SAS® Visual Forecasting 8.4: Overview

What’s New in SAS Visual Forecasting 8.4

The following features and enhancements are introduced in this release of SAS Visual Forecasting.

Segmentation

Segmentation has been enhanced this release to provide a new pipeline template for projects with segmented data. You can view time series data for each segment in the project. Each segment has its own nested pipeline that you can edit and run separately. SAS Visual Forecasting supports a maximum of 1,000 segments.

For more information about this feature, see “Segmenting Project Data” in SAS Visual Forecasting: User’s Guide.

You can also create segmented projects that are based on predefined demand classification attributes of the times series instead the imported _SEG_ attribute. When a project is created, SAS Visual Forecasting evaluates patterns in each time series so that appropriate modeling strategies can be applied. See “Demand Classification” in SAS Visual Forecasting: User’s Guide for more information.

Derived Attributes

In addition to attributes from project data, you can query and work with project data based on attributes derived from the characteristics of each time series. For example, you can view specific time series that have seasonal patterns, or that have a minimum number of events used in the forecast model. For a complete list of these attributes, see “Derived Attributes” in SAS Visual Forecasting: User’s Guide.

Time Series and Forecast Viewers

In the pipelines for each project, you can view envelope plots or series plots for selected filters or time series. The Time series viewer shows these plots for historical periods and the Forecast viewer provides plots for historical periods and forecasts. Each of the plots can be filtered by selecting values for specific attributes. For more information, see “Viewers for Time Series in your Project” in SAS Visual Forecasting: User’s Guide.
Filter Panel Enhancements

The Filter panel has been enhanced to enable you to save filters that can be used with the Time series viewer, Forecast viewer, and Overrides tab. The Filter Manager has been added for viewing the properties of a filter, showing or hiding a filter in the filter selection list, or deleting a filter. You can also use Filter Settings to show or hide attributes in the panel for creating filters.

New date and datetime selectors have been added to make it easier to select date and time formatted ranges from attributes. Filters that include forecast attributes are available only in the Forecast viewer and Overrides tab. For more information, see “Working with Filters” in SAS Visual Forecasting: User’s Guide.

New Model Strategy Nodes

The following modeling strategies have been added to provide customized forecasting for time series with specific demand patterns:

- Time Series Regression
- Retired Series
- Seasonal Model
- Non-seasonal Model
- Temporal Aggregation Model

For more information about these new strategies, see “Modeling Strategy Nodes for Demand Classification” in SAS Visual Forecasting: User’s Guide.

The new modeling strategies are automatically used in pipelines that are segmented based on the demand pattern classifications. For more information, see “Demand Classification” in SAS Visual Forecasting: User’s Guide.

Project Insights

The Insights tab is new for this release. It provides a summary report for the project after pipelines have been run and a champion pipeline is chosen. For more information, see “Insights” on page 9.

Supported Browsers

For a list of supported web browsers, see https://support.sas.com/en/documentation/third-party-software-reference/viya/34/support-for-web-browsers.html. Note that as of Model Studio 8.4, Internet Explorer 11 is no longer supported.

About SAS Visual Forecasting

What Is SAS Visual Forecasting?

SAS Visual Forecasting is the next generation forecasting product from SAS. It includes a web-based user interface for creating and running projects to generate forecasts from historical data. SAS Visual Forecasting provides automation and analytical sophistication to generate millions of forecasts in the turnaround time that is necessary to run your business. Forecasters can create projects using visual flow diagrams, or pipelines. Pipelines run multiple models on the same data set and choose a champion model based on the results.
SAS Visual Forecasting is built on SAS Viya, an analytic platform powered by Cloud Analytic Services (CAS). As a result, it is designed to effectively model and forecast time series on a large scale with its highly parallel and distributed architecture. This essentially provides a platform for the speed and scalability needed to create the models and generate forecasts for millions of time series. Massive parallel processing within a distributed architecture is one of the key advantages in SAS Visual Forecasting for large-scale time series forecasting.

Forecasters can develop forecasting projects with data from individual session-scoped or shared CAS libraries. You can also easily share data, modeling components, and forecasting results without moving data in the CAS environment.

