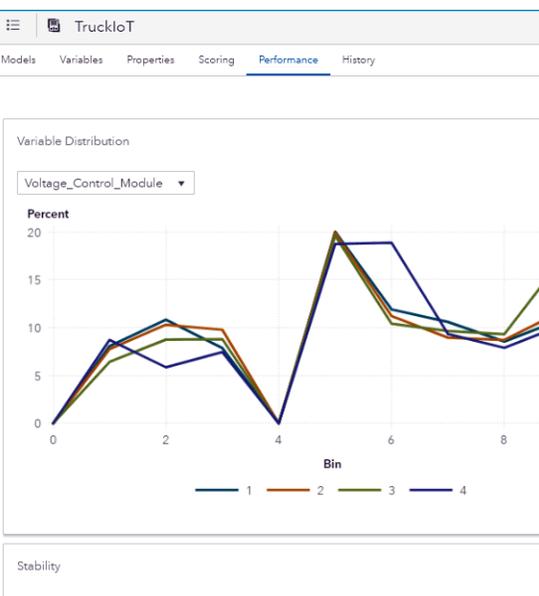


SAS® Model Manager on SAS® Viya®

Create, manage, monitor, deploy and govern analytical models



Organizations face a lot of challenges in managing analytical model collections.

For many, it's an inefficient manual process that takes too long, especially when there are more models than ever. Model decay from underlying market or behavioral changes diminishes model effectiveness and can lead to poor decisions. Failure to update models frequently enough can result in loss of revenue as competitors act on changing trends before you. And, not understanding why the champion model was chosen or how a particular score was calculated makes it difficult to meet regulatory requirements.

SAS Model Manager is a web-based application that helps streamline analytical model management and administration. Your centralized model repository, integrated with a single, visual analytical lifecycle environment, promotes collaboration among all stakeholders. Modeling workflows can be managed easily and efficiently. You'll gain timely analytical insights you know you can trust.

What does SAS® Model Manager do?

SAS Model Manager streamlines the tedious and often error-prone steps of creating, managing, deploying, monitoring and operationalizing analytical models.

Why is SAS® Model Manager important?

Analytical models enable better decision making. SAS Model Manager provides a web-based environment to support lifecycle management and governance of models. Easily manage modeling processes and identify champion models for deployment. Performance monitoring and alerting automate the model updating process to address model degradation and ensure that models reflect current conditions.

For whom is SAS® Model Manager designed?

It's designed for model validation and compliance analysts, data scientists and other analytics professionals concerned with performance degradation. Business unit leaders who manage analytical teams will also benefit from centrally managed model administration.

Benefits

- Streamline analytical modeling processes.** An automated and collaborative environment lets you track each step of the modeling project process, defining customized workflows for different types of models. Users interacting or interpreting models get a unified view of each model's currency, definition and function.
 - Gain confidence from complete knowledge of model collections.** With a centralized and repeatable process for registering, validating, monitoring and retraining models, you can track models from inception through usage to retirement. Comprehensive version control contains a snapshot of model properties and files whenever a version is created. Models are secured, and model version history is locked down and retained.
 - Govern model workflow.** For more efficient model processing and governance, analytical models can be easily tested and compared, performance benchmarking reports and alerts generated, and workflow notifications sent. Modelers can collaborate and reuse models, and
- automatic detection notices can be sent when scoring results change over time, indicating model decay.
- Operationalize analytics quickly.** If you can't put analytics to work within your business processes, what's the point? Rapid, automated model deployment with a few clicks means models can be easily deployed to your business processes, regardless of whether your needs are batch or real time.
 - Ensure auditability and compliance to meet regulatory requirements.** A centralized model repository and version control provide visibility into analytical processes so they can be audited, making compliance with internal governance and external regulations less of a headache.
 - Get faster answers to complex analytical problems.** This solution runs on SAS® Viya®, the latest addition to the SAS Platform. It delivers predictive modeling and machine learning results at breakthrough speeds. Analytical model processing time is measured in seconds or minutes rather than hours, and there are plenty of deployment options.

Overview

SAS Model Manager is a web-based product that streamlines the process of creating, managing, administering, deploying and monitoring an organization's analytical models. It offers a patented, secure analytics model repository that is complemented by a rich, underlying metadata structure consisting of projects and model files. A repeatable framework makes it easy to register, validate, track, monitor and retrain models to ensure they're

performing well. A common visual environment allows stakeholders across your organization to collaborate and treat analytical models as high-value assets throughout their life cycles.

