the placement of cards when a theme is applied, see Placeholder cards.

Resources

Use the following resources to learn more about themes:

- Customize your page
- Add text and media

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Share a model

A model is a visual recording of the steps in your analysis. In Insights, models are created automatically as you work, so you can focus on exploring your data and performing analysis, rather than creating a model.

Access and share your model

A model records your analysis steps on a workbook page, including adding and joining datasets, spatial analytics (such as spatial filtering), data analytics (such as attribute aggregation), and styling. You can edit, use, and share a model to automate common analytical tasks. Models can be viewed by clicking the **Analysis view** button.

Complete the following steps to share your model:

1. Click the **Share and edit page** button on the page that you want to share.
2. Click **Share**. The **Share as** window appears.
3. Change **Type** to **Model**.
4. Provide a title, description, and tags for your model.
5. Choose who you want to share the model with. You can share your model with your organization, certain groups, or everyone.
6. Click **Share**.

Once your model has been shared, an Insights model item is created. The Insights model item can be accessed to rerun the analysis.

Note:
Any member of an organization with Administrator privileges will be able to access all models created by members of the organization whether they have been shared or not.

Change the shared status

Shared models are saved as Insights model items. The status of the model item can be changed using the **Share** button for the item on the home page.

For more information, see Share your work.

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Share a workbook

Insights workbooks can be used to share your analysis with your colleagues. You can share your workbooks with groups, your organization, or the public. You can also access workbooks that have been shared with you from the **Workbooks** tab on the home page or through the **Gallery** in your ArcGIS organization.

Note:
Users with Administrator privileges will have access to all workbooks created within their organization, regardless of whether or not the workbook is shared.

Share your workbook

A workbook item is created automatically when a new workbook is created. The status of the Workbook item can be changed using the **Share** button for the item on the home page.

Note:
When you share a workbook, you are providing read-only access to those with whom you share it. You will still have full editing access for workbooks you created.

For more information, see Share your work.

Use shared workbooks

Workbooks that were created by other users and shared with you can be opened in viewer mode with capabilities to explore the data, but not edit any aspects of the workbook, including performing analysis or adding and deleting cards.

If you want to edit a workbook created and shared by another user, you can make a copy using the **Duplicate** button for the item on the **Workbooks** tab of the home page. You will have full editing privileges for any workbook you duplicate.

Note:
Workbooks shared through a distributed collaboration cannot be duplicated.

Sharing from Insights desktop

When a workbook is shared in Insights desktop, an Insights workbook item is created in the ArcGIS organization used for the primary connection. The workbook can be opened and edited in the hosting ArcGIS organization by the workbook owner and viewed by other users with access to the shared workbook.

Shared workbooks from Insights desktop include a snapshot of the data at the time the shared page was created. Therefore, you must reshare the page to view updates to your datasets or analysis. Data will be displayed live in the following exceptions:

- A cross filter is applied to the card.
- A predefined filter is used on the page.

If you are sharing workbooks with database tables from Insights desktop to Insights in ArcGIS Enterprise, you may have to map your database connections.

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Editing the original workbook in Insights desktop will not automatically update the shared workbook item. The workbook must be reshared from Insights desktop to update the item. Updating the item will overwrite any saved changes made to the workbook in Insights in ArcGIS Online or Insights in ArcGIS Enterprise. Therefore, it is best practice to duplicate your shared workbook to make a separate copy if you plan to make changes to both the original workbook and the shared workbook.

Changes made to the shared workbook cannot be shared back to the original workbook in Insights desktop.

Data in shared workbooks

When a workbook is shared, it is best practice to also share all the feature layers used in the workbook so that the entire analysis is accessible to everyone using the workbook.

When you open a workbook that has been shared with you, the following datasets will be visible:

- Public data, such as ArcGIS Living Atlas layers
- All result datasets
- All datasets that you own
- All Excel input datasets
- All database datasets
- Input feature layers that have been shared with everyone, your organization, or groups of which you are a member.

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Share a script

Scripts can be shared to create Insights script items. Script items can be opened in the Insights scripting environment.

Share your script

Complete the following steps to share your script:

1. Expand the **Scripts** heading in the data pane, if necessary.
2. Click the **Dataset options** button ··· for the script you want to share.
3. Click **Share**.
   The **Share script** window appears.
4. Provide a title, description, and tags for your script.
5. Choose who you want to share the script with. You can share your script with your organization, certain groups, or everyone.
6. Click **Share**.

An Insights script item is created. The script item can be opened from the **Models** tab on the home page, or from the **Scripts** tab in the **Add to page** window.

Open a script in your workbook

A script item can be opened and added to your data pane. Use the following steps to open a script item in your workbook:

1. Open the **Add to page** window using one of the following options:
   - Create a workbook. The **Add to page** window appears when the workbook is created.
   - Click the **Add to page** button above the data pane in an existing workbook.
   - Create a page in an existing workbook. The **Add to page** window appears when the page is created.
2. Click the **Scripts** tab.
3. If you created the script, continue on the **Contents** tab. If the script was shared with you, click **Groups** or **Organization**.
   The available scripts are listed in the content pane.
4. Optionally click **View details** if you want more information about a script in the list, such as a description.
5. Choose the script and click **Add**.
   The script is added to the data pane.

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Customize

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Manage pages

Insights workbooks contain one or more pages you can use to organize your analysis.

Share and edit pages

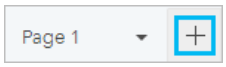
You can access the options to share and edit a page using the **Share and edit page** button ▾ on the tab for the active page.

The following options are available on the menu:

- **Delete**
- **Duplicate**
- **Rename**
- Print
- **Share** (allows you to share the page, model, or theme)
- Refresh

Tip:

You can also duplicate a page by dragging a page tab and dropping it on the **New page** button.



Create pages

Use one of the following options to create a new page in your workbook:

- Click the **New page** button +.
- Drag a dataset or card and drop it on the **New page** button +. The dataset or card is copied onto the new page.

The **Add to page** pane appears when a page is created, allowing you to add the data, themes, or models that are required for your analysis.

You can create unlimited pages in an Insights workbook. If you create more pages than can fit on the toolbar, the **More pages** button » appears. Use the **More pages** button to browse to any page in the workbook.

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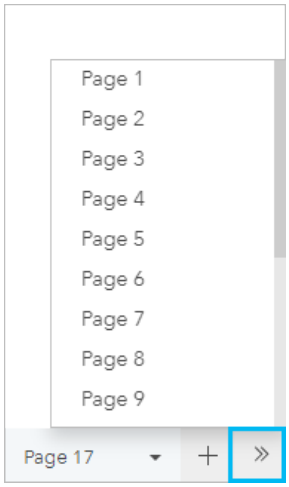

Reorder pages

You can reorder your pages by dragging the page tab and dropping it in a different position.

Resources

See the following resources for more information:

- Customize your page
- Share a page
- Share a model
- Share a theme
- Manage workbooks

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Customize your page

An ArcGIS Insights page can be customized using a combination of colors, font sizes, images, and other settings to help you present your data and analysis effectively. You can customize the page using company colors and logos to make sure that you are communicating your analysis consistently with your company standards.

Overview

Each page that you create will be customized for individual purposes. Therefore, the settings that you use will be different depending on what you are trying to communicate. The following steps provide a generalized workflow for creating a page with all the settings. You may choose to skip or modify steps based on which settings are relevant for your project.

1. Make sure you are looking at Insights in **Page view**, rather than **Analysis view** (**Page view** is the default).
2. Click the **Page options** button to display the **Page options** pane.
   a. Use the **Colors** tab to change the page background color, card background color, and foreground color for the full page.

      Note:
      The background color will not be included on a printed page to limit the amount of ink used. If you want your printed page to have a certain background color, you should use colored paper for printing.

   b. Use the **Card borders** tab to change the color, width, and style of the card borders for the full page.
   c. Use the **Fonts** tab to change the font style for the titles and axis labels for all applicable cards on the page.
   d. Use the **Apply to all pages** button to apply the settings from the current tab to all current and future pages in the workbook. Use the **Reset** button to revert the settings for the tab to the default.

   Note:
   The card settings are applied to all cards on the page, as well as any cards created after the settings are applied.

3. Click the **Widgets** button and choose **Text and media** from the menu to add a text and media card to the page. Use the **Card options** button to access more options for the card.
   a. Click the **Appearance** button to change the font size, text alignment, colors, border, and other properties.
   b. If you want to add media, click the **Media options** button. You can embed media from a URL or browse to an image on your computer.
4. Resize and move the cards around your page so that they are displayed in a way that is easy to understand. If your cards do not fit on the page, click the **Zoom in** button and **Zoom out** button to adjust them.
5. For overlapping cards, change the order by clicking the **Card options** button then clicking the **Order** button to display the options for bringing the card forward or sending it backward.

Now that you've created your Insights page, you can print the page, share the page, or share the theme.

Themes

If you want to reuse the customized settings or share them with other members of your organization, you can share the settings as a theme. Themes save the page settings and placeholders for all the cards used on your page with

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the card settings applied. Optionally you can embed text, such as a commonly used title, and images, like your company logo. Other content, such as data or models, is not saved with a theme.

Text and media

To save text and media with the theme, activate the text and media card with the content you'd like to embed. Click the **Include with Theme** button. The content on the card will be saved when the theme is shared.

Note:
By default, the content is not shared with a theme unless you have explicitly chosen to include it.

If you change your mind and decide not to include the content with the theme, click the **Do not include with Theme** button. You can also reshare your theme to update the setting.

Apply a theme

To apply a theme, click the **Add to page** button above the data pane. Navigate to the **Themes** tab, select your theme, and click add. Your page will then be updated with the applied settings in the theme.

Note:
Only one theme can be applied to a page at a time.

Placeholder cards

When a theme is applied to a page, the settings, including position, are applied to the cards on the page. Cards from your page will be placed in the position of cards of the same type when possible. The cards will be placed using the following system:

- If the theme and your page both have two maps and two charts, then the maps and charts will be moved to the corresponding placements from the theme in the order they are found on your page.
- If your page does not have all of the same card types, then the cards of the same type will be placed first and the extra cards will be placed in the position of the remaining card.
- If your page has fewer cards than the theme, then a placeholder card will be added in the placement specified in the theme.
- If your page contains more cards than the theme, then your cards will be placed as described above and the remaining cards will be placed at the bottom of the page.

If your page has unused placeholder cards, you can replace them with any card type. The exception is a text and media placeholder card, which can only be filled with text and media. To create a card on a placeholder, activate the placeholder card and drag the fields to the drop zones. Alternatively, you can use the buttons above the data pane. You can remove a placeholder card from the page using the **Delete** button.

