Keyboard Shortcuts for SAS Visual Analytics

The Keyboard Shortcuts window in SAS Visual Analytics provides all of the available shortcuts. To display the window, either press Ctrl+F9 or click ☐ in the report toolbar, and then select Keyboard shortcuts. The Keyboard Shortcuts window lists shortcuts in the following categories: General, Visual Analytics, Graph, and List.

Gallery of Objects

Tables

Crosstab

A crosstab (also known as a crosstabulation table) shows an aggregate metric for the intersections of two or more categories. Crosstabs often have two or more categories assigned to both the rows and columns, forming a matrix. Crosstabs can be easier to read than list tables because they often use less space, and they always collapse repeating values for outer category data items into one unique value, which is known as grouping. A crosstab can use a hierarchy.
List Table

A list table is a two-dimensional representation of data in which the data values are arranged in unlabeled rows and labeled columns. List tables can use any data items from a data source. A list table cannot use a hierarchy.

You can add sparklines to a column (if the data source contains a date data item) when aggregated data is displayed in the list table.

Graphs, Charts, and Plots

Bar Chart

A bar chart consists of vertical or horizontal bars that represent quantitative data. Use bar charts to compare data that is aggregated by the distinct values of a category.

You can apply grouping and create data-driven lattices. You can filter or rank your data based on a specified number of top or bottom values.
Box Plot

A box plot displays the distribution of values for a measure using a box and whiskers. The size and location of the box indicate the range of values that are between the 25th and 75th percentile.

Bubble Change Plot

A bubble change plot displays the difference between two sets of measures by using bubbles that are connected by lines. For example, you can use a bubble change plot to compare data from two different time periods.
Bubble Plot

A bubble plot is a variation of a scatter plot in which the markers are replaced with bubbles. A bubble plot displays the relationships among at least three measures. Two measures are represented by the plot axes, and the third measure is represented by the size of the bubbles. A bubble plot is useful for data sets with dozens to hundreds of values. You can add categories to the Grouping and Lattice roles.

Note: A bubble's size is scaled relative to the minimum and maximum values of the size variable. The minimum and maximum sizes are illustrated in the plot legend. The actual value for each bubble is displayed as a data tip.
Butterfly Chart

A *butterfly chart* displays two bar charts with a shared category axis. The baselines of the two bar charts are located in the center of the chart.

**Comparative Time Series Plot**

A *comparative time series plot* displays two time series in parallel with a shared time axis and separate Y axes.
Correlation Matrix

A correlation matrix displays the degree of correlation between multiple intersections of measures as a matrix of rectangular cells. Each cell in the matrix represents the intersection of two measures, and the color of the cell indicates the degree of correlation between those two measures.

Dot Plot

A dot plot displays the data for each value of a category data item by using dots. The position of each dot on the Y (response) axis represents the value.
Dual Axis Bar Chart

A dual axis bar chart is a variation of the bar chart that has measures on two Y axes.

Dual Axis Bar-Line Chart

A dual axis bar-line chart is a variation of the bar chart that is overlaid by a line chart. The two measures in a dual-axis bar-line chart have separate Y axes.
Dual Axis Line Chart

A dual axis line chart is a variation of the line chart that has two measures. A measure is displayed on both the left and right side of the Y axis. The relationship between two measures can be examined on two different scales in a dual axis line chart.

![Dual Axis Line Chart](image)

Dual Axis Time Series Plot

A dual axis time series plot is a variation of the time series plot that has two measures. A measure is displayed on both the left and right side of the Y axis.

For example, a dual axis time series plot can be useful when you need to display two measures that have the same unit of measurement and different scales, such as expenses and revenue, or when you need to display two measures that have different units of measurement, such as sales and quantity ordered.
Gauge

A gauge is a dashboard indicator that compares an actual value to a target value. The scale of the gauge and the colored data ranges on the gauge are controlled by display rules. To change these properties, edit the display rules for the gauge.

Several types of gauges are available:

**Bullet**

- displays a linear gauge. The target value is indicated by a line and the actual value is indicated by a narrow bar.

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**Note:** The scale of a bullet gauge often begins at zero, but it can contain both positive and negative values if both types of values apply to the primary measure, such as profit. The inset horizontal bar should always begin at zero so that comparing multiple bullet graphs is not confusing.
Dial
displays an arc-shaped gauge. The target value is indicated by a small black arrow pointing inward. The actual value is indicated by a large arrow pointing outward.

Slider
displays a linear gauge. The target value is indicated by a small black arrow. The actual value is indicated by a large arrow.

Note: Like a bullet gauge, a slider gauge is oriented horizontally by default, but you can change the gauge’s orientation to vertical. You should use a slider gauge when the numeric scale does not start at zero.
**Speedometer**

displays an arc-shaped gauge. The target value is indicated by a small white triangle pointing outward. The actual value is indicated by a black pointer pointing outward.

**Thermometer**

displays a linear gauge. The target value is indicated by a line. The actual value is indicated by the background bar.

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**Note:** The base of a thermometer bar should always start at zero. You can set this by defining your first range display rule to begin at zero. SAS Visual Analytics always shows the base of the bar at the bottom of the thermometer.
Heat Map

A heat map displays the distribution of values for two data items by using a table with colored cells.

Histogram

A histogram displays the distribution of values for a single measure.
Key Value

A *key value* displays a single aggregated value for a measure, a category, or both.

![Cholesterol Frequency Chart]

**Line Chart**

A *line chart* shows the relationship of one or more measures over some interval, such as time or a series of ranges. You can display a single measure (univariate analysis), or you can show the relationships among multiple measures (multivariate analysis), such as the leading or lagging relationship between advertising and sales over time.