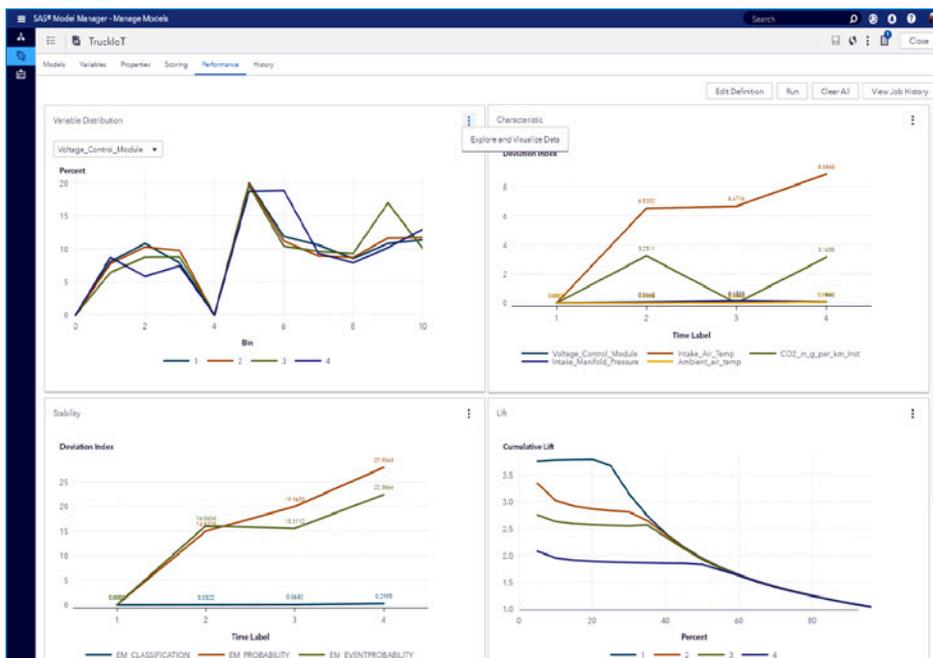
As analytical models are used across different departments and marked as champions for use in other applications, extensive tracking, validation and auditing reports are produced. Ongoing monitoring identifies when it's necessary to refine or

retire a model. Model retraining integrates with SAS Visual Analytics, SAS Visual Statistics, SAS Studio, and Model Studio for SAS Visual Text Analytics and SAS Visual Data Mining and Machine Learning for increased efficiency. This web-based interface makes it easy to automate the model management process, and enables more effective collaboration by letting users track the progress through each step of the modeling process.

Performance monitoring and reporting help automate the model updating process to ensure that models perform at their highest levels at all times.

Name	Role	Model Function	Location	Project (Version)	Date Modified	Modified By
Bayesian Network (Pipeline 1)	RM	Classification	/DMRepository	Trucks, Version 1 (1.0)	Nov 29, 2017 11:07 AM	saedhd
Bayesian Network (Pipeline 1)		Classification	/DMRepository	Trucks, Version 2 (2.0)	Dec 7, 2017 11:04 AM	saedhd
CarrieModelASTORE		Regression	/Carrie Repository/Carrie Folder	Carrie Project, Version 1 (1.0)	Nov 30, 2017 11:40 AM	saecis
CarrieModelPMML		Classification	/Carrie Repository/Carrie Folder	Carrie Project, Version 1 (1.0)	Nov 30, 2017 11:40 AM	saecis
CarrieModelSPK		Classification	/Carrie Repository/Carrie Folder	Carrie Project, Version 1 (1.0)	Nov 30, 2017 12:55 PM	saecis
CarrieModelZIP			/Carrie Repository/Carrie Folder	Carrie Project, Version 1 (1.0)	Nov 30, 2017 11:40 AM	saecis
Carrie_DS1		Classification	/Carrie Repository/Carrie Folder	Carrie Project, Version 1 (1.0)	Nov 30, 2017 11:35 AM	saecis
Carrie_DS2ep		Classification	/Carrie Repository/Carrie Folder	Carrie Project, Version 1 (1.0)	Nov 30, 2017 11:35 AM	saecis
Carrie_DS2epAST			/Carrie Repository/Carrie Folder	Carrie Project, Version 1 (1.0)	Nov 30, 2017 11:36 AM	saecis
Carrie_DS2epkg			/Carrie Repository/Carrie Folder	Carrie Project, Version 1 (1.0)	Nov 30, 2017 11:35 AM	saecis
Cross Sell Response		Classification	/Repository 1		Nov 29, 2017 03:41 PM	edmedev
DS1_hmeq_dmeeg		Classification	/Repository 1	DS1_hmeq_model, Version 1 (1.0)	Dec 4, 2017 09:43 AM	brmddev
Decision Tree (Pipeline 1)		Classification	/DMRepository	saevan28NovVDMML, Version 1 (1.0)	Nov 28, 2017 03:06 PM	raevan
Model6	RM	Classification	/MMREPOS/MMFolder9	MMProject9, Version 1 (1.0)	Dec 5, 2017 09:24 PM	scrikuj
Neural		Classification	/QS_Repository	DOC_Hoq1, Version 1 (1.0)	Dec 3, 2017 08:21 PM	kriapo