Note:
If you share a page with a placeholder card, a blank card will appear in the Page Viewer. It is best practice to remove the placeholder card before sharing your page.

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Customize your banner and logo

You can customize the Insights workbook banner and logo to match the branding of your report or company. The customized banner and logo will also be used on a shared page and shared workbook.

Customize banner

You can customize the banner by changing the title text and icon color, changing the banner color, and uploading a banner image.

Tip:

You can configure the banner with both a banner color and banner image. The banner color will be visible if the image does not fill the width of the banner or if the banner image includes transparency.

Banner and title color

Complete the following steps to change the banner and title color:

1. On the workbook banner, click the **Style workbook banner** button .
2. From the menu, choose **Customize banner**.
   The **Customize banner** window appears.
3. On the **Color** tab, click the drop-down arrow for **Title color** and **Banner color** and choose a color from the palette or enter a hex value.
   The default title and banner colors (white and blue, respectively) are also available below the color palettes.
4. Click **Apply** to apply the changes or **Reset** to return to the default banner and title colors.

Banner image

Complete the following steps to add a banner image:

1. On the workbook banner, click the **Style workbook banner** button .
2. From the menu, choose **Customize banner**.
   The **Customize banner** window appears.
3. Click the **Image** tab.
4. Open an image to use as your banner.
   The image must be a PNG, JPEG, or GIF format.
5. Choose an image alignment:
   - **Align left** (default)—The image is left justified. If the image does not fill the full banner, the banner color will appear to the right of the image.
   - **Align center**—The image is center justified. If the image does not fill the full banner, the banner color will appear to the left and right of the image.
   - **Align right**—The image is right justified. If the image does not fill the full banner, the banner color will appear to the left of the image.
   - **Horizontal fill**—The image is stretched or compressed to fill the full width of the banner. **Horizontal fill** may result in distortion for images that are not the same width as the browser window.

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- **Repeat** —The image is repeated to fill the full width of the banner.

6. Click **Apply** to apply the changes or **Reset** to remove the image.

Customize logo

You can customize the logo by changing the image. Complete the following steps to customize the logo:

1. On the workbook banner, click the **Style workbook banner** button .
2. From the menu, choose **Customize logo**.
   The **Customize logo** window appears.
3. Click the **Edit logo** button and choose **Change**.
4. Open an image to use as your logo.
   The image must be a PNG, JPEG, or GIF format.
5. Optionally, click the **Square** button to change the shape of the logo from circular to square.
6. Use the slider to resize the image and drag the image to reposition it within the circle or square, if necessary.
7. Click **Apply** to apply the changes or close the window to exit without applying the changes.

To reset the logo to the default Insights logo, click the **Edit logo** button and choose **Reset**.

Image requirements

For best results, use the following requirements and recommendations for logo images:

- PNG, JPEG, or GIF format
- Recommended size of 100x100 pixels or larger
- Maximum file size of 5 MB

For best results, use the following requirements and recommendations for banner images:

- PNG, JPEG, or GIF format
- Recommended height of 60 pixels or larger. For banner images that are expected to fill the width of the browser window, a minimum width of 1440 pixels is recommended.
- Maximum file size of 5 MB

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Add text and media

Text and media can give necessary context to your analysis and help communicate your results more effectively. Text can come in the form of titles, headings, paragraphs, or lists. Media includes hyperlinks, videos, and images.

Tip:

You can copy a text and media card onto another page by dragging it to the **New page** tab or an already created page. If you want to copy the card onto the same page, use `Ctrl+C` to copy and `Ctrl+V` to paste.

Add text

To add text to your page, complete the following steps:

1. Click the drop-down menu under the **Widget** button in the data pane and choose **Text and media**. A blank text and media card is added to your page.

   Note:
   You may need to scroll down to see the new card.

2. With the card activated, click near the top of the card where your text will appear.
3. Add your text to the card.

Change the text options

Once you have created a card with text, you will need to use the text options to customize your text and the text card.

To change your text options, complete the following steps:

1. Activate the card with text on it. The card is active when the edges are resizable.
2. Click the **Card options** button ···.
3. Click the **Appearance** button. The **Appearance** pane opens on the **Font options** tab.
4. Highlight the text on the card, and use the **Font** parameters to change the font, including the font face type, size, color, bold, italics, superscript, and subscript.
5. Use the **Alignment** and **List** parameters to format your text as necessary.
6. Click the **Color options** tab. The **Background color** parameter is displayed.
7. Expand the background color palette and choose a color, either on the palette or using the hex code, or change the transparency of the card. Click the no fill button next to the hex code box to remove the background.
8. Click to the **Border options** tab.
9. Use the pane to change the **Border color**, **Border width**, and **Border style**. The border style **None** will remove the border.
10. Close the **Appearance** pane using the close dialog button ×.
11. Drag the corners and edges to resize the card so that the text fits appropriately.

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Add a hyperlink

A hyperlink can be used to link your page to external web pages, such as your company web page. To add a hyperlink, you must already have a text and media card on the page.

To add a hyperlink to your text, complete the following steps:

1. Click the **Media options** button. The **Text and media options** pane opens to the **URL** tab.
2. Highlight the text you want to display and click **Add Hyperlink**.
3. Type or copy and paste the URL of the web page that you want to link to in the **Enter URL** text box.
4. Click **Save**.

Once the link is embedded, you can click the hyperlinked text to edit or remove the link.

Add an image

Images, such as logos and diagrams, can be added to your page to make communication more effective and to comply with branding guidelines.

Note:
For Insights in ArcGIS Enterprise, images cannot exceed 5 MB.

The following image formats are supported:

- PNG
- JPEG
- GIF
- SVG
- BMP

To add an image to your page, complete the following steps:

1. Click the drop-down menu under the **Widget** button in the data pane and choose **Text and media**. A blank text and media card is added to your page.

   Note:
   You may need to scroll down to see the new card.

2. Click the **Card options** button.
3. Click the **Media options** button. The **Text and media options** pane appears.
4. Click on the **Image** tab.
5. Click the **Browse my computer** button. Browse to and open the image. Alternatively, you can type or paste a URL to an image on the web.
6. Click **Apply** and close the **Text and media options** pane.
7. If necessary, click the **Appearance** button to change the background color and border style of the card. The background and borders can be removed by setting the background to no fill and the border to **None**.

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8. Click the image to activate it. An activated image can be resized or the placement can be changed.
9. Drag the corners and edges to resize the card so that the image fits appropriately.

Add a video

Videos can be used to provide context or introduce concepts in your analysis.

To add a video to your page, complete the following steps:

1. Click the drop-down menu under the **Widget** button in the data pane and choose **Text and media**. A blank text and media card is added to your page.

   Note:
   You may need to scroll down to see the new card.

2. Click the **Card options** button ···.
3. Click the **Media options** button. The **Text and media options** pane appears.
4. Click on the **Video** tab.
5. Enter or paste the URL for the video in the **URL** box and click **Apply**. The URL must be in a format that can be used in an `<iframe>`, such as `https://www.videoplatform.com/embed/videoID`. For example, a video with the URL `https://www.youtube.com/watch?v=IofLgPAN7X8` could be embedded as `https://www.youtube.com/embed/IofLgPAN7X8`.
6. Close the **Text and media options** pane.
7. If necessary, click the **Appearance** button to change the background color and border style of the card. The background and borders can be removed by setting the background to no fill and the border to **None**.
8. Drag the corners and edges to resize the card so that the video fits appropriately.

Copy a text and media card

A text and media card can be duplicated on a page by activating the card (a text and media card is active when the toolbar is visible) and using `Ctrl+C` to copy the card and `Ctrl+V` to paste it on the page.

A text and media card can be copied to a different page by dragging the card to the **New page** tab or to an existing page. All of the text and media from the card will also be copied.

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Add a predefined filter

Predefined filters can be added to your ArcGIS Insights page and used as part of your shared page. Predefined filters allow some of the functionality of filters to be accessed on a shared page, including by users who do not have an Insights license.

Note:
A predefined filter acts like a dataset filter, meaning that it will be applied to all cards using the filtered dataset, rather than an individual card.

Predefined filters are not supported for some remote datasets. You can copy the dataset to your workbook to access predefined filter functionality for remote datasets. For more information, see Feature layers.

Add a predefined filter card

Predefined filters are stored on cards on your Insights page. To add a predefined filter card, complete the following steps:

1. Click the **Widget** button on the workbook toolbar and choose **Predefined filter**.
2. Click the **Add** button to create a new filter.
3. Click **Choose a field** to expand the drop-down list with field names.

   Tip:
   Use the search box or sort button to find the fields, if necessary.

4. Choose a field from the list.
5. Apply the filter parameters that you want available on your shared page. For more information, see Filter data.
6. Click **Apply**, By group, or By value to add the filter.

You can change the background and border for a predefined filter card by clicking the **Card options** button and the **Appearance** button to open the **Appearance** pane. Hover your mouse pointer over the filter to display the **Rename filter** button, **Edit filter** button, and **Remove filter** button. You can also remove the predefined filter title using the **Hide** button.

Predefined filter options

Predefined filters have options for how the filters are added and how selections are made on the filter.

Add filters by group

A group of filters can be used to add a single filter for multiple categorical values from a string field. For example, if you have a dataset of world countries, you can create a single filter for the United Kingdom that includes Northern Ireland, Scotland, England, and Wales by selecting only those four countries and adding them to the predefined filter card using the **By group** button. A single filter will be added to the card, labeled with the field name (for example, `CountryName`). The filter can be renamed to better describe the group using the **Rename filter** button.

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Add filter by value

Individual categorical values from a string field can be added to the predefined filter card using the **By value** button. You can use the **By value** button to add a single value, multiple values, or all of the values from the field. Each value selected will be added to the card as an individual filter value.

Selection properties

A predefined filter can be created in a drop-down menu, single-select, or multiselect format. A drop-down filter allows you to select a single value from a menu of options. A single-select filter allows you to turn on a single value at a time. If a different value is selected, the first value will be unselected. A multiselect filter allows you to select more than one value at once.

Multiselect filters have an additional **When no filters are selected** parameter, which allows you to choose the functionality when no values are selected. If **Show all features** is chosen (default), deselecting all filter values will cause all features to appear on the cards, as if there were no filter on the page. If **Show no features** is chosen, deselecting all filter values will filter out all data and cause your cards to appear empty.