You can apply grouping and create lattices.
Needle Plot

A needle plot displays vertical lines that connect the data points to a horizontal baseline. The baseline intersects the 0 value or the minimum value on the vertical axis.

Numeric Series Plot

A numeric series plot displays data by using a line that connects the data values for two or more measures. A numeric series plot requires numeric data on the X axis.
Parallel Coordinates Plot

A parallel coordinates plot displays data as lines moving through categories and binned measures. The thickness of a line indicates the relative number of observations in that bin. You can restrict the active lines to one or more bins in order to focus on only the data that interests you.

Pie Chart

A pie chart is a circular chart that is divided into slices by radial lines. Each slice represents the relative contribution of each part to the whole.
A scatter plot is a two-dimensional plot that shows the relationship of two measure data items. Each marker (represented by a symbol such as a dot, a square, or a plus sign) represents an observation. The marker’s position indicates the value for each observation. Use a scatter plot to examine the relationship between numeric data items.

Scatter plots do not use aggregated data.
Schedule Chart

A schedule chart displays the duration of events by using bars. The edges of each bar indicate the start and end times of an event.

Step Plot

A step plot displays vertical lines that connect the data points to a horizontal baseline. A step plot enables you to see the exact point on the X axis when a change in the Y-axis measure occurs.
Targeted Bar Chart

A targeted bar chart is a variation of the bar chart that has target values. A target value is represented as a triangle with a line at the target value that is determined by the target role.

Time Series Plot

A time series plot shows an ordered sequence of values that are observed at equally spaced time intervals. A time series plot requires a date, datetime, time, or date hierarchy data item that is continuous on the X axis.
Treemap

A treemap displays your data as a set of rectangles (called tiles). Each tile represents a category node or a hierarchy node. The color and size of the tiles can both represent the value of a measure.

The layout of the tiles in the treemap is dependent on the size of the display area because it uses a space-filling algorithm to lay the tiles out. This means that the same treemap might appear slightly different in SAS Visual Analytics than it does on a mobile device because the aspect ratio and size available in those viewers might be different from what the original report designer sees in SAS Visual Analytics.

Vector Plot

A vector plot displays the change in data by using directed line segments or vectors to represent both direction and magnitude at each point.
Waterfall Chart

A waterfall chart (also known as a progressive bar chart) shows how the initial value of a measure increases or decreases during a series of operations or transactions. The first bar begins at the initial value, and each subsequent bar begins where the previous bar ends. The length and direction of a bar indicate the magnitude and type (positive or negative, for example) of the operation or transaction. The resulting chart is a stepped bar showing how incremental changes lead to the final value of the measure.
Word Cloud

A word cloud displays a set of category values as text, grouped in a cloud-like shape. Depending on the word cloud data roles, the size of the text indicates the frequency of a category value or the value of a measure that corresponds to a category value.

Geographic

A geographic object overlays your data on a geographic map.

Geo Contour

A geo contour map displays your data as shaded areas or lines that indicate the density of data or the values of a measure.
Geo Coordinate

A *geo coordinate* map displays your data as either a bubble plot or a scatter plot. Each marker or bubble is located at the center of a geographic region or at the coordinates of a location.

Geo Network

A *geo network* map displays relationships between the values of geography data items or geographic hierarchies by using a series of linked nodes on top of a map background.
Geo Region

A geo region map displays your data as colored regions. You can fill geographical boundaries (for example, a country or a state) on a map with color, based on measure values that are aggregated to the level defined by a geographical boundary.
Geo Region-Coordinate

A *geo region-coordinate* map displays a coordinate map on top of a region map. The coordinate map and region map can represent different data.

Controls

A *control* is an object that filters or narrows the scope of the data that the user is viewing. A control enables a report designer to select a value or set of values that he or she wants the report user to see.

Button Bar

A *button bar* control displays buttons, which represent a narrowed scope of data, in a horizontal or vertical layout. A report user can select a button to filter a list of category values.

<table>
<thead>
<tr>
<th>East</th>
<th>North</th>
<th>South</th>
<th>West</th>
</tr>
</thead>
</table>

Drop-Down List

A *drop-down list* control enables a report user to select an item from a list of category values.
A list control enables a report user to select one or more category values from a list.

- East
- North
- South
- West

A slider control enables a report user to move a selector horizontally or vertically to select a single data item or range of data items.

A text input control enables a report user to enter text in a field to narrow the list of category values.

An automated explanation object determines the most important underlying factors for a specific response variable. The results include relative importance, relationship plots, and the highest and lowest groups. The groups are based on the average value of a measure response or the percentage of the event level of a category response.
Automated Prediction

An automated prediction object determines the best model for predicting the specified variable of interest. You can then adjust the values of the underlying factors to determine how the model prediction changes with each adjustment.

Decision Tree

A decision tree displays a series of nodes as a tree in which the top node shows the overall distribution of the response data item, and each branch of the tree represents a split in the values of a
predictor data item. The splits enable you to see which values of the predictor data item correspond to different distributions of values in the response data item.
Forecasting

A forecasting object uses the statistical trends in your data to predict future data values.

Network Analysis

A network analysis object displays the relationships between the values of categories or hierarchy levels by using a series of linked nodes.
Path Analysis

A *path analysis* object displays flows of data from one event (value) to another as a series of paths.
Text Topics

A *text topics* object analyzes each value in a document collection as a text document that can contain multiple words. Words that often appear together in the document collection are identified as topics. For the selected topic, the text topics object displays the terms with the greatest topic term weight values. The topic term weight indicates the importance of the term within the topic.