Easily view model project content and manage model settings in a centralized model repository.



Visually examine model performance results with user-defined performance data.

Integration with SAS Scoring Accelerator enables the registration and validation of scoring functions within Hadoop (Hortonworks and Cloudera) and Teradata Aster. Additionally, SAS Model Manager supports deployment of analytical models to the real-time, in-memory scoring engine, SAS Micro Analytic Service and SAS Cloud Analytic Services (CAS). Testing and validation is supported on all of these execution targets to ensure model validation is accurate and complete.

Web-based, centralized and secure repository for managing models

The SAS Model Manager repository stores extensive documentation about a model, scoring code and associated metadata. And it permits collaborative model sharing based on each user's group authentication - retaining version control and auditability. Analytical professionals analyze historical data and register the predictive models into the repository along with the required data structure for the models' usage instructions.

Open and RESTful APIs

You can easily register, access, monitor and publish models from the central repository using open and RESTful APIs. Using open and publicly available APIs simplifies integration with business applications.

Analytical workflow management

You can easily define and track custom workflows for analytical lifecycle management in

the visual pipeline environment. This includes all phases, from problem-statement creation to model development and use, including deploying models for execution.

Scoring logic validation before models are published into production

Scoring officers get a defined process to follow and a system that records each test performed by the scoring engine to ensure that the logic embedded within the champion model is sound. A map that details each accuracy checkpoint (along with the expected scoring results) is captured, recorded and logged in the system. This precise method of checking and double-checking the model scoring logic reduces risk exposure from incorrect decisions after the model is pushed to production. Champion models can be exported for on-demand and batch scoring only after they are completely validated.

Users can import select models and code snippets from a variety of modeling environments, including SAS, ZIP files, open source and PMML. SAS Model Manager is also fully integrated with SAS Event Stream Processing and SAS Decision Manager for deploying models as part of complete streaming projects and decision flows.

Performance monitoring/reporting during test and production cycles

As the champion model reaches test, stage and production lifecycle milestones, model status and performance information is pushed to subject-matter experts who manage the test criteria being evaluated at each milestone. Procedural templates document the validation performance and sign-off process.

An audit trail is created as the champion model is marked for production and the predecessor champion model is retired. Performance benchmarks are calculated to display the champion model's scoring performance and document conformity to required standards. Several out-of-the-box performance reports are provided, as well as the flexible user-designed reports that monitor performance on an ongoing basis.

Key Features

Accessible, web-based, centralized and secure repository for managing analytical models