Use the following steps to change the selection properties for a predefined filter:

1. Click the **Card options** button ··· on the predefined filter card to display the side toolbar.
2. Click the **Appearance** button .
   The **Appearance** pane appears.
3. Click the **Selection properties** tab .
4. Click **Drop-down**, **Single select**, or **Multi select** to choose the selection type.
5. If **Multi select** is chosen, choose how you want the filter to behave when no values are selected by clicking **Show all features** or **Show no features**.
6. Close the **Appearance** pane.

Add multiple filters

There are two ways to add multiple predefined filters to a page: adding multiple filters on the same card and adding multiple predefined filter cards.

Multiple filters on the same card

Multiple filters can be added to a predefined filter card. When there are multiple filters on the same card, the filters are joined with an OR clause, meaning all the filters will be displayed individually on the page.

To create multiple filters on the same card, repeat steps 2 to 6 from Add a predefined filter card or use the By value button to add multiple values at once.

Multiple predefined filter cards

An Insights page can include more than one predefined filter card. When there are multiple predefined filter cards for a single dataset on a page, the filters are joined with an AND clause, meaning only features that meet all the criteria from each filter card will be displayed on the page.

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Add a temporal filter

You can add a temporal filter to an ArcGIS Insights page and use it as part of a shared page. Temporal filters enable date- and time-based filters to be accessed on a shared page, including by users who do not have an Insights license.

Note:
A temporal filter acts like a dataset filter, meaning that it will be applied to all cards using the filtered dataset, rather than an individual card.

Add a temporal filter card

You can add temporal filters as cards on an Insights page. To add a temporal filter card, complete the following steps:

1. Click the **Widget** button on the workbook toolbar, and choose **Temporal filter**.
2. Click **Choose a field** to expand the drop-down list with field names.
   Only date/time fields are available.

   Tip:
   Use the search box or sort button to find the fields, if necessary.

3. Choose a field from the list.
4. Click the **Filter options** button.
5. From the menu, choose **Date only**, **Time only**, or **Date and time**.

   Note:
   The options in the menu depend on the data in the date/time field. For more information, see Filter options.

6. On the second menu, choose whether to configure the filter for a single value or for a range of values:
   - For **Date only**, choose **Date** or **Date range**.
   - For **Time only**, choose **Time** or **Time range**.
   - For **Date and time**, choose **Date and time** or **Date and time range**.
7. Optionally, use the following steps to change the **Widget settings**:
   a. On the temporal filter header, click the **Card options** button.
   b. From the menu, click the **Appearance** button.
   c. Click the **Widget settings** tab.
   d. Choose settings for the temporal filter from **Widget options** and **Layout options**.

   For more information, see Widget settings.
8. Configure the filter to the correct date, time, or range:
   - To change the date, click the calendar button and use the calendar or slider to choose a date. If the filter is for a date range, you will have to set both a start date and an end date.

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- To change the time, click the clock button and use the menu or slider to choose a time. If the filter is for a time range, you will have to set both a start time and an end time.

Note:
If the layout is set to **Expanded**, the calendar or slider will be available without clicking the calendar or clock buttons.

Filter options

You can configure a temporal filter for dates only, times only, or dates and times. For each option, you can also choose to configure a single date or time or a date or time range.

Date

Note:
Date filters are only available for date/time fields that include date values. If the date/time field only contains time, the only option will be **Time only**.

You can configure date filters for dates only or for date and time. If you are configuring a filter for date and time, you must also configure the time filter.

A single date filter shows a snapshot of data with the same date value. If your filter is for a date and time, you will configure both a single date and a single time.

A date range filter shows all of the data that falls within the specified start and end date values. If your filter is for date and time, you will configure the start and end values with both dates and times.

Time

Note:
Time filters are only available for date/time fields that include time values. The **Time only** option is only available for date/time fields that include time values but not dates.

You can configure time filters for time only or for date and time. If you are configuring a filter for date and time, you must also configure the date filter.

A single time filter shows a snapshot of data with the same time value. If your filter is for a date and time, you will configure both a single date and a single time.

A time range filter shows all of the data that falls within the specified start and end time values. If your filter is for date and time, you will configure the start and end values with both dates and times.

Widget settings

The widget settings are used to change the way dates and times are configured and the layout of the filter.

The following widget options are available for configuring dates and times:

- **Calendar**—The filter date or start and end date are chosen from a calendar, including the day, month, and year. This option is the default for filtering dates and is not available in **Time only** filters.

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- **List**—The filter time or start and end time are chosen from a list of times in 15-minute increments. A custom time can also be typed into the filter. This option is the default for filtering times and is not available in **Date only** filters.
- **Slider**—The filter date or time, or the start and end dates or times are chosen by adjusting a slider. This option is available for **Date only** and **Time only** filters.

Note:
Widget options are not available for **Date and time** filters. The default widget options (**Calendar** and **List**) are always used for **Date and time**.

The following layout options are available for temporal filters with a calendar or slider:

- **Collapsed** (default)—The calendar or slider is only visible when you click the calendar or clock button.
- **Expanded**—The calendar or slider is visible permanently on the time widget.

Note:
Layout options are not available for the **List** option. The list of times will always remain collapsed until you click the clock button.

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Add a legend

A legend is a way for a person viewing a map to discern meaning from the symbols on a map or the colors used on a chart. In Insights, a legend can also be used to make selections on a card or change the color of a symbol.

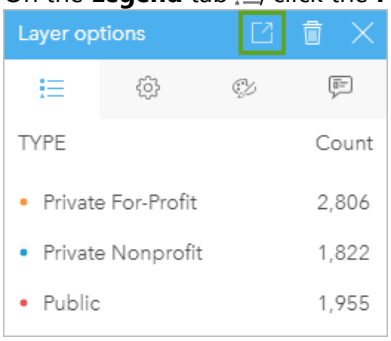
A legend card that has been added to the page will be grouped with the corresponding map or chart card. Therefore, moving the map or chart also moves the legend. The legend is also updated automatically when changes are made to the map or chart, such as color or symbol changes.

Add a map legend

Legends are available for all map types except link maps.

To add a legend for a map, use the following steps:

1. If necessary, click the **Layer options** button on the map toolbar to display the map layers.
2. Expand a layer to view the **Layer options** pane.
3. On the **Legend** tab, click the **Pop out legend** button.



A legend card is added to the page.

Note:
If your map contains more than one layer, you'll need to add a legend for each layer individually.

Add a chart legend

Legends are available for charts except link charts, KPI cards, and histograms.

Note:
Legends on chart cards can display up to 100 unique values. If your chart has more than 100 unique values, a warning will be displayed at the bottom of the legend indicating that not all values are displayed. Filters and predefined filters can be used to reduce the number of unique values on the chart.

To add a legend for a chart, use the following steps:

1. Click the **Layer options** button on the chart toolbar to display the **Layer options** pane.
2. Click the **Legend** tab, if necessary.
3. Click the **Pop out legend** button.

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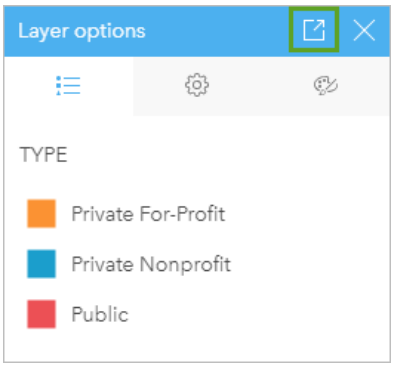

A legend card is added to the page.

Change the legend style

Legends can be styled to give the legend the correct appearance for your maps and charts.

To change your legend, complete the following steps:

1. Click the **Card options** button ⋯.
2. Click the **Appearance** button.
   The **Appearance** pane appears on the **Color options** tab.
3. Expand the background color palette and choose a color, either on the palette or using the hex code, or change the transparency of the card. Click the no fill button next to the hex code box to remove the background.
4. Click the **Border options** tab.
5. In the pane, change the **Border color**, **Border width**, and **Border style** options. The border style **None** removes the border.
6. Click the **Legend options** tab.
7. Change the label position in relation to the symbol icon, or hide or show the count on the legend.
8. Click the close button to close the **Appearance** pane.
9. Drag the corners and edges to resize the card so that the legend fits appropriately.
10. Click the legend title to make it editable. Type a new legend title and hit Enter. You can also remove the legend title using the **Hide** button.
11. Use the handles on the edges of the card to resize the legend. The legend can be adjusted lengthwise to show more or fewer rows. The legend can also be adjusted widthwise. If the width is increased, more columns will be used to display the legend entries. If the width is reduced, fewer columns will be used until only one column of entries is visible.

Note:

The **Legend options** tab, legend header and title, and multiple columns are not available in legends for point charts.

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Collaborate

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Package a workbook

A workbook package is an exportable file containing all aspects of an Insights workbook. All pages, data, models, and themes are included in the package exactly as they appear in the original workbook.

A packaged workbook is saved as a `.insightswbk` file, which can be distributed and imported to other Insights deployments.

Create a workbook package

A workbook package can be created by the workbook owner. If a workbook was shared with you, you must duplicate the workbook first before creating the package.

Complete the following steps to create a workbook package:

1. If a workbook is open in Insights, save your work and click the **Home** button to return to the home page. If you are launching Insights you will be brought to the home page automatically.
2. Click the **Workbooks** tab to view your saved workbooks.
3. Find the workbook you want to package. Use the search bar, filter button, and **Sort** button, if necessary.
4. Hover over the workbook. A list of icons appears.
5. Click the **Export** button.
6. If your workbook contains data from a connection, the **Packaging method** window appears. Complete the following steps:
   a. Choose **Reference data** or **Copy data**.
   b. Click **OK**.

   For more information on packaging methods, expand **Additional information** or see Packaging methods.

The package is downloaded in your browser's default download folder. If you are using Insights desktop, a window opens for you to navigate your folders and choose a location to save your workbook package.

Import a workbook package

Complete the following steps to import a workbook package:

1. If a workbook is open in Insights, save your work and click the **Home** button to return to the home page. If you are launching Insights you will be brought to the home page automatically.
2. Click the **Workbooks** tab.
3. Click the **Import** button.
4. Navigate to the saved workbook package (`.insightswbk`) you want to import, select the package, and click **Open**.

A workbook is created and can be opened from the **Workbooks** tab. If you are importing a package that contains database tables that were packaged by reference, you may have to map your database connections.

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Note:
An error will occur if a workbook package containing database connections is imported into Insights in ArcGIS Online, or if a database connection using OS authentication is imported in Insights desktop for macOS.

Workbooks containing cards and scripts from the Insights scripting environment can be imported into Insights in ArcGIS Online, but the scripts cannot be opened or run.

Packaging methods

There are two options for packaging workbooks containing connections: reference the data from the connection or copy the data to the workbook before creating the package.