A text topics object displays a set of words from a character data item. The size of each word in the cloud indicates the importance (topic term weight) of the word.

A text topics object can also display whether the documents in a topic express positive, negative, or neutral sentiment.

Containers

A *container* enables you to group other objects or prompts in your report.

Precision Container

A *precision container* enables you to place, align, and size the objects within the container. The precision type allows objects to overlap.

Note: Precision containers are not recommended if your report is viewed on mobile devices.
Prompt Container

A prompt container groups prompt controls. Only objects that are controls can be placed inside a prompt container. Objects inside prompt containers are filtered by the same rules as other objects.

Prompt containers can be added to the report prompt area and page prompt area on the canvas. They can also be added to the content area of the canvas.
Scrolling Container

A *scrolling container* displays content in a scrolling layout, where each object fills the entire container area and you scroll to see other objects. You can select either a vertical layout or a horizontal layout.

Stacking Container

A *stacking container* displays the objects as if they are in a slide deck. Only one object is displayed at a time. A stacking container has a control bar that lets you move between objects.
Standard Container

A *standard container* lays out the content horizontally or vertically. Where it is possible, the content is resized so that multiple objects can be displayed together without scrolling.

Content

Data-Driven Content

A *data-driven content* object enables you to display your data in a custom third-party visualization within your SAS Visual Analytics report. The third-party visualization can be authored in any JavaScript charting framework, such as D3.js, Google Charts, or CanvasJS. The visualization in a data-driven content object receives its data from SAS Visual Analytics and interacts with filters, ranks, and actions in the same way as other objects in your report.
The data-driven content object enables you to incorporate your own content, like a calendar object, into a SAS Visual Analytics report.

<table>
<thead>
<tr>
<th>Facility City</th>
<th>Unit Yield (actual)</th>
<th>Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birmingham</td>
<td>929269567</td>
<td>47823282.21822265</td>
</tr>
<tr>
<td>Chicago</td>
<td>433590511</td>
<td>227715290.96053994</td>
</tr>
<tr>
<td>Cincinnati</td>
<td>333896134</td>
<td>89745321.60402142</td>
</tr>
<tr>
<td>Cleveland</td>
<td>70177513</td>
<td>48154290.72321804</td>
</tr>
<tr>
<td>Corpus Christi</td>
<td>1156561527</td>
<td>52229408.3807718</td>
</tr>
<tr>
<td>Dallas</td>
<td>585447386</td>
<td>269153687.50115013</td>
</tr>
<tr>
<td>Elgin</td>
<td>3769062</td>
<td>51125210.592067845</td>
</tr>
<tr>
<td>Houston</td>
<td>823300727</td>
<td>309863920.63582513</td>
</tr>
<tr>
<td>Izist</td>
<td>4343300729</td>
<td>27227924.78226484</td>
</tr>
</tbody>
</table>

Image

An *image* object enables you to include your corporate logo or other graphics in your report.

Text

A *text* object displays static text, which can contain links, in your report. A text object can also display dynamic text, such as measure and parameter values, or tokens such as the most recent update to the data source and a description of the current interactive filters.
Web Content

A web content object displays a web page or embedded video content in an inline frame (IFrame).

SAS Visual Statistics

About SAS Visual Statistics Objects

If SAS Visual Statistics is licensed at your site, then these plots are available.

Assessment Plot

The assessment plot displays how well the model predicts the value of the dependent variable against the true value of the dependent variable.
Cluster Matrix Plot

The *cluster matrix* displays a two-dimensional projection of each cluster onto a specified number of effect pairs.

Confusion Matrix

The *confusion matrix* displays the classification results for categorical response models. After a model is created, each observation has an observed value and a predicted value. The confusion matrix displays how many observations fall into each observed-predicted pair.
Fit Statistic

The *fit statistic* plot compares a selected model statistic across all models included in a model comparison object. In the image below, the event level misclassification rate is plotted. The statistics that are available for selection depend on the models that are being compared.
Fit Summary Plot

The fit summary plot ranks each input variable based on importance to the model as determined by its p-value.
Icicle Plot

An icicle plot is an alternative way to view a decision tree. The width of each item in the plot indicates what percentage of the data is contained in that item. The root node spans the entire width of the plot because it contains 100% of the data. Each leaf node contains only a fraction of the data and is thus much smaller.

Influence Plot

The influence plot displays the relative influence of each observation on the model parameters based on a specified statistic.
For the generalized additive model and nonparametric logistic regression model, the iteration plot displays the change in the value of the objective function at each step of the model creation algorithm.
Lift Plot

*Lift* measures the ratio of percent captured response within each decile to the baseline percent response.

![Lift Plot](image)

*Cumulative lift* measures the ratio of percent captured response within each decile, up to and including the current decile, to the baseline percent response.

![Cumulative Lift Plot](image)
Misclassification Plot

This *misclassification plot* displays the number of true positives, false positives, true negatives, and false negatives in a bar chart.

![Misclassification Plot](image)

Parallel Coordinates Plot

The *parallel coordinates plot* displays how each cluster interacts with the effect variables.

![Parallel Coordinates Plot](image)

Residual Plot

The *residual plot* displays a specified residual value for each observation in the input data set.