Use this application to do the following tasks:

- Perform automatic model and variable selection from your source data.
- Generate forecasts automatically by using modeling strategies that are shipped with SAS Visual Forecasting.
- Create your own modeling strategies.
- Perform hierarchical forecasting.
- Visually analyze and diagnose time series data.
- Create attribute-based filters to view subsets of historical and forecast data.
- Override forecasts using attribute-based filters.
- Run disaggregation of overrides using an optimization model with automatic conflict resolution or manual resolution by the user.
- Export projects as SAS or Python code for processing in a batch environment.

This documentation is intended for forecast analysts, demand planners, and managers and executives who oversee the forecast process. Users of SAS Visual Forecasting are more successful if they are familiar with forecasting methods and concepts, such as the following:

- Time series models used for forecasting, such as ARIMA and exponential smoothing models (ESM)
- The difference in long-term trends, seasonal patterns, and cyclic patterns in data
- Measures to evaluate forecast accuracy, including mean absolute error (MAE), root mean square error (RMSE), and mean absolute percentage error (MAPE)

If you do not have a background in the principles of forecasting, SAS Visual Forecasting provides tools that apply different forecasting methods and that determine which methods are most appropriate for the data that you are working with. For more information about forecasting, see these resources.

- Forecasting: principles and practice
- Forecasting Principles
- Business Forecasting: Practical Problems and Solutions
- Demand-Driven Forecasting: A Structured Approach to Forecasting, Second Edition

**How SAS Visual Forecasting Works**

Given a time-stamped data set, the software provides the following automatic forecasting process:

1. accumulates the time-stamped data to form a fixed-interval time series.
2. aggregates the time series to form a hierarchical time series, if requested by the user.

For each time series in the hierarchy, SAS Visual Forecasting performs these steps:

1. diagnoses the time series using time series analysis techniques.
2. creates a list of candidate model specifications based on the diagnostics.
fals each candidate model specification to the time series.

4 generates forecasts for each candidate fitted model.

5 selects the most appropriate model specification based on either in-sample or holdout sample evaluation using a model selection criterion.

6 refits the selected model specification to the entire historical range of the time series.

7 generates forecasts from the fitted model.

8 evaluates the forecast using in-sample analysis and provides for out-of-sample analysis of forecast performance.

The actual data processing runs on a CAS server. In a distributed CAS environment, the time series are delineated and shuffled based on the distinct combination of values for the BY variables. The time series data is processed in parallel. It is written out to CAS tables on each worker node. Furthermore, threads are used on each worker node to process the time series vectors that are loaded onto a node concurrently.

**How SAS Visual Forecasting Relates to Other SAS Software**

SAS Visual Forecasting contains much of the same functionality as SAS Forecast Studio. The main differences are that the performance time is much faster running in the CAS environment and the user interface runs in your web browser. The user interface is shared with other SAS products in Model Studio, which provides a common interactive framework for predictive modeling and analytics. From a single data source, you can create multiple pipelines that contain multiple models in a single project.

Users of SAS Forecast Studio can export their existing projects and upload them to SAS Visual Forecasting. For more information, see “Working with Projects” in *SAS Visual Forecasting: User’s Guide*.

**See Also**

*Learn SAS® Visual Forecasting*

**Using SAS Visual Forecasting**

**Accessing SAS Visual Forecasting**

To access SAS Visual Forecasting, direct your browser to the SAS Drive URL as shown here and sign in.

http://host:port/SASDrive

SAS Drive enables you to access Model Studio. Model Studio provides a common interface for you to work with your data in one or more of the following products, depending on your site license.

- SAS Visual Forecasting
- SAS Visual Data Mining and Machine Learning
- SAS Visual Text Analytics

After you log on, you can access Model Studio from the side menu. Click ☰ in the upper left corner of SAS Drive. Here is an example of what you might see in the side menu:
Click **Build Models**. You are presented with a list of projects that have been previously created. The project type indicates which application is used for the project.

If no projects are shown, follow the instructions in "Creating a Forecasting Project" in *SAS Visual Forecasting: User's Guide*.

To see a list of the supported web browsers for Model Studio, click ☰ in the SAS Drive banner, select **About**, and click the link for Supported Browsers and Platforms.

**Working with Model Studio**

Model Studio provides a common interface between analytic products on SAS Viya. Before you open a project, the following pages are used to manage your projects.