Note:
Datasets that require you to choose a packaging method include data from a database connection and remote feature layers, including ArcGIS Living Atlas datasets.

If data is packaged by reference, the equivalent dataset or connection must be available in the Insights account where the package is imported. Workbooks containing database datasets and packaged by reference cannot be imported into Insights in ArcGIS Online.

Data can also be copied to the workbook before being packaged. Workbooks packaged with copied data can be imported into any Insights account. However, any updates to the original datasets or database tables will not be reflected in the imported workbook.

The following table summarizes different functions of workbook packages and whether they are supported when data is referenced or copied:

Function	Specifications	Packaged with reference data	Package with copied data
Live updates from the original dataset (when applicable)	Not applicable	Yes	No
Import into Insights in ArcGIS Online	Workbook containing database tables	No	Yes
	Workbooks containing remote feature layers	Yes	Yes
	Workbooks containing cards from the scripting environment	Yes — The script cannot be opened or run, but existing cards in the workbook will be visible.	

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Function	Specifications	Packaged with reference data	Package with copied data
Import into Insights in ArcGIS Enterprise	Workbook containing database tables	Yes — The database connection must be available in the organization where the package is imported for the data to display on the cards correctly.	Yes
	Workbooks containing remote feature layers	Yes	Yes
Import into Insights desktop	Workbook containing database tables	Yes — The database connection must be available in Insights desktop for the data to display on the cards correctly. Databases with OS authentication are not supported in Insights desktop for macOS.	Yes
	Workbooks containing remote feature layers	Yes — You must be signed in to an organization with access to the remote feature layer.	Yes

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Map database connections

Shared pages and workbooks from Insights desktop and workbook packages can contain references to database tables. A connection to the same database must be available in the destination Insights account for the page or workbook to display correctly. In some cases you will be required to map your connection in the destination Insights account.

You will not need to map connections if the destination Insights account includes a similar connection to the one used to share the page or package the workbook. Connections are considered similar when they use the same database with the same username. Otherwise, the connection must be mapped.

Note:
Oracle databases using TNS have different file paths on Windows, Linux, and macOS. If your shared page, workbook, or workbook package references an Oracle connection using TNS and is being shared between different operating systems, then you will need to edit the **TNS file path** parameter for the connection even though the connections in both deployment reference the same Oracle database. The **TNS alias** is not editable and must match on both deployments.

Map connections when sharing a page or workbook

Shared pages and workbooks usually contain a snapshot of the data and layout at the time the item was shared. However, shared pages and workbooks with cross filters and predefined filters contain live data. When a page or workbook with live data from a database connection is shared from Insights desktop to Insights in ArcGIS Enterprise, the database connections in Insights in ArcGIS Enterprise are used to view the data. If the database connection is not available in your Insights in ArcGIS Enterprise account, the connections must be mapped so that the correct credentials are available when the page is viewed.

Note:
Pages and workbooks shared from Insights desktop to Insights in ArcGIS Online always require database datasets to be copied, rather than referenced.

Use the following steps to map the database connections on a shared page or workbook:

1. Follow the steps to share your page or share a workbook to an ArcGIS Enterprise portal and click **Share**.

   Note:
   The page is shared to your primary ArcGIS connection.

   If there are database connections that must be mapped, the **Map connections** window appears.
2. Click the **Connect** button next to a connection name. If the **Connect** button is disabled, the connection does not need to be mapped.
3. Enter your password for the database connection. The username will be populated automatically.
4. Click **Add**.
5. Repeat steps 2 through 4 for all unmapped database connections.
6. Click **Apply**.

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The connections are mapped and the connection is created in ArcGIS Enterprise. The data can be displayed when the page or workbook is viewed in Insights in ArcGIS Enterprise.

Map connections when importing a package

Workbooks containing database datasets can be packaged by referencing the data or by copying the data. A package with referenced data requires access to the same database when imported into Insights desktop or Insights in ArcGIS Enterprise. If the database cannot be found using the database name and username then the connection has to be mapped before the package can finish importing.

Note:
Packages with referenced database datasets cannot be imported into Insights in ArcGIS Online.

Use the following steps to map the database connections for a workbook package:

1. Follow the steps to import a workbook package.
   If there are database connections that must be mapped, the **Map connections** window appears.
2. Click the **Connect** button next to a connection name. If the **Connect** button is disabled, the connection does not need to be mapped.
3. Enter your password for the database connection. The username will be populated automatically.
4. Click **Add**.
5. Repeat steps 2 through 4 for all unmapped database connections.
6. Click **Apply**.

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Distributed collaboration

Note:
Distributed collaboration is available for Insights in ArcGIS Enterprise and Insights in ArcGIS Online. The collaboration itself is made through the ArcGIS Online or ArcGIS Enterprise portals.

A distributed collaboration is a connection between two or more trusted portals that allows you to organize and share content between individuals, businesses, and communities. Once you've established a trusted collaboration, you are able to extend your GIS content to a network of participants. Shared content becomes discoverable for each participant in the collaboration.

A collaboration can be set up between two or more ArcGIS Enterprise portals or between ArcGIS Enterprise and ArcGIS Online. There are two common patterns for leveraging a collaboration:

- Collaboration between two portals
- Collaboration between multiple portals with one central portal

Collaboration allows you to share your Insights work with other ArcGIS Enterprise deployments and with ArcGIS Online. Users can then view your pages and workbooks and even take your models and re-create their own data exploration and analysis workflows using them as a framework.

Supported items

The following items can be used in Insights and shared through distributed collaboration:

- Feature Layer
- Insights Page
- Insights Model
- Insights Workbook
- Insights Theme

Limitations

The following limitations exist for distributed collaborations:

- Insights items cannot be shared from ArcGIS Online to ArcGIS Enterprise.
- Items cannot be shared from a newer version of Insights to an older version of Insights.
- Relational database connection items cannot be shared in a collaboration. The database connection should be created in each Insights in ArcGIS Enterprise organization to access database datasets.
- Shared workbooks from a collaboration can only be accessed in viewer mode.
- Workbooks from a collaboration cannot be duplicated in the recipient ArcGIS Online or ArcGIS Enterprise portal.

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Administer

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Configure your organization

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Configure Insights in ArcGIS Enterprise

As the Insights in ArcGIS Enterprise administrator, you can add an application configuration file to specify a variety of options. The configuration file must be called `insights.json` and should be placed in the following location on the ArcGIS Server: `ArcGIS Server install directory\framework\etc\insights.json`. Available options are described below.

Administrative settings

The following properties are used to define options.

Property	Description
max_feature_copy_limit	Controls the maximum size of a remote feature layer that can be copied to the relational data store or a database. If the number of records in the dataset exceeds this value, operations requiring data to be copied will return an error. Acceptable values are integers; the default is 250,000. This is an Integer property value and does not require quotation marks. **Note:** This limit applies to remote feature layers that are accessed through a proxy, layers accessed from an ArcGIS Enterprise deployment that does not have Insights installed, and layers whose hosting portal cannot be determined. If the limit is exceeded, the following error message will be displayed: **The dataset contains too many records. Try reducing the size of your dataset.** You can reduce the size of your dataset using an attribute filter or spatial filter. Example: `"max_feature_copy_limit": 250000`
database_timeout	Controls the length of time in seconds that an operation using data from a database connection will run before timing out. If the length of time to run an operation exceeds this value, the operation will return an error. Acceptable values are integers; the default is 120 seconds. This is an Integer property value and does not require quotation marks. Example: `"database_timeout": 120` **Note:** Operations performed with SAP HANA databases do not have time-out limits. The database_timeout property will not be applied to SAP HANA.
task_timeout_secs	Controls the length of time in seconds that a scheduling task can run before timing out. If the length of time to run the scheduled update exceeds this value, the operation will return an error. Acceptable values are integers; the default is 1800 seconds (30 minutes). This is an Integer property value and does not require quotation marks. Example: `"task_timeout_secs": 1800`

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Property	Description
allow_running_tasks_without_sandboxing	**Note:** This setting is for Linux deployments only. Controls whether scheduling tasks are run with sandboxing. Acceptable values are `true` or `false`; the default value is `false`. This is a boolean property and does not require quotation marks. Example: `"allow_running_tasks_without_sandboxing": false`
max_concurrent_task_runners	Controls the number of scheduling tasks that can be run at the same time. If the number of tasks scheduled to run exceeds the maximum, tasks will be queued until another task completes. Acceptable values are integers; the default is 4. This is an Integer property value and does not require quotation marks. Example: `"max_concurrent_task_runners": 4`
enforce_database_connection_sharing_permission	Controls whether a database connection must be shared when a page referencing data from the connection is shared. Acceptable values are `true` or `false`; the default value is `true`. This is a boolean property and does not require quotation marks. If the property is set to `true`, you will be required to share the database connection at the same level as pages that use its data (for example, if the page is shared with the public, the database must also be shared with the public). If the property is set to `false`, then the database connection will not need to be shared. However, the users with access to the page will also have access to the tables seen on the page. Example: `"enforce_database_connection_sharing_permission":true`

Change settings

Follow these steps to configure the settings for Insights in ArcGIS Enterprise.

1. Create a file named `insights.json`.
2. Add the settings you want to configure to a single object in the JSON file.
3. Copy the `insights.json` file to `\framework\etc\`.
4. Restart ArcGIS Server.
5. If your Insights in ArcGIS Enterprise implementation includes more than one ArcGIS Server, repeat steps 3 and 4 for each ArcGIS Server in your site. The settings should be identical on all servers.

Note:

Ensure that the `insights.json` file contains valid JSON. The settings will not take effect if the file is not formatted correctly.

If you want to restore the default administrative settings, you can do so by deleting `insights.json` and restarting ArcGIS Server. Be sure to repeat these actions on each ArcGIS Server in your site.

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Example

Contents of the insights.json file when configuring enrich_max_features, locate_geocode_max_features, buffer_network_max_features, max_feature_copy_limit:

```
{
"enrich_max_features": 10000,
"locate_geocode_max_features": 10000,
"buffer_network_max_features": 1000,
"max_feature_copy_limit": 500000
}
```

Sandboxing

Note:
Sandboxing settings are used in Linux deployments only.

Scheduled updates for shared pages require the execution of JavaScript code, which is done with a special build of the Chromium browser. Chromium has a security feature called sandboxing, which acts as extra security incase the code the browser is executing is able to bypass any of its own security restrictions. It works by isolating the process from the rest of the system via either the namespace sandbox or setuid sandbox.