![Residual Plot](image)
ROC Plot

The Receiver Operator Characteristic (ROC) plot displays the sensitivity and 1–specificity measures for a model over a range of cutoff values. Sensitivity is defined as the number of true positives divided by the sum of true positives and false positives. Specificity is defined as the number of true negatives divided by the sum of true negatives and false negatives. One minus specificity is the number of false positives divided by the number of nonevents.
Spline Plot

The spline plot displays the spline created for use in the generalized additive model and nonparametric logistic regression model. A one-dimensional spline plot includes a confidence band around the spline.

A two-dimensional spline is plotted as a contour plot.
Tree Plot
See “Decision Tree” on page 26 for more information.

Variable Importance Plot
A variable importance plot ranks each input variable based on its relative contribution to the model.
SAS Visual Data Mining and Machine Learning

About SAS Visual Data Mining and Machine Learning Objects

If SAS Visual Data Mining and Machine Learning is licensed at your site, then these plots are available.

Bayesian Network

The *Network* plot displays the network that was selected by the Bayesian network object. The model with the best misclassification rate is selected.
Iteration Plot

For tree-based models with a categorical response, the iteration plot displays the change in misclassification rate at each iteration during model training. For tree-based models with a measure response, the iteration plot displays the change in average squared error.

Error Plot

For other models, the iteration plot displays the value of a specified model convergence criterion at each iteration during model training.
Model Selection — Bayesian Network

The model selection plot for a Bayesian network shows how the misclassification rate of the model changes as the number of parents changes. For each type of Bayesian network, a network is created with the number of parents iterating from 1 to the value of the Maximum number of parents property. By definition, the Tree-augmented naive Bayesian network always contains exactly two parents, so only one point is plotted. The misclassification rate of each network is plotted, and the network with the best misclassification rate is indicated with a star icon.
Neural Network

The *neural network* plot displays the input nodes, hidden nodes, connections, and output nodes of a neural network.

Partial Dependence Plot

The *partial dependence* plot helps you determine how the value of the response changes as the value of a given predictor changes.
Rankings Plot

The rankings plot is used by the factorization machine to display the top or bottom ranked event levels for category variables.

<table>
<thead>
<tr>
<th>CLUSTER_CODE</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>23</td>
<td>3</td>
</tr>
<tr>
<td>03</td>
<td>4</td>
</tr>
<tr>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>34</td>
<td>8</td>
</tr>
<tr>
<td>24</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>
Relative Importance Plot

The relative importance plot ranks each input variable based on its relative contribution to the model. This plot is similar to the variable importance plot, but the results are computed differently.

![Relative Importance Plot](image)

Scored Response

The scored response plot is used by the factorization machine to display the computed responses against the true, observed values.
Variables in Network — Bayesian Network

The variables in network plot is used by the Bayesian network to display variables used to create the model, sorted by its BIC score.

High-Cardinality Thresholds for Objects

Default client-side thresholds for objects are documented in the following table. These thresholds affect SAS Visual Analytics and all of the viewers. The second column indicates the maximum number of unique values.
Note: You can use the **Override system data limit** option to specify a different system data limit for an object. See “Specify Options for an Object” in *SAS Visual Analytics: Working with Report Content*.