**Projects**

When you first sign in to Model Studio, the Projects page is opened with a tile view of projects that have been created. Each project tile shows the title and project type, according to the product that is used for the project. From any location in Model Studio, you can access the Projects page using ☰ in the left side toolbar.

**Overview**

Use the menu icon (ʼ) over the right side of Projects to access menu options for working a project that is selected. In the tile view, the menu icon is also available on each project's tile. The available actions depend on your access rights to the projects.

- **Open** — Opens a selected project. To open a project, you must also have access to the data source for the project. You can also open a project by clicking the link on the project name.
  
  Some projects might display a lock indicator. This means that the project is currently being edited and you cannot open it. The lock is removed after the user closes the project.

- **Edit** — You can edit the project's name and description.
- **Share** — If you are the owner of a project, then you can also share the project with other groups of users. For more information, see “Sharing Projects” in *SAS Visual Forecasting: User’s Guide*.

- **Import** — You can import forecast projects from other sources. See “Importing Projects” in *SAS Visual Forecasting: User’s Guide* for more information.

- **View project report** — If a pipeline has been successfully run on a project, you can read a summary of the project’s time lines and modeling strategies.

- **Delete** — Removes the project.

- **Download Batch API** — You can also download the batch code needed to run the project outside of the application. For more information, see “Running Batch Code” in *SAS Visual Forecasting: User’s Guide*.

On the Project page in Model Studio, click at the top of the page to view the projects and their properties in a table. The table view provides more information about each project, such as the data source and who the project is shared with.

**Working with Tables in Model Studio**

You can customize the columns in tables by clicking and selecting **Manage columns**.

- To add columns to the table display, select the column name in the **Hidden columns** list and click ↪.

- To remove columns from the table display, select the column name from the **Displayed columns** list and click ⬅.

- To rearrange the columns in the table, select the columns in the **Displayed columns** list and use ↑ and ↓ to place the columns.

You can use this feature with many tables within your projects to customize the table layout.

**The Exchange**

The Exchange displays a list of templates used for project pipelines and modeling nodes. Each template listed includes a description, the product type, the name of the owner who created the template, and the date on which it was last modified. From any location in Model Studio, you can access The Exchange using in the left side toolbar.

Use the menu icon (⋮) over the right side of The Exchange to delete, duplicate, edit, or download any of the templates selected in the list. You can also upload any templates from your workstation into The Exchange. For more information, see “Working with Projects” in *SAS Visual Forecasting: User’s Guide*.

**Upgrade Considerations**

An **upgrade** to Model Studio adds significant feature changes or improvements to the product.

Consider the following information before performing an upgrade:

- If you are upgrading Model Studio within the same version of SAS Viya, see “Adding SAS Viya Software to a Deployment and Upgrading Products in SAS Viya 3.4” in *SAS Viya for Linux: Deployment Guide* for more information.

- If you are upgrading Model Studio in addition to upgrading SAS Viya, see “Upgrading to SAS Viya 3.4 from Earlier Versions of SAS Viya” in *SAS Viya for Linux: Deployment Guide* for more information.

- After all the steps have been completed in the *SAS Viya for Linux: Deployment Guide* and Model Studio or SAS Viya has been upgraded, users can upgrade their individual projects. To upgrade a project:
  - Sign in to Model Studio. The icon in the lower left corner of the project tile indicates that the project has not been upgraded.
  - Open the project that you want to upgrade, and click the **Upgrade** button in the Upgrade Project window.
If you are the project owner, you must upgrade the projects that you created. SAS Administrators cannot upgrade projects that are created by other users.

Before you upgrade a project, you must load the input data for that project to the target environment.

When a shared project is upgraded, it becomes a private project. After you upgrade a project, you must re-share the project.

Overview of Forecasting Projects
To open a project, click the link on the project name. The project is opened displaying the Data tab.

Data
The Data tab provides information about your input data set. You can select the following data sources for your project.

Time Series
For data from an input data source, the variables from the input data set are listed here. The table also shows the attributes of those variables, such as the variable's role in the project. You can assign the variable roles for the project, including time variable, dependent variable, and any BY variables. You can also define independent variables and leave any variables that are not needed for this forecasting project as unassigned.