The namespace sandbox requires asking the kernel to perform an unprivileged user namespace clone. If the kernel flag is supported on your system, check with your administrator about enabling this feature using the following:

```
sudo sysctl -w kernel.unprivileged_userns_clone=1
```

If the namespace sandbox is not supported, you can set up the setuid sandbox instead.

The actions performed by the setuid sandbox require root privileges. Therefore, it must be configured so that anyone can run it as root.

1. Locate the `chrome-sandbox` file in your ArcGIS Server installation at the following path: `framework/runtime/insights/linux/`
2. Change the owner to root using the following command: `sudo chown root chrome-sandbox`.
3. Allow anyone to execute the `chrome-sandbox` as the owner (root) using the following command: `sudo chmod 4755 chrome-sandbox`.

As a last resort, if your scheduled updates fail because there is no working sandbox, this security feature can be disabled with the Insights setting `allow_running_tasks_without_sandboxing`. If a sandbox is working, this setting will be ignored. Otherwise, the tasks will run without a system level sandbox.

Esri User Experience Improvement program

The Esri User Experience Improvement program collects usage information from users and uses the data to make improvements to the software.

Administrators can opt-out of the program during the install process. If the Insights in ArcGIS Enterprise installation process is complete, the settings can be configured to discontinue participation in the program.

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Configure the settings for Windows

If you are installing Insights in ArcGIS Enterprise on Windows, you can uncheck **Click here to participate in the Esri User Experience Improvement program** in the install wizard to opt-out.

The settings for the Esri User Experience Improvement program can be configured using the settings file (`<portal_install_dir>/apps/insights/settings.json`). To opt-out of the program, change the setting from `eueiEnabled: "true"` to `eueiEnabled: "false"`.

Configure the settings for Linux

If you are installing Insights in ArcGIS Enterprise on Linux, you can run the install command `./Insights-Setup.sh -e No` to opt-out of the Esri User Experience Improvement program.

The settings for the Esri User Experience Improvement program can be configured using the settings file (`<portal_install_dir>/apps/insights/settings.json`). To opt-out of the program, change the setting from `eueiEnabled: "true"` to `eueiEnabled: "false"`.

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Administer Insights in ArcGIS Enterprise and Insights in ArcGIS Online

There are several settings that need to be set by the administrator of an organization before Insights in ArcGIS Enterprise or Insights in ArcGIS Online can be used by members of the organization. The settings include granting licenses and privileges to the necessary members of the organization.

User types, roles, and licenses must be applied to members of an ArcGIS organization by an administrator. For information on how to manage members and licences, see the ArcGIS Enterprise help documentation.

Insights user

There are several privileges that are required to use Insights, as well as some that are recommended or only required for certain functions.

Required user types and privileges

Insights users must have one of the following user types:

- Insights Analyst
- Creator
- GIS Professional

The following privileges are also required to use Insights:

- Use maps and apps
- Create content
- Publish hosted web layers
- Perform analysis

The required privileges are included in the Publisher and Administrator roles. They can also be granted through custom roles. Every organization must have at least one member with Administrator privileges.

Licenses

Insights licenses must be granted to users before they can access Insights.

The Insights Analyst user type includes an Insights license.

Suggested privileges

The following privileges are required to make use of all of the functionality in Insights and are suggested for all Insights users.

Geocoding

The Geocoding privilege is required to enable location on a dataset using the Address method. All default roles (Viewer, Data Editor, User, Publisher and Administrator) include the Geocoding privilege.

GeoEnrichment

The GeoEnrichment privilege is required to use Enrich Data. The User, Publisher, and Administrator roles include the GeoEnrichment privilege.

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Insights viewer

Users without an Insights license can still open Insights in viewer mode to access pages and workbooks that have been shared with them. Publicly shared pages can be seen by anyone, including users who do not have an ArcGIS account, provided the user has access to the URL for the shared page in the Page Viewer, or the page is embedded into a public forum such as a web page or ArcGIS app.

Note:
The Storyteller user type does not currently support accessing Insights in ArcGIS Enterprise in viewer mode.

For ArcGIS Enterprise users, security features like firewalls may also impact your ability to share pages to the public.

For more information, see Who can see your page.

Resources

Use the following resource to learn more about licensing in Insights:

- Licensing
- Configure ArcGIS Enterprise to support Insights

Next steps

Now that you've assigned the required licenses to members of your organization, you can begin configuring data connectors. For more information, see Manage connector types.

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Configure databases

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Required vendor files

Vendor files are used to add database connectors for relational databases. Once a connector is added, database connections can be created and database tables can be accessed directly in Insights.

Note:
The PostgreSQL JDBC driver is included in ArcGIS Server. A vendor file is not required when adding a connector for PostgreSQL in Insights in ArcGIS Enterprise.

Supported databases

The following table lists the vendor files for each database type and the latest version that was certified with Insights:

Supported database	Required vendor files
Microsoft SQL Server	Microsoft JDBC Driver for SQL Server: • mssql-jdbc-9.2.1.jre11.jar
Oracle	The following three JAR files are required to register Oracle: • Oracle JDBC driver: ojdbc8-19.3.0.0.0.jar • Oracle Spatial and Graph (Spatial Java Class API): ▪ sdoapi-19.3.0.0.0.jar ▪ sdoutl-19.3.0.0.0.jar **Note:** You should use the latest version of the Oracle JDBC driver that is compatible with the Java Runtime Environment (JRE) used by ArcGIS Server.
PostgreSQL	PostgreSQL JDBC driver is included in ArcGIS Server.
SAP HANA	SAP HANA JDBC driver: • ngdbc-2.8.11.jar
Snowflake	Snowflake JDBC driver: • snowflake-jdbc-3.12.17.jar
Google BigQuery	Simba JDBC Driver for Google BigQuery: • SimbaBigQueryJDBC42_1.2.21.1025.zip **Note:** The Google BigQuery JDBC package includes mulitple files. All files in the package are required to add a BigQuery connector.

The required vendor files (for example, JDBC driver) must be provided to register relational data store types with ArcGIS Server. The following table provides tips on how to get these files. For more information, refer to the help documentation for the database type or contact your database account manager.

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Vendor	Instructions
Microsoft SQL Server	The latest JDBC driver can be directly downloaded from the Microsoft Download Center.
Oracle	The latest JDBC driver and Oracle Spatial and Graph software option can be downloaded from the Oracle Technology Network.
PostgreSQL	PostgreSQL JDBC driver is included in ArcGIS Server.
SAP HANA	The latest JDBC driver can be downloaded from SAP Support Portal.
Snowflake	The latest JDBC driver can be downloaded from Maven Central Repository.
Google BigQuery	The latest JDBC driver can be downloaded from Magnitude Simba.

Note:
Some vendors may require you to have a customer account to download files.

Other databases

Connectors can be added for relational databases that use JDBC drivers that aren't on the list of supported database for Insights. For information about vendor files for connectors that have been tested in Insights, or to request help adding a connector, see the Insights connector guide (https://links.esri.com/insights-connector-guide).

Next steps

Now that you have the required vendor files, the next step is to add connector types. For more information, see Manage connector types.

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Required database privileges

There are two types of data operations in ArcGIS Insights:

- Connect to and browse contents of a relational database without data caching.
- Connect to and browse contents of a relational database with data caching.

Connect to and browse contents of a relational database with data caching allows Insights to create and manage temporary tables in the database.

The following tables list the minimum required privileges you need to connect to and browse the contents of a relational database and to optionally allow Insights to do data caching.

Note:

The connections are read-only. Insights does not permit you to create or edit data in the database.

Data will be copied to your deployment's hosted data store if you don't have the required database privileges to use data caching.

Google BigQuery

In BigQuery, privileges are applied to users through roles. The user who creates a database connection to BigQuery must have the privileges of the Basic roles (Editor, Owner, or Viewer), or the equivalent privileges in a Custom role.

Microsoft SQL Server

Type of operation	Required privileges	Purpose
Without data caching	CONNECT	This privilege allows users to connect to the database. The CONNECT privilege is granted on databases to the public database role by default. If you revoke this privilege from public, you must explicitly grant CONNECT on databases to specific roles or logins.
	SELECT on other users' tables	Data viewers need select privileges on specific tables you want them to see and query. If allowed to read all tables in the database, you can assign users to the db_datareader database role; otherwise, grant SELECT on specific tables and views.
With data caching **Note:** Connections with data caching also require the privileges for connections without data caching.	ALTER on schema	The ALTER permission allows Insights to create indexes and manage temporary tables in the user's schema.
	CREATE TABLE	The CREATE TABLE permission allows Insights to create temporary tables or views in the user's schema.

Examples

The following SQL code is an example of how privileges can be granted for SQL Server databases. Database administrators can customize these examples to grant privileges to database users in their organization.

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Grant privileges to read-write users:

```
use <databaseName>;
GO

GRANT CREATE TABLE TO <userName>;
GRANT ALTER ON SCHEMA::dbo TO <userName>;

EXEC sp_addrolemember N'db_datareader', N'<userName>';
EXEC sp_addrolemember N'db_datawriter', N'<userName>';
GO
```

Grant privileges to read-only users at the database level:

```
use <databaseName>;
GO

EXEC sp_addrolemember N'db_datareader', N'<userName>';
GO
```

Grant the SELECT privilege to read-only users on specific tables:

```
use <databaseName>;
GO

GRANT SELECT ON OBJECT::<schema>.<tableName1> TO <userName>;
GRANT SELECT ON OBJECT::<schema>.<tableName2> TO <userName>;
```

Oracle

Type of operation	Required privileges	Purpose
Without data caching	CONNECT role or CREATE SESSION	The CONNECT role or CREATE SESSION allows users to connect to the database. Beginning in Oracle 10g Release 2 (10.2), the CONNECT role has only the CREATE SESSION privilege.
	SELECT on other users' tables	Data viewers need SELECT privileges on specific tables you want them to see and query.
With data caching **Note:** Connections with data caching also require the privileges for connections without data caching.	CREATE TABLE*	The CREATE TABLE permission allows Insights to create temporary tables in the user's schema. *Allocate a proper QUOTA to the user in a tablespace with the command `ALTER USER <username> QUOTA <size> ON <tablespace>`.
	CREATE SEQUENCE	The CREATE SEQUENCE permission allows Insights to generate spatial indexes.

Examples

The following SQL code is an example of how privileges can be granted for Oracle databases. Database administrators can customize these examples to grant privileges to database users in their organization.