### Table 1  Client-Side Thresholds for Objects

<table>
<thead>
<tr>
<th>Object</th>
<th>Rows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar chart (regular, targeted, and dual axis)</td>
<td>truncates the data after 3,000 rows.</td>
</tr>
<tr>
<td>Box plot</td>
<td>displays an error message if the data would create more than 800 boxes.</td>
</tr>
<tr>
<td>Bubble change plot</td>
<td>displays an error message if the server returns more than 3,000 rows.</td>
</tr>
<tr>
<td>Bubble plot</td>
<td>displays an error message if the server returns more than 25,000 rows.</td>
</tr>
<tr>
<td>Butterfly chart</td>
<td>displays an error message if the server returns more than 3,000 rows.</td>
</tr>
<tr>
<td>Button bar</td>
<td>truncates the data after 100 rows</td>
</tr>
<tr>
<td>Crosstab</td>
<td>displays an error message if the server returns more than 40,000 rows.</td>
</tr>
<tr>
<td>Correlation matrix</td>
<td>allows only 60 measures to be assigned.</td>
</tr>
<tr>
<td>Custom graph</td>
<td>displays an error message if the server returns more than 3,000 rows.</td>
</tr>
<tr>
<td>Data-driven content</td>
<td>truncates the data after 40,000 rows.</td>
</tr>
<tr>
<td>Decision tree</td>
<td>displays an error if the server returns more than 100,000 rows for the response values, or more than 10,240 rows for the predictor values.</td>
</tr>
<tr>
<td>Drop-down list</td>
<td>truncates the data after 500 rows</td>
</tr>
<tr>
<td>Dual axis bar chart</td>
<td>displays an error message if the server returns more than 3,000 rows.</td>
</tr>
<tr>
<td>Dual axis bar-line chart</td>
<td>displays an error message if the server returns more than 3,000 rows.</td>
</tr>
<tr>
<td>Dual axis line chart</td>
<td>displays an error message if the server returns more than 3,000 rows.</td>
</tr>
<tr>
<td>Forecasting</td>
<td>displays an error message if the server returns more than 10,000 rows.</td>
</tr>
<tr>
<td>Object</td>
<td>Rows</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td>Gauge</td>
<td>with the <strong>Group</strong> role assigned, truncates the data after 500 rows.</td>
</tr>
<tr>
<td>Geo contour</td>
<td>truncates the data if the contour grid contains more than 40,000 cells.</td>
</tr>
<tr>
<td>Geo coordinate</td>
<td>for coordinates, displays an error if the server returns more than 40,000 rows.</td>
</tr>
<tr>
<td></td>
<td>for bubbles, displays an error if the server returns more than 25,000 rows.</td>
</tr>
<tr>
<td>Geo network</td>
<td>displays an error message if the network contains more than 25,000 nodes and links.</td>
</tr>
<tr>
<td>Geo region</td>
<td>displays an error if the server returns more than 5,000 rows. An error is displayed if a request to the polygon provider returns more than 250,000 vertices.</td>
</tr>
<tr>
<td>Geo region-coordinate</td>
<td>for the region map, displays an error if the server returns more than 5,000 rows. An error is displayed if a request to the polygon provider returns more than 250,000 vertices.</td>
</tr>
<tr>
<td></td>
<td>for coordinates, displays an error if the server returns more than 40,000 rows.</td>
</tr>
<tr>
<td></td>
<td>for bubbles, displays an error if the server returns more than 25,000 rows.</td>
</tr>
<tr>
<td>Heat map</td>
<td>when category values are assigned, displays an error if the server returns more than 3,000 rows.</td>
</tr>
<tr>
<td>Histogram</td>
<td>has no client or server cardinality limits.</td>
</tr>
<tr>
<td>Line chart (regular and dual axis line)</td>
<td>truncates the data after 3,000 rows.</td>
</tr>
<tr>
<td>List</td>
<td>truncates the data after 50,000 rows.</td>
</tr>
<tr>
<td>List table</td>
<td>truncates the data after 40,000 rows.</td>
</tr>
<tr>
<td>Needle plot</td>
<td>displays an error message if the server returns more than 3,000 rows.</td>
</tr>
<tr>
<td>Network analysis</td>
<td>displays an error message if the network contains more than 25,000 nodes and links.</td>
</tr>
<tr>
<td>Numeric series plot</td>
<td>displays an error message if the server returns more than 3,000 rows.</td>
</tr>
<tr>
<td>Object</td>
<td>Rows</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Path analysis</td>
<td>displays an error if the data set contains more than 2,000,000,000 paths.</td>
</tr>
<tr>
<td></td>
<td>displays an error if the number of transaction IDs is greater than 10,000.</td>
</tr>
<tr>
<td></td>
<td>truncates the number of links to 4,000.</td>
</tr>
<tr>
<td></td>
<td>ignores any paths that are longer than 2,000 links.</td>
</tr>
<tr>
<td>Pie chart</td>
<td>displays an error message if the server returns more than 3,000 rows.</td>
</tr>
<tr>
<td>Scatter plot</td>
<td>displays an error message if the server returns more than 40,000 rows.</td>
</tr>
<tr>
<td>Schedule chart</td>
<td>displays an error message if the server returns more than 3,000 rows.</td>
</tr>
<tr>
<td>Step plot</td>
<td>displays an error message if the server returns more than 3,000 rows.</td>
</tr>
<tr>
<td>Text input</td>
<td>truncates the data after 40,000 rows.</td>
</tr>
<tr>
<td>Text topics</td>
<td>displays an error message if the data source contains more than 10,000,000 rows.</td>
</tr>
<tr>
<td></td>
<td>truncates the number of topics to 13.</td>
</tr>
<tr>
<td></td>
<td>truncates the number of terms to 100.</td>
</tr>
<tr>
<td></td>
<td>truncates the number of documents to 1,000.</td>
</tr>
<tr>
<td>Time series plot (regular and dual axis)</td>
<td>displays an error message if the server returns more than 10,000 rows.</td>
</tr>
<tr>
<td>Treemap</td>
<td>truncates the data after 1,500 rows.</td>
</tr>
<tr>
<td>Vector plot</td>
<td>displays an error message if the server returns more than 3,000 rows.</td>
</tr>
<tr>
<td>Waterfall chart</td>
<td>displays an error message if the server returns more than 3,000 rows.</td>
</tr>
<tr>
<td>Word cloud</td>
<td>truncates the data to the value of the <strong>Word display limit</strong> option. The maximum value is 100.</td>
</tr>
</tbody>
</table>
Programming Considerations for Data-Driven Visualizations

Overview of Programming for Data-Driven Visualizations

The third-party visualization for a data-driven content object can be authored in any JavaScript charting framework, such as D3.js, Google Charts, and CanvasJS. The content must be capable of being displayed in an iFrame.

To find and share samples of third-party visualizations, see the SAS Software GitHub repository: https://github.com/sassoftware/sas-visualanalytics-thirdpartyvisualizations.

For a third-party visualization to receive data in a data-driven content object, you must add a listener as described in “Receiving Data” on page 56.

If you want your visualization to serve as the source of an action, then see “Selection Handling” on page 57.

If you want your visualization to participate in linked selections (data brushing), then see “Linked Selection Handling” on page 58.

You can provide an instructional message to users of your custom visualization. See “Custom Instructional Message” on page 59.