- Access all models in the model repository - whether they're located in a folder or project.
- Access models and model-score artifacts using open REST APIs.
- Support for SAS model registration from SAS Visual Analytics, SAS Visual Statistics, SAS Studio, and Model Studio for SAS Visual Text Analytics and SAS Visual Data Mining and Machine Learning.
- Set up, maintain and manage separate versions for models:
 - Champion model is automatically defined as a new version when the model is set as champion, updated or published in a project.
 - Only one champion model is produced per project. New versions are automatically created when new model projects are registered from the Model Studio environment in SAS Visual Data Mining and Machine Learning and SAS Visual Text Analytics.
 - Choose challenger models to the project champion model.
 - Monitor and publish challenger and champion models.
 - Integration of champion models with SAS Event Stream Processing, including automated notifications when model project champion is updated.
- Monitor performance of champion models for all projects using performance report definition and execution.
- Publish SAS models to SAS Cloud Analytic Services (CAS), Hadoop, SAS Micro Analytic Service or Teradata.
- Python code publishing support for SAS Micro Analytic Service execution target.
- Provides accounting and auditability, including event logging of major actions, including model creation, project creation and versioning.
- Add general properties as columns to the listing for models and projects, such as model name, role, type of algorithm, date modified, modified by, repository location, description, version and keywords (tags).
- Import models from the SAS Platform, including training code, score logic, estimate tables, target and input variables and output variables, using SAS package files (.SPK), PMML and ZIP format files.
- Export models as .ZIP format, including all model file contents for movement across environments.
- Easily copy models from one project to another, simplifying model movement within the repository.
- Import code snippets/models from any code base (C, C++, Java, Python, etc.) into the managed inventory.
- Create DATA step score code for PMML models on import for inclusion in scoring tasks, reporting and performance monitoring.
- Model repository can be searched, queried, sorted and filtered by attributes used to store models - such as type of asset, algorithm, input or target variables, model ID, etc. - as well as user-defined properties and editable keywords.
- Register, compare, report, score and monitor models built in R or Python (classification and prediction).
- Compare two or more models using automatically calculated model fit statistics to easily understand model differences through plots and analytical metrics.
- Provides secure, reliable model storage and access administration, including backup and restore capabilities, overwrite protection, event logging and user authentication.

Key Features (continued)

The production champion model remains active until business conditions dictate its retirement, or until a new model is created and the predictive model life cycle begins a new iteration.

Accessible, cloud-enabled, in-memory engine

SAS Model Manager takes advantage of the SAS Viya engine for even faster insights. SAS Viya brings new enhancements to the SAS Platform, including high availability, faster in-memory processing, the ability to call SAS actions from open source languages and native cloud support.

SAS Model Manager on SAS Viya is available for both public and private cloud delivery in a scalable and elastic environment. Depending on the size of the problem, processing can spin up or down as needed. You can solve your largest problems, using the appropriate computational resources based on the scale of the problem.

TO LEARN MORE »

To learn more about SAS Model Manager, download white papers, view screenshots and see other related material, please visit sas.com/model-manager.

Analytical workflow management

- Create custom processes for each model using SAS Workflow Studio:
 - The workflow manager is fully integrated with SAS Model Manager so you can manage workflows and track workflow tasks within the same user interface.
 - Import, update and export generic models at the folder level – and duplicate or move to another folder.
- Provides collaboration across teams with automated notifications.
- Perform common model management tasks such as importing, viewing and attaching supporting documentation; setting a project champion model and flagging challenger models; publishing models for scoring purposes; and viewing dashboard reports.

Scoring logic validation before models are exported to production

- Define test and production score jobs for SAS and Python models using required inputs and outputs.
- Define and execute scoring tasks, and specify where to save the output and job history.
- Publish model updates to different scoring channels and notify subscribers via message queues.
- Create model input and output variables from the score.sas file to generate missing metadata from model variables.
- Integration with SAS Scoring Accelerator for in-database model deployment.
- Integration with SAS Micro Analytic Service – for SAS and Python code testing and result validation.

Model performance monitoring and reporting during test and production

- Integrated retraining for data mining and machine learning models using Model Studio:
 - Retrain data mining and machine learning models when performance reporting threshold metrics are reached.
 - Automated, configured registration after model retraining is completed from Model Studio. No need to import separately.
- Model performance reports produced for champion and challenger models include variable distribution plots, lift charts, stability charts, ROC, K-S and Gini reports with SAS Visual Analytics using performance-reporting output result sets.
- SAS Visual Analytics provides a wide range of model comparison reports.
- Performance results are prepared and made available to SAS Visual Analytics for simplified access to a wide range of model comparison reports.
- Ability to specify multiple data sources and time-collection periods when defining performance-monitoring tasks.

Distributed, accessible and cloud-ready

- Runs on SAS Viya, a scalable and distributed in-memory engine of the SAS Platform.
- Distributes analysis and data tasks across multiple computing nodes.
- Provides fast, concurrent, multiuser access to data in memory.
- Includes fault tolerance for high availability.
- Lets you add the power of SAS Analytics to other applications using RESTful APIs.

To contact your local SAS office, please visit: sas.com/offices