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Grant privileges to read-write users:

```
GRANT CONNECT TO <userName>;
GRANT CREATE TABLE TO <userName>;
ALTER USER <userName> QUOTA <size> ON USERS;
GRANT CREATE SEQUENCE TO <userName>;
```

Grant privileges to read-only users:

```
GRANT CONNECT TO <userName>;
GRANT SELECT ON <schema>.<tableName> TO <userName>;
```

PostgreSQL

Type of operation	Required privileges	Purpose
Without data caching	CONNECT on database	This privilege allows users to connect to the database. Grant CONNECT privilege on databases to specific database logins.
	USAGE on users' schemas or SELECT on users' tables	Data viewer users need USAGE privilege on specific schemas containing user tables. Or SELECT privileges on specific user tables or views you want them to see and query. Grant SELECT on specific tables and views.
With data caching **Note:** Connections with data caching also require the privileges for connections without data caching.	CREATE on schema	The CREATE permission allows Insights to create indexes and manage temporary tables in the user's schema.

Examples

The following SQL code is an example of how privileges can be granted for PostgreSQL databases. Database administrators can customize these examples to grant privileges to database users in their organization.

Grant privileges to read-write users:

```
GRANT CONNECT ON DATABASE <databaseName> TO <userName>;
GRANT USAGE ON SCHEMA <schemaName>TO <userName>;
GRANT CREATE ON SCHEMA <schemaName> TO <userName>;
```

Grant privileges to read-only users:

```
GRANT CONNECT ON DATABASE <databaseName> TO <userName>;
GRANT USAGE ON SCHEMA <schemaName>TO <userName>;   -- Give the access to all tables in
the schema
GRANT SELECT ON <tableName> TO <userName>;  -- Or give the access to a specific table
```

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SAP HANA

Type of operation	Required privileges	Purpose
Without data caching	SELECT ON sys.st_geometry_columns and sys.st_spatial_reference_systems	These privileges are required to read ST_GEOMETRY metadata for spatial operations.
	SELECT ON <table1>,<table2>, <tablen>	Data viewers need SELECT privileges on specific tables you want them to see and query.
With data caching **Note:** Connections with data caching also require the privileges for connections without data caching.	CREATE TABLE DROP TABLE Alternatively, the user must be a HANA Standard User.	Allow Insights to create or drop tables in its own schema and insert data.

Examples

The following SQL code is an example of how privileges can be granted for SAP HANA databases. Database administrators can customize these examples to grant privileges to database users in their organization.

A standard read-write user has all the privileges required to use Insights.

Non-standard users:

```
GRANT SELECT ON SCHEMA <schemaName> to <userName>;   -- executed by the schema owner

GRANT SELECT ON sys.st_geometry_columns TO <userName>;   -- executed by SYSTEM account
GRANT SELECT ON sys.st_spatial_reference_systems TO <userName>;
```

Snowflake

In Snowflake, privileges are applied to users through roles. The role for the user who creates a database connection to Snowflake must include the following privileges:

Required privilege	Purpose
USAGE on <database>	Required to access tables in the database. USAGE must be granted on the database for the user who creates a database connection.
USAGE on <schema>	Required to access tables from a schema. The default schema is PUBLIC.
SELECT on <table>	Required to see and query data from a table. SELECT must be granted on each table used from a database connection.
USAGE on <warehouse>	Required to run queries in the specified warehouse.

Examples

The following SQL code is an example of how privileges can be granted for Snowflake databases. Database administrators can customize these examples to grant privileges to database users in their organization.

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Grant privileges on all tables in the database:

```
grant USAGE on DATABASE <databaseName> to role <roleName>;
grant USAGE on SCHEMA <schemaName> to role <roleName>;
grant SELECT ON ALL TABLES IN DATABASE <databaseName> to role <roleName>;
grant USAGE on WAREHOUSE <warehouseName> to role <roleName>;
```

Next steps

Now that you've verified and updated your database privileges, if necessary, the next step is to create connection to your database so you can access your database tables directly in Insights. For more information, see Create a database connection.

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Enable OS authentication

Note:
OS authentication is currently available on Windows operating systems.

Database connections to Microsoft SQL Server databases have two possible authentication methods: SQL Server authentication and Windows authentication. SQL Server authentication uses a SQL Server user name and password to authenticate. Windows authentication uses a local Windows user account or trusted domain account.

SQL Server relies on Windows to authenticate the Windows user accounts.

The following prerequisites are required before OS authentication can be used to create a database connection:

- Your Insights deployment must be updated to Insights 2020.2 or later. For Insights in ArcGIS Enterprise, the upgrade must include the additional steps to allow OS authentication for database connections if you are updating from Insights 2020.1 or earlier.
- The domain user must be granted delegation by the domain administrator. See the Insights connector guide (https://links.esri.com/grant-delegation) for more information.
- ArcGIS Enterprise must be configured to use Integrated Windows Authentication (required for Insights in ArcGIS Enterprise only).

Resources

Use the following resources to learn more about OS authentication:

- Create a database connections
- Install Insights

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Licensing

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Licensing

The ability of individual organization members to access Insights depends on the privileges they have in the organization. Privileges are determined by the user type, role, and licenses that are assigned to the user.

User types

ArcGIS administrators assign user types to members based on the members' needs and requirements. Members are assigned a user type when they are invited to the organization. The user type determines the privileges that can be granted to the member through a default or custom role. Each user type also includes access to specific apps.

The following user types are offered:

- Storyteller, Viewer, Editor, and Field Worker—Storytellers, Viewers, Editors, and Field Workers can view pages and workbooks that are shared with them by Insights users. These user types are ideal for users who need to view Insights content in a secure environment.
- Creator—Creators have all the capabilities required to use Insights, including creating and sharing content and performing analysis, provided they are assigned the appropriate roles and licenses. This user type is compatible with an Insights license.
- GIS Professional—GIS Professionals have all the capabilities and apps of the Creator, plus access to ArcGIS Pro (Basic, Standard, or Advanced). This user type is designed for those who need the full suite of GIS apps to perform their work, for example, sharing data between Insights and ArcGIS Pro. The GIS Professional user type is compatible with an Insights license. This user type does not include access to ArcMap and other ArcGIS Desktop products.
- Insights Analyst—Insights Analysts have all the capabilities required to use Insights, including creating and sharing content, and performing analysis, provided they are assigned the appropriate roles. Insights Analysts do not require an Insights license. Insights Analysts do not have access to other apps.

Note:
Insights licenses are only included with the Insights Analyst user type. Insights licenses can be purchased and assigned to members who have been granted the Creator or GIS Professional user types.

Roles

A role defines the set of privileges assigned to a member. Members are assigned a role when they are invited to the organization.

The following default roles are available:

Note:
A member's user type determines the default roles that can be assigned to the member. User types compatible with each role are noted below.

- Viewer, Data Editor, and User—These roles allow users to view pages and workbooks that have been shared with the member and join groups owned by the organization. The Viewer role is compatible with all user types. The Data Editor role is compatible with all user types except Viewer. The User role is compatible with the Storyteller, Insights Analyst, Creator, and GIS Professional user types. These roles include the necessary privileges to open Insights in viewer mode.

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- Publisher—This role includes the privileges to create content, publish and share data, and perform spatial analysis. The Publisher role is compatible with the Storyteller, Insights Analyst, Creator, and GIS Professional user types and includes all the privileges required to use Insights when paired with an appropriate user type. The Publisher role is compatible with an Insights license.
- Administrator—This role includes Publisher privileges plus privileges to manage the organization and other users. An organization must have at least one administrator. However, there is no limit to the number of Administrator roles that can be assigned within an organization. It is recommended that an organization have at least two administrators, while restricting this role to those who require the additional privileges associated with it. The Administrator role is compatible with the Storyteller, Insights Analyst, Creator, and GIS Professional user types and includes all of the privileges required to use Insights when paired with an appropriate user type. The Administrator role is compatible with an Insights license.

Licenses

For users who do not have an Insights Analyst user type, an Insights license is required to use Insights.

Shared pages and workbooks from Insights can be viewed by members of the organization with any user type, as long as the items are shared with them.

Examples

The following table outlines some examples of the combination of user types, roles, and app licenses, and the corresponding abilities for the user:

Licensing	View pages and workbooks	Use Insights	Manage licenses
• User type: Editor • Role: User • Insights license: No	Yes. Insights can be opened in viewer mode.	No	No
• User type: GIS Professional • Role: Administrator • Insights license: No	Yes. Insights can be opened in viewer mode.	No	Yes
• User type: Insights Analyst • Role: Publisher • Insights license: Included with the user type	Yes	Yes	No
• User type: Creator • Role: Administrator • Insights license: Yes	Yes	Yes	Yes

Note:
See Share a page for more information on who can see shared pages.

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Licensing in Insights desktop

Insights desktop is available to all Insights in ArcGIS Online and Insights in ArcGIS Enterprise users. Insights desktop is activated using an ArcGIS account that is licensed to use Insights.

Resources

Use the following resources to learn more about applying and using licensing in Insights:

- Configure ArcGIS Enterprise to support Insights
- Administer Insights in ArcGIS Enterprise
- Share a page

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Settings

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Manage profiles

Your profile contains personal settings like your name, email address, and password.

The profile in Insights is a condensed version of your ArcGIS profile. Any updates made to your profile in Insights will be reflected in your profile in ArcGIS Enterprise or ArcGIS Online.

View and edit your profile

Use the following steps to view or edit your profile:

1. Sign in to Insights, if necessary.
2. Do one of the following:
   - Click the **Settings** tab on the home page.
   - Click your profile picture at the top of your page then click **My profile**.
3. View and edit the necessary settings.
4. Click **Save changes** to save the edits and exit your profile. Click **Cancel** to exit without making changes.

An email will be sent to the email address associated with your account indicating that your profile settings have been changed.

Personal information

Your profile contains personal information, such as your name, email address, and user type.

Profile picture

Your profile picture can be changed or removed using the **Edit photo** button. To change your profile picture, click the **Edit photo** button then click **Change photo**. Browse to the picture you want to make your profile picture and click **Open**. Supported files include PNG, JPEG, and GIF formats, and do not exceed 20 MB in size. For best results, choose a picture that is 150 pixels high by 150 pixels wide.

To remove your profile picture, click the **Edit photo** button, then click **Remove photo**.

Name

You can edit your first name and last name from your profile in Insights. Your first and last name will be visible for members of your organization (for example, when filtering by owner on the home page).

Email address

Your email address can be viewed under **Personal information**. Users with administrative privileges can also edit their email address.

User type and role

Your user type and role are displayed under **Personal information**. User types and roles can only be changed in your ArcGIS portal by users with administrator privileges.

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User settings

The user settings include the default tab that will be displayed on the home page. You can choose either the **Home** tab or the **Workbooks** tab as the default.