Receiving Data

SAS Visual Analytics shares data with the data-driven content object by using the HTML5 window.postMessage() API. (See https://developer.mozilla.org/en-US/docs/Web/API/API/Window/postMessage.) For a third-party visualization to receive the data, it needs a listener. The following example code adds a listener:

```javascript
if (window.addEventListener) {
  // For standards-compliant web browsers
  window.addEventListener("message", onMessage, false);
} else {
  window.attachEvent("onmessage", onMessage);
}

// Retrieve data and begin processing
function onMessage(event) {
  if (event && event.data) {
    //process event.data
  }
}
```

The onMessage function is called each time the data for the data-driven content object is updated. The event.data object is a JSON object. Here are some of its attributes:
resultName
The name of the associated query result. This name is needed for communicating any messages from the data-driven content object back to SAS Visual Analytics.

data
The query results stored in a two-dimensional array. The data is in row-major order. So, event.data.data[0] is the first row of data and event.data.data[0][0] is the first column in the first row. The data in this array is unformatted for measures. Specifying a format for a measure has no impact on the data returned. Dates and datetimes are formatted, so the data reflects the format that is specified on any date or datetime variable.

rowCount
The number of rows of data returned. If all the data has been filtered out or no data items are assigned to the object, then the row count is 0.

columns
An array of column objects that let the author determine the type of data and other attributes such as format and label.

parameters
An array of parameter objects that the data-driven content object consumes when executing the query. This array of parameter objects enables the author to access the current value of the parameters and other parameter attributes. Only the parameters that are used by the query are returned in this array.

Note: Numeric data is exchanged as unformatted values. If you want to display formatted numeric values, then you must apply the formatting in the code for your third-party visualization.

Selection Handling
If you want the third-party visualization to serve as the source of an action in SAS Visual Analytics, then the visualization must communicate back to SAS Visual Analytics whenever a selection is made.

The message that is sent must include the resultName attribute (retrieved from the data which SAS Visual Analytics sent to the visualization). SAS Visual Analytics needs to know which rows of data were selected, so the message needs a selections attribute that contains an array of the objects that specifies the selected row indices (where 0 is the first row of data). Each entry in the selections array needs to have an attribute of row with a value of the selected row. Here is a JavaScript example that creates two functions for handling selections:

```javascript
function sendSelection(selectedRows, resultName) {
  var selections = [];
  if (selectedRows)
  {
    selectedRows.forEach(function (row) {
      selections.push({row: row});
    });
  }
  var message = {
    resultName: resultName,
    selections: selections
  };
  sendMessage(message);
}
```
function sendMessage(message) {
    var url = (window.location != window.parent.location) ? document.referrer : document.location.href;
    window.parent.postMessage(message, url);
}

When calling postMessage, the code needs to call it on the parent and needs to pass in the target origin as the second argument.

Linked Selection Handling

If the data-driven content object is the target of a linked selection (data brushing action), then the data that is sent to the object contains an additional column of data. This column informs the visualization which rows of data are to be selected. In the `<columns>` array, if a column has a `usage` attribute that has a value of `brush`, then this column of data controls selection and should not be processed with the rest of the data.

If the data-driven content object author wants the visualization to honor the linked selection, then it is the author's responsibility to make the selections in the visualization. If a row is selected, then the `brush` column has a value greater than 0. If the row is not selected, then the `brush` column has a value of 0. In the sample data, the first row and third row of data is to be selected. The second row should not be selected.

```json
{
    "version": "1",
    "resultName": "dd40",
    "rowCount": 3,
    "availableRowCount": 3,
    "data": [
        [ "Finch", 95000.0, 0.42857142857142855 ],
        [ "Jones", 26000.0, 0.0 ],
        [ "Smith", 108000.0, 0.5 ]
    ],
    "columns": [
        {
            "name": "bi184",
            "label": "dealer",
            "type": "string"
        },
        {
            "name": "bi258",
            "label": "sales",
            "type": "number",
            "usage": "quantitative",
            "aggregation": "sum",
            "format": {
                "name": "BEST",
                "width": 12,
                "precision": 0,
                "formatString": "BEST12."
            }
        },
        {
            "name": "ri1",
            "type": "number",
            "usage": "brush",
            "format": {
                "name": "COMMA",
                "width": 12,
```
Custom Instructional Message

The data-driven content object supports displaying a custom instructional message to the report author. The instructional message is displayed in the report designer interface only. The message is sent when the data that is assigned to the **Variables** role does not meet the requirements of the visualization.

The instructional message is sent in the same way as a selection message, but instead of sending a `selections` attribute, a `message` attribute is sent.

```javascript
function sendNoDataMessage(resultName) {
  var message = {
    resultName: resultName,
    message: "No data items are assigned. This visual requires 1 category and 2 measures."
  };
  sendMessage(message);
}
```

Release Dates for SAS Visual Analytics

The following tables show the release dates for SAS Visual Analytics and the associated SAS Viya and SAS 9 releases:

<table>
<thead>
<tr>
<th>SAS Visual Analytics</th>
<th>SAS Viya</th>
<th>Initial Release Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1</td>
<td>3.1</td>
<td>March 21, 2017</td>
</tr>
<tr>
<td>8.2</td>
<td>3.2</td>
<td>December 12, 2017</td>
</tr>
<tr>
<td>8.3</td>
<td>3.4</td>
<td>July 24, 2018</td>
</tr>
<tr>
<td>8.3 update¹</td>
<td>3.4</td>
<td>September 26, 2018</td>
</tr>
<tr>
<td>8.4</td>
<td>3.4</td>
<td>August 20, 2019</td>
</tr>
<tr>
<td>8.5</td>
<td>3.5</td>
<td>November 19, 2019</td>
</tr>
<tr>
<td>8.5 update²</td>
<td>3.5</td>
<td>June 23, 2020</td>
</tr>
</tbody>
</table>

¹ This release is officially called the September 2018 Update.
² This release is officially called the June 2020 Update.
Managing Access to Functionality

Manage Access to Features: URI Reference

An administrator can manage access to features in SAS Visual Analytics by granting permissions for the URI (Uniform Resource Identifier). For more information about assigning access, see "Access to Functionality: How To (Basic Approach)" in SAS Viya Administration: Access to Functionality.