External Forecast
Projects can be created using output data from another forecasting project rather than a time series. You cannot access the variables table to change any variable roles.

Attributes
Attributes provide a way for you to filter the project based on specific attribute values, such as Region = Northwest and Usage = Low. A project’s default attributes are established when you assign some variables in the input data set as BY variables. The default attributes determine the basic structure and hierarchy of the input data.

After the default attributes are assigned, SAS Visual Forecasting creates additional sets of derived attributes, based on the characteristics of the time series in the input data set. Derived attributes include descriptive statistics and demand classification patterns. After running the input data through forecasting models, forecasting attributes are generated to enable you to create more filters. You can also add more attributes by importing them from a separate data source.

Events
An event is an incident that disrupts the normal flow of a process that generates the time series. You can add events that are already defined by SAS Visual Forecasting or you can add your own.
**Pipelines**

Use the Pipelines tab to create an executable process flow for your project. Each pipeline consists of a set of nodes that are executed sequentially when you run your project.

The Data node represents the input data source of the project.

Each Modeling node assesses the data to determine the best models to use for forecasting and to generate the forecasts for the forecast horizon. Select a modeling strategy from the nodes, such as hierarchical or naive models. You can select multiple models and run them within the same pipeline.

The Model Comparison node selects a champion model when you insert more than one modeling strategy in a pipeline. You can select a different modeling node as champion. You can also view summary statistics for each modeling node in the pipeline, even if only one is used.

The Output node represents the output of a pipeline after it has been successfully run.

Segmented pipelines have a different structure than described here. For more information, see “Creating Segmented Pipelines” in SAS Visual Forecasting: User’s Guide.

**Pipeline Comparison**

If you build multiple pipelines for a project, use this tab to compare pipeline MAPE distribution and summary statistics. A champion pipeline is automatically identified in the list based on the selection criteria that you choose in the project settings. You can set another pipeline as the champion based on other assessments. It is important to make sure that the best pipeline and model have been selected as champion before creating overrides. For more information, see “Selecting a Champion Pipeline” in SAS Visual Forecasting: User’s Guide.

If you have only one pipeline in your project, you can still use this tab to view the MAPE distribution and summary statistics for that pipeline.

**Overrides**

The Overrides tab shows the results of the champion pipeline, including the historical and forecast data. From this tab, you can select and specify filters to view segments of the forecast results and enter any overrides to replace forecasted values for different time series. You can create an override using a percentage difference with the forecasted value, a range of values, or by entering a specific value.
Note: When the Overrides tab is first opened after running one or more pipelines, the data definition for the project is locked and cannot be changed. Make sure you are satisfied with the variable assignments and project settings before accessing the Overrides tab. After the data definition is locked, you can still work with pipelines, adding or removing new models, or changing settings for the models.

You can create filters based on any set of attributes, such as location, brand, category, size, color, or any other variables that are part of your input table. Filters enable you to subset the data so that you can work with these subsets based on specific combinations of attribute values. Here is an example:

- **Location** = Northeast
- **Product Category** = Cosmetics

You can name each filter so that you can select that filter again for future use. When you submit overrides, SAS Visual Forecasting detects any conflicts with overrides created for other filters. Use the Override Management view to resolve these conflicts or choose to resolve them automatically. For complete information, see “Working with Overrides” in SAS Visual Forecasting: User’s Guide.

You can use the following views on the Overrides tab:

- ** Overrides**
  - Use this view to create filters and overrides.

- **Override Management**
  - Use this view to manage overrides and resolve any conflicts between overrides.

### Insights

The Insights tab provides a summary report for the project after pipelines have been run and a champion pipeline is chosen. The report is available after you run a pipeline for the project.

Insights includes the following tiles:

- **Project Summary**
  - Lists the number of time series and pipelines, the name of the dependent variable, and other general information about the project.

- **Project Notes**
  - Provides a place for users to add notes or comments about the project.

- **WMAPE Distribution**
  - Shows the weighted MAPE distribution for the champion pipeline.

- **Execution Summary**
  - Shows a summary of the results for the champion pipeline.

- **Results of All Pipelines**
  - Lists all of the pipelines, their weighted error measurements, and designates the champion pipeline.

- **Data definition**
  - Describes the input data set and variable assignments.