Other user settings are saved based on the choices you make as you use Insights. You can reset all of the following settings using the **Reset all user settings** check box:

- Skip the **Welcome to Insights** window.
- Set the default tab on the home page
- Setting in the **View items** menu on the home page.
- View items on the home page using **Tile view**.
- **Don't ask me again** checkbox when updating a shared page or theme.

Note:
User settings are stored locally when using Insights in ArcGIS Enterprise. Therefore, the settings will also be reset by clearing the browser cache or switching to a new browser.

Password

Note:
The **Password** section of your profile is not shown if you use either an enterprise login or a social login.

Your profile includes a **Password** section, where both your password and security question can be updated, and multifactor authentication can be enabled.

Change Password

The password for your account can be changed from your profile. Click the **Change password** button and enter your username and password if prompted. Enter your current password and new password in the text boxes on the **Change your password** page. Click **Change password** to apply the changes. Passwords must be at least eight characters and contain at least one letter and one number. Your password is case sensitive and spaces are not allowed.

Note:
Weak passwords won't be accepted. A password is considered weak if it is commonly used, such as `password1` or includes repetitive or sequential characters, such as `aaaabbbb` or `1234abcd`.

Security question

For security reasons, the answer to your security question is not displayed on your profile. You can change only the answer to your security question or change both the security question and answer.

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Multifactor authentication

Multifactor authentication provides an extra level of security by requiring a verification code in addition to a user name and password when you sign in. Multifactor authentication must be configured in your organization before it can be enabled for your account. Use the following steps to enable multifactor authentication for your account:

1. Click the **Enable** button next to **Enable mulitfactor authentication**.
2. If necessary, install a supported authenticator app on your mobile device: Google Authenticator (for Android or iOS) or Authenticator (for Windows Phone). Once the authenticator is installed, click **Next**.
3. Use your authentication app to scan the QR code that appears and click **Next**. If you have trouble scanning, click **Can't scan the code?**, type the 16-character code that appears, and click **Next**.
4. Enter the unique, time-sensitive six-digit verification code that the app provides and click **Finish**.

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Manage connector types

Database connectors allow Insights in ArcGIS Enterprise users to connect directly to databases and use database tables in Insights. ArcGIS administrators can manage connector types for the organization, including adding and removing connector types.

Add a connector type

Note:
Before you add a database connector, you must have the required vendor files. See Required vendor files and the Insights connector guide (`https://links.esri.com/connector-type-bundle`) for more information.

A database connector must be added before a connection can be made to the database type.

Complete the following steps to add a connector type:

1. From the home page, click the **Settings** tab.
2. Click the **Connector types** tab.

   Note:
   The **Connector types** tab is only available to users with administrator privileges.

   The **Connector types** page includes a section named **Manage your connector types**, which lists the database connectors that have already been added.
3. In the **Manage your connector types** section, click **Add a connector type**.
   A menu of database options appears. The menu includes the names of supported databases and **Other**.

   Note:
   Database connectors that have already been added for your organization do not appear in the menu.

4. Select a database connector from the menu.
   If you are adding a database connector that is not listed, choose **Other**. See Supported databases for more information.
5. Do one of the following:
   - Click **Browse my computer** and open the required file for the database connector.
   - Drag the required file for the database connector to the window.

   The file uploads and validates.
6. Click **Finish**.
   The connector appears in the list of database connectors that have been added to your organization. Oracle, Microsoft SQL Server, and SAP HANA connectors will not be available to create connections until ArcGIS Server is restarted.
7. If you are adding or removing more database connectors, complete the steps for the next connector. Otherwise, restart ArcGIS Server to complete the process, if necessary.

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The database connector is now available for the organization. You must create a database connection before you can access data from your databases in Insights.

Remove a connector type

Database connectors can be removed so that the connector is no longer available for members of the organization. Preexisting database connections using the database connector will no longer be available, and all data from the connections referenced in a workbook or on a shared page will be broken.

Note:
A connector that was previously removed can be readded, if necessary.

Complete the following steps to remove a connector type:

1. From the home page, click the **Settings** tab.
2. Click the **Connector types** tab.
   The **Connector types** page includes a section named **Manage your connector types**, which lists the database connectors that have been added to your organization.
3. Hover the pointer over the name of the database connector you are removing.
4. Click the **Remove** button.
   The connector is removed from the list of database connectors that are available for your organization.

   Oracle, Microsoft SQL Server, and SAP HANA connectors remain in the list of database connectors that are available for your organization but appear unavailable. These connectors will not be fully removed until ArcGIS Server is restarted.
5. If you are adding or removing more database connectors, complete the steps for the next connector. Otherwise, restart ArcGIS Server to complete the process, if necessary.

The database connector is now removed from the organization.

Next steps

Now that the database connectors are available for your organization, the next step is to check your database privileges and create a database connection. If you are using SQL Server databases, you may also want to enable OS authentication.

Resources

Use the following resources to learn more about connector types:

- Insights connector guide (https://links.esri.com/insights-connector-guide)
- Video: Adding database connectors (https://mediaspace.esri.com/media/t/1_w6riwcb6)

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Set language

The language in Insights in ArcGIS Enterprise is set based on your browser language, rather than the language set in your ArcGIS profile.

App languages

Language determines the user interface as well as the way time, date, and numerical values appear. The Insights user interface can be viewed in the following languages:

Arabic	Lithuanian
Bosnian	Norwegian
Bulgarian	Polish
Catalan	Portuguese (Brazil)
Croatian	Portuguese (Portugal)
Czech	Romanian
Danish	Russian
English	Serbian
Estonian	Simplified Chinese
Finnish	Slovak
French	Slovenian
German	Spanish
Greek	Swedish
Hebrew	Thai
Hungarian	Traditional Chinese (Hong Kong)
Indonesian	Traditional Chinese (Taiwan)
Italian	Turkish
Japanese	Ukranian
Korean	Vietnamese
Latvian	

Number and date formatting within Insights is based on the app language. For supported languages that use region-specific number and date formats (English, French, German, Italian, and Spanish), the region is used to determine the default formats for numbers and dates. For Insights in ArcGIS Enterprise, the region is based on the browser region.

Note:
German (Switzerland) is not supported in Safari. The language and region will default to German (Germany) if Safari is set to German (Switzerland).

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Documentation languages

Help can be viewed in the following languages: Arabic, English, French, German, Italian, Japanese, Korean, Polish, Portuguese (Brazil), Russian, Simplified Chinese, and Spanish.

The English help documentation is installed as part of the Insights in ArcGIS Enterprise setup. To view the installed help in a language other than English, you'll need to download and install the ArcGIS Insights Help Language Pack from My Esri.

The English help documentation is installed as part of the Insights desktop setup. To view the installed help in a language other than English, you'll need to download and install the ArcGIS Insights Help Language Pack from the Insights desktop client download page.

Dates and times

Date formats are not supported in all languages. The following cultures will be used to view dates in unsupported languages:

Unsupported language	Default culture
Portuguese (Brazil)	Portuguese
Simplified Chinese	Chinese
Bosnian	English (Insights desktop only)
Norwegian	English
Vietnamese	English

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Support

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Compatibility with ArcGIS Enterprise

The following table indicates supported Insights in ArcGIS Enterprise versions and their compatibility with ArcGIS Enterprise:

Insights version	ArcGIS Enterprise 10.7.1	ArcGIS Enterprise 10.8	ArcGIS Enterprise 10.8.1	ArcGIS Enterprise 10.9	ArcGIS Enterprise 10.9.1
2020.3	Yes	Yes	Yes	No	No
2021.1	No	No	Yes	No	No
2021.1.1	No	No	No	Yes	No
2021.2	No	No	Yes	No	No
2021.2.1	No	No	No	Yes	No
2021.3	No	No	Yes	No	No
2021.3.1	No	No	No	Yes	Yes
2022.1	No	No	Yes	No	No
2022.1.1	No	No	No	Yes	Yes

Insights 2022.1 has two separate versions for ArcGIS Enterprise. Insights in ArcGIS Enterprise 2022.1 is compatible with ArcGIS Enterprise 10.8.1. Insights in ArcGIS Enterprise 2022.1.1 is compatible with ArcGIS Enterprise 10.9 and ArcGIS Enterprise 10.9.1. The two Insights in ArcGIS Enterprise versions have equivalent functionality.

Note:

Insights does not support ArcGIS Enterprise versions in pre-release.

Insights is not currently supported by ArcGIS Enterprise on Kubernetes.

Additional resources

- Configure ArcGIS Enterprise to support Insights
- Supported databases
- Supported browsers
- System requirements

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Supported databases

Database connections allow you to connect directly with your database tables in Insights. The tables below list the supported databases and versions you can connect to when using Insights.

Google BigQuery

BigQuery is a cloud-based database that updates automatically. BigQuery is supported in the following versions of Insights:

Insights 2022.1	Insights 2021.3	Insights 2021.2	Insights 2021.1	Insights 2020.3
Supported*				Not supported

*Spatial capabilities are not supported at Insights 2021.1. Connections are read-only at Insights 2021.2.

Note:
Insights uses service account authentication when connecting to BigQuery. A service account with an Editor, Owner, or Viewer role is required to create a connection from Insights to BigQuery. For more information, see Create a service account and private key in the Insights connector guide (https://links.esri.com/create-service-account-private-key).

Limitations

BigQuery uses approximate calculations for median and percentile. Therefore, median and percentile statistics calculated on datasets from BigQuery may not match the results seen from other data sources. Median and percentile statistics are available on summary tables and some charts.

Note:
The median value on a box plot represents the true median, rather than the approximate median calculated by BigQuery.

BigQuery does not support mode calculations for Spatial Aggregation or Spatial Mean.

BigQuery only supports spatial reference 4326 (World Geodetic System 1984). Therefore, only spatial reference 4326 is supported when enabling location with coordinates. To enable location using a different spatial reference, you must first copy the data to your workbook.

Partitioned tables from BigQuery are not supported. A filtered view must be created to add data from a partitioned table.

The following spatial capabilities are not currently supported for read-only connections:

- Use Spatial Aggregation with lines or areas in the **Choose a layer to summarize** parameter.
- Use Enable location.
- Use Calculate Density.
- Use Calculate Density Ratio.
- Use K-Means Clusters.
- Use Spatial Mean.

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- Use Enrich Data.