The following table provides examples of application URIs that you can use as rule targets in the basic approach to managing access to functionality. Here are the key points about managing access to functionality:

- Most of the predefined rules for documented URIs grant access to authenticated users. In the following table, exceptions are noted.
- In general, access to functionality is controlled by the Read permission. Some predefined rules grant additional permissions.
- For details about a predefined rule, see the rule’s description. On the Rules page in SAS Environment Manager, right-click the rule and select Properties.

<table>
<thead>
<tr>
<th>SAS Visual Analytics</th>
<th>SAS 9</th>
<th>Initial Release Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>9.3</td>
<td>March 27, 2012</td>
</tr>
<tr>
<td>5.2</td>
<td>9.3</td>
<td>June 5, 2012</td>
</tr>
<tr>
<td>6.1</td>
<td>9.3</td>
<td>December 18, 2012</td>
</tr>
<tr>
<td>6.2</td>
<td>9.3 and 9.4</td>
<td>July 10, 2013</td>
</tr>
<tr>
<td>6.3</td>
<td>9.4</td>
<td>December 17, 2013</td>
</tr>
<tr>
<td>6.4</td>
<td>9.4</td>
<td>March 11, 2014</td>
</tr>
<tr>
<td>7.1</td>
<td>9.4</td>
<td>October 7, 2014</td>
</tr>
<tr>
<td>7.2</td>
<td>9.4</td>
<td>May 12, 2015</td>
</tr>
<tr>
<td>7.3</td>
<td>9.4</td>
<td>August 13, 2015</td>
</tr>
<tr>
<td>7.4</td>
<td>9.4</td>
<td>April 18, 2017</td>
</tr>
<tr>
<td>7.5</td>
<td>9.4</td>
<td>May 21, 2019</td>
</tr>
<tr>
<td>Application, Component, or Feature</td>
<td>URI</td>
<td>Notes</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-----</td>
<td>-------</td>
</tr>
<tr>
<td>SAS Visual Analytics</td>
<td>/SASVisualAnalytics/**</td>
<td></td>
</tr>
<tr>
<td>Access the application.</td>
<td>/SASVisualAnalytics/**</td>
<td></td>
</tr>
<tr>
<td>Geo</td>
<td>/maps/providers</td>
<td>Initially granted to SAS Administrators.</td>
</tr>
<tr>
<td>Add a custom map provider.</td>
<td>/maps/providers/*</td>
<td>Initially granted to SAS Administrators.</td>
</tr>
<tr>
<td>Update or delete a custom map provider.</td>
<td>/maps/providers/*</td>
<td>Initially granted to SAS Administrators.</td>
</tr>
<tr>
<td>Use the ESRI service.</td>
<td>/webDataAccess/esri/user/token</td>
<td></td>
</tr>
<tr>
<td>Personalization</td>
<td>/preferences/preferences/@currentUser/**</td>
<td></td>
</tr>
<tr>
<td>Set personal preferences.</td>
<td>/preferences/preferences/@currentUser/**</td>
<td></td>
</tr>
<tr>
<td>Access personal history folder.</td>
<td>/folders/folders/@myHistory</td>
<td></td>
</tr>
<tr>
<td>Manage personal favorites folder.</td>
<td>/folders/folders/@myFavorites</td>
<td></td>
</tr>
<tr>
<td>Report and Data Interactions</td>
<td>/SASVisualAnalytics_capabilities/edit</td>
<td>Provides access to edit reports.</td>
</tr>
<tr>
<td>Create and edit reports.</td>
<td>/SASVisualAnalytics_capabilities/edit</td>
<td>Provides access to edit reports.</td>
</tr>
<tr>
<td>Access the <strong>Import</strong> window.</td>
<td>/casManagement_capabilities/importData</td>
<td></td>
</tr>
<tr>
<td>Import Facebook data.</td>
<td>/webDataAccess_capabilities/facebookImport</td>
<td></td>
</tr>
<tr>
<td>Import Google Drive data.</td>
<td>/webDataAccess_capabilities/googledriveImport</td>
<td></td>
</tr>
<tr>
<td>Import Google Analytics data.</td>
<td>/webDataAccess_capabilities/googleanalyticsImport</td>
<td></td>
</tr>
<tr>
<td>Import YouTube data.</td>
<td>/webDataAccess_capabilities/youtubeImport</td>
<td></td>
</tr>
<tr>
<td>Import Twitter data.</td>
<td>/webDataAccess_capabilities/twitterImport</td>
<td></td>
</tr>
<tr>
<td>Upload data files.</td>
<td>/casManagement/servers/<em>/caslibs/</em>/tables</td>
<td>Affects uploads via the service.</td>
</tr>
<tr>
<td>Export reports as PDF.</td>
<td>/reportRenderer/reports/**</td>
<td></td>
</tr>
<tr>
<td>Export data from reports.</td>
<td>/reportData_capabilities/exportData</td>
<td></td>
</tr>
<tr>
<td>Application, Component, or Feature</td>
<td>URI</td>
<td>Notes</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-----</td>
<td>-------</td>
</tr>
<tr>
<td>Export detail data from reports.</td>
<td>/reportData_capabilities/exportDetailData</td>
<td>Export images from SAS Visual Analytics and the SAS Visual Analytics Apps.</td>
</tr>
<tr>
<td>Export report images.</td>
<td>/SASVisualAnalyticsCommon_capabilities/exportImage</td>
<td>Controls the availability of the Download Table action in SAS Data Explorer and SAS Data Studio.</td>
</tr>
<tr>
<td>Export data from loaded tables.</td>
<td>/dataPreparation_capabilities/exportTable</td>
<td></td>
</tr>
<tr>
<td>Email or share report images.</td>
<td>/SASVisualAnalyticsCommon_capabilities/shareReport</td>
<td>Email or share reports from SAS Visual Analytics and the SAS Visual Analytics Apps.</td>
</tr>
<tr>
<td>Create jobs to obtain report images.</td>
<td>/reportImages/jobs/**</td>
<td>Examples: thumbnails and section images</td>
</tr>
<tr>
<td>Create models in SAS Visual Analytics.</td>
<td>/SASVisualAnalytics_capabilities/buildAnalyticalModel</td>
<td></td>
</tr>
<tr>
<td>Manage report states for reports.</td>
<td>/reports/reports/*/states</td>
<td></td>
</tr>
<tr>
<td>Create shared data views.</td>
<td>/SASVisualAnalytics_capabilities/shareDataView</td>
<td>Initially granted to Application Administrators.</td>
</tr>
<tr>
<td>Subscribe to report alerts.</td>
<td>/reportAlerts/**</td>
<td></td>
</tr>
<tr>
<td>Manage comments.</td>
<td>/comments/**</td>
<td></td>
</tr>
<tr>
<td>Import reports.</td>
<td>/importVASpk/**</td>
<td></td>
</tr>
<tr>
<td><strong>Report Distribution</strong>&lt;sup&gt;1, 2&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provides access to the report distribution feature for users who are editing reports.</td>
<td>/reportDistribution/distributions/**</td>
<td>Initially granted to Application Administrators.</td>
</tr>
<tr>
<td>Create and edit schedules for report distribution.</td>
<td>/reportDistribution/scheduler/**</td>
<td>Initially granted to Application Administrators.</td>
</tr>
<tr>
<td>Provides access to the Distribute option to users who are editing reports.</td>
<td>/reportDistribution/distributionRequests/**</td>
<td>Initially granted to Application Administrators.</td>
</tr>
<tr>
<td>Application, Component, or Feature</td>
<td>URI</td>
<td>Notes</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-----</td>
<td>-------</td>
</tr>
<tr>
<td>Provides access to the report distribution feature for users who are editing reports.</td>
<td>/reportDistribution/distributionRequestsWithSchedules</td>
<td>Initially granted to Application Administrators.</td>
</tr>
<tr>
<td>Create and edit schedules for report distribution.</td>
<td>/scheduler/jobs/**</td>
<td>Initially granted to Application Administrators.</td>
</tr>
<tr>
<td>Access and monitor schedules for report distribution. Run schedules in the background.</td>
<td>/jobExecution/jobs/**</td>
<td>Initially granted to Application Administrators.</td>
</tr>
<tr>
<td>Access and modify schedules for report distribution. Run schedules for report distribution in the background.</td>
<td>/jobExecution/jobRequests/*</td>
<td>Initially granted to Application Administrators.</td>
</tr>
<tr>
<td>Create and run schedules for report distribution. Run schedules in the background and view the logs.</td>
<td>/files/files/**</td>
<td>Initially granted to Application Administrators.</td>
</tr>
</tbody>
</table>

1 See “Example: Expand the Ability to Distribute Reports” on page 63.
2 See “Example: Reduce the Ability to Distribute Reports” on page 64.

**Example: Expand the Ability to Distribute Reports**

By default, only members of the Application Administrators group can distribute reports in SAS Visual Analytics. To grant access to additional users, provide appropriate access to all eight of the URIs that are listed in the "Report Distribution" section of Table 2 on page 61.

Here is one way to provide that access:

1 Sign in to SAS Environment Manager as an administrator.

2 Create a custom group.
   a Specify Report Distributors as the group name.
   b Specify ReportDistributors as the group ID.
   c Include the following identities as members:
      ▪ The predefined custom group Application Administrators
      ▪ Any other users and groups that should be able to distribute reports
      
      For more information, see “Identity Management: How To (SAS Environment Manager)” in SAS Viya Administration: Identity Management.

3 In each predefined authorization rule (for each of the eight specified URIs), replace the original principal (ApplicationAdministrators) with a new principal (ReportDistributors).
TIP  As a safer alternative to directly editing the original rules, make a copy of each original rule, replace the principal in each copy, and disable the original rules.

CAUTION  Do not change other predefined authorization rules. There are other predefined rules that impact report distribution. Some of those rules provide required access to service accounts.

CAUTION  Change only the principal (and, optionally, the description). Report distribution requires that existing values in other fields (such as permissions and conditions) are preserved.

For more information, see “General Authorization: How To (Rules Page)” in SAS Viya Administration: General Authorization.

4  Verify that access to the report distribution feature in SAS Visual Analytics is available, as expected.

Example: Reduce the Ability to Distribute Reports

To further restrict access to the report distribution feature in SAS Visual Analytics, you can a custom group that contains only those users who should be able to distribute.

Follow the steps in “Example: Expand the Ability to Distribute Reports”. However, there are the key differences when you reduce the ability to distribute reports:

- Modify only these rules that are specific to report distribution:
  - `/reportDistribution/distributions/**`
  - `/reportDistribution/scheduler/**`
  - `/reportDistribution/distributionRequests/**`
- Do not include Application Administrators as a member of the ReportDistributors group.

CAUTION  Do not change other predefined authorization rules. There are other predefined rules that impact report distribution. Some of those rules provide required access to service accounts.

CAUTION  Do not change the principal in rules that reference other URIs. Application administrators might need access to the other URIs for other, unrelated purposes.