Microsoft SQL Server

The following table lists the supported versions of Microsoft SQL Server:

Insights 2022.1	Insights 2021.3	Insights 2021.2	Insights 2021.1	Insights 2020.3
Standard/Enterprise editions: • Microsoft SQL Server 2019 (64 bit) • Microsoft SQL Server 2019 for Linux (64 bit) • Microsoft SQL Server 2017 (64 bit) • Microsoft SQL Server 2017 for Linux (64 bit) • Microsoft SQL Server 2016 (64 bit)	Standard/Enterprise editions: • Microsoft SQL Server 2019 (64 bit) • Microsoft SQL Server 2019 for Linux (64 bit) • Microsoft SQL Server 2017 (64 bit) • Microsoft SQL Server 2017 for Linux (64 bit) • Microsoft SQL Server 2016 (64 bit) • Microsoft SQL Server 2014 (64 bit)			
Cloud database as a service: • Microsoft Azure SQL Database				

Oracle

The following table lists the supported versions of Oracle:

Insights 2022.1	Insights 2021.3	Insights 2021.2	Insights 2021.1	Insights 2020.3
Standard/Standard One/ Enterprise editions: • Oracle 21c • Oracle 19c (64 bit) • Oracle 18c (64 bit) • Oracle 12c R2 (64 bit) 12.2.0.1 • Oracle 12c R1 (64 bit) 12.1.0.2	Standard/Standard One/ Enterprise editions: • Oracle 19c (64 bit) • Oracle 18c (64 bit) • Oracle 12c R2 (64 bit) 12.2.0.1 • Oracle 12c R1 (64 bit) 12.1.0.2	Standard/Standard One/Enterprise editions: • Oracle 19c (64 bit) • Oracle 18c (64 bit) • Oracle 12c R2 (64 bit) 12.2.0.1 • Oracle 12c R1 (64 bit) 12.1.0.2 • Oracle 11g R2 (64 bit) 11.2.0.4		

Note:

Oracle 11g supports read-only functionality. Other Oracle database versions support read/write functionality.

When Oracle connections using TNS are used in a multiple ArcGIS Server deployment, all ArcGIS Server machines must have the same Oracle configuration, including the following:

- The same TNS file path
- The same content in the TNS file (`tnsnames.ora`)

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Advanced string matching

Advanced string matching logic uses case-insensitive string comparisons and matches null and empty strings. The logic improves outputs for joins on string fields, filters on string fields, and field calculations using equal to (=) or not equal to (<>) on string fields, but negatively affects database performance.

Advanced string matching functionality in Oracle databases is used in Insights 2020.3 and earlier but has been deprecated for Insights 2021.1 and higher. Connections created in Insights 2020.3 and earlier will continue to use advanced string matching unless the property is changed manually.

An ArcGIS administrator can manually override the `advancedStringMatching` property for the **RelationalCatalogServer** in the ArcGIS Server Administrator Directory.

PostgreSQL

The following table lists the supported versions of PostgreSQL:

<table>
<tr><th>Insights 2022.1</th><th colspan="2">Insights 2021.3</th><th>Insights 2021.2</th><th colspan="2">Insights 2021.1</th><th>Insights 2020.3</th></tr>
<tr><td>Postgres PostGIS support:
PostgreSQL 14 (64 bit) with PostGIS 3.1.4
PostgreSQL 13 (64 bit) with PostGIS 3.03
PostgreSQL 12 (64 bit) with PostGIS 3.0.1
PostgreSQL 11 (64 bit) with PostGIS 2.5
PostgreSQL 10 (64 bit) with PostGIS 2.4 or 2.5</td><td colspan="3">Postgres PostGIS support:
PostgreSQL 13 (64 bit) with PostGIS 3.03
PostgreSQL 11 (64 bit) with PostGIS 2.5
PostgreSQL 10 (64 bit) with PostGIS 2.4 or 2.5
PostgreSQL 9.6 (64 bit) with PostGIS 2.3, 2.4, or 2.5</td><td colspan="3">Postgres PostGIS support:
PostgreSQL 11 (64 bit) with PostGIS 2.5
PostgreSQL 10 (64 bit) with PostGIS 2.4 or 2.5
PostgreSQL 9.6 (64 bit) with PostGIS 2.3, 2.4, or 2.5</td></tr>
<tr><td colspan="7">PostgreSQL geodatabase support:
PostgreSQL 10.6 (64 bit)
PostgreSQL 9.6 (64 bit)
For PostgreSQL databases without spatial extensions, only versions 9.6, 10, and 11 are supported.</td></tr>
</table>

SAP HANA

The following table lists the supported versions of SAP HANA:

<table>
<tr><th>Insights 2022.1</th><th colspan="2">Insights 2021.3</th><th>Insights 2021.2</th><th colspan="2">Insights 2021.1</th><th>Insights 2020.3</th></tr>
<tr><td>• SAP HANA Cloud
• SAP HANA 2.0 SPS05</td><td colspan="3">• SAP HANA Cloud
• SAP HANA 2.0 SPS05
• SAP HANA 2.0 SPS04</td><td colspan="3">• SAP HANA 2.0 SPS04
• SAP HANA 2.0 SPS03
• SAP HANA 2.0 SPS02
• SAP HANA 1.0 SPS12</td></tr>
</table>

Note:
SAP HANA modeling views are not supported.

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Snowflake

Snowflake is a cloud-based database that updates automatically. Snowflake is supported in the following versions of Insights:

Insights 2022.1	Insights 2021.3	Insights 2021.2	Insights 2021.1	Insights 2020.3
Supported*				Not supported

*Spatial capabilities are not supported at Insights 2021.1. Connections are read-only at Insights 2021.2.

Limitations

String fields in tables from Snowflake connections cannot be converted to date/time fields from the data pane or using a `DATEVALUE` calculation that does not specify a date format in Insights 2021.3 and lower. Date and time data should be stored in the database using a valid date or time data type or calculated using an expression that includes a valid date format.

Snowflake only supports spatial reference 4326 (World Geodetic System 1984). Therefore, only spatial reference 4326 is supported when enabling location with coordinates. To enable location using a different spatial reference, you must first copy the data to your workbook.

Joins are not currently supported for tables from Snowflake. You can create a view with the required join within Snowflake and use the view in Insights.

The following spatial capabilities are not currently supported for read-only connections:

- Use Spatial Aggregation with lines or areas in the **Choose a layer to summarize** parameter.
- Use Enable location.
- Use Buffer/Drive Times.
- Use Calculate Density.
- Use Calculate Density Ratio.
- Use K-Means Clusters.
- Use Spatial Mean.
- Use Enrich Data.

Enterprise geodatabases

Insights allows you to create a connection to a supported Microsoft SQL Server, Oracle, SAP HANA, or PostgreSQL database that has a non-versioned enterprise geodatabase defined. If the geodatabase is versioned, the data must be unregistered as versioned to work in Insights. Currently, only geodatabase user tables not created under the sde user schema can be viewed and accessed from Insights. Insights does not work directly with file and personal geodatabases.

Additional database platforms

In addition to the supported databases, connectors can also be added for other relational databases that use a Java Database Connectivity (JDBC) driver. See the Insights connector guide (`https://links.esri.com/insights-connector-guide`) for more information about the required configuration files and connectors that have been certified in Insights.

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Additional database connectors are available in the following Insights versions:

Insights 2022.1	Insights 2021.3	Insights 2021.2	Insights 2021.1	Insights 2020.3
Supported	Preview*			Not supported

*Spatial capabilities are not supported at Insights 2021.1. Connections are read-only at Insights 2021.2.

Limitations

Insights only supports client-server database systems that can be accessed over a network. Other types of database systems, such as embedded databases, are not supported.

String fields cannot be converted to date/time fields from the data pane or using a `DATEVALUE` calculation that does not specify a date format for these connectors. Date and time data should be stored in the database using a valid date or time data type (configured in the `dialect.yml` file) or calculated using an expression that includes a valid date format. See the Insights connector guide for more information on configuring data types.

The following spatial capabilities are not currently supported for read-only connections:

- Use Spatial Aggregation with lines or areas in the **Choose a layer to summarize** parameter.
- Use Enable location.
- Use Buffer/Drive Times.
- Use Calculate Density.
- Use Calculate Density Ratio.
- Use K-Means Clusters.
- Use Spatial Mean.
- Use Enrich Data.
- Calculate geometry is only supported for read-only connections if the database itself supports calculating geometry (length, area, and perimeter) and the `geometricProperties` capability is set to `true` in the SQL dialect configuration file.

Resources

For more information about databases, see the following:

- Required vendor files
- Manage connector types
- Create a database connection
- Supported data types from database datasets

Next steps

Now that you know which databases are supported, the next step is to download the required vendor files for your database type. For more information, see Required vendor files.

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Supported browsers

For the best performance with ArcGIS Insights, use the latest version of your browser. Insights supports the following browsers:

- Microsoft Edge*
- Mozilla Firefox
- Google Chrome
- macOS Safari

*Microsoft Edge Legacy is no longer supported in Insights. For best results, use the latest version of Microsoft Edge.

Note:
In addition to the supported browsers, Insights also supports iOS Safari (tablets only) for viewing content.

Troubleshoot

Enabling hardware acceleration is recommended for cards to display correctly in the browser. If your cards are not displaying correctly (for example, the basemap and features do not extend to the bottom of a map card), you can verify if hardware acceleration is the issue by enabling **Override software rendering list** on the browser's flags menu (for example, `chrome://flags`). If enabling **Override software rendering list** fixes the display issues, then the issue can be fixed permanently by upgrading your system (including drivers and hardware) so that it is supported by the browser you are using.

Additional resources

- Supported data
- System requirements
- Sign in to Insights

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System requirements

Insights in ArcGIS Enterprise supports the following operating systems:

- Windows
- Linux

Insights in ArcGIS Enterprise has the following minimum system requirements:

- Screen resolution: 1440x900

For more information on minimum system requirements, refer to the help documentation for your ArcGIS Enterprise version.

Note:
A minimum of 16 GB of memory/RAM is recommended for Insights in ArcGIS Enterprise deployments. This recommendation is higher than the 8 GB requirement for ArcGIS Enterprise.

Additional resources

- Supported browsers
- Set language

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Troubleshoot a map image layer

Map image layers must support statistics in order to perform many of the processes in ArcGIS Insights, such as create a chart. If you receive the error **The layer does not support statistics**, try republishing the layer making sure that all of the following conditions are met:

- The dataset resides in an enterprise or file geodatabase.
- The dataset is not a Query Layer, meaning a dataset that is defined by a SQL query (for example, a layer from a database).
- The dataset does not have more than one join defined on it.
- The dataset is not joined with another dataset from a different workspace.
- The dataset does not have an outer join if the workspace is a geodatabase from an application earlier than ArcGIS 10.1 for Desktop and an application server connection is used.

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