



SAS® Model Manager

Create, manage, monitor and deploy lifecycle analytics

What does SAS® Model Manager do?

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

Why is SAS® Model Manager important?

Analytical models are high-value assets that must be well-managed for optimum performance. Because they play an increasingly important role in business processes, it is critical to reduce the likelihood of erroneous model output or incorrect interpretation of model results. The powerful monitoring and retraining features and detailed systems of checks and balances continually verify the accuracy and usefulness of analytical models.

For whom is SAS® Model Manager designed?

- Business decision makers who want to apply analytical insights to improve quality and precision of resulting decisions.
- Model validation/compliance analysts who need to perform independent review and validation of models and ensure that models perform correctly and comply with stated specifications.
- IT professionals responsible for preparing data for model deployment and validating score code as it is deployed in operational environments.
- Analytic stakeholders concerned with the performance degradation of analytical models.

For most organizations today, managing the life cycle of analytics is largely a manual process. Moving data and models from creation to production often entails tedious programming or operating system translations as the analytics are pushed across platforms. Mistakes can be made as code is cut, pasted or rewritten by different people. Rarely is there time to go back and add comments describing why a particular algorithm was used or why variables were chosen. Model deployment simply takes too long.

Model decay is another serious challenge. Retaining poorly performing models can result in inaccurate projections, which leads to poor business decisions. Failure to update a model frequently enough can result in loss of revenue and earnings as competitors observe and act on changing trends before you do. SAS Model Manager defends against risks associated with model degradation with capabilities that continually verify the accuracy and usefulness of models.

The lack of standardized management of analytical models through the model life cycle is also painfully evident as organizations struggle to meet deadlines from external agencies. Compliance reports are frantically prepared, and problems arise when conflicting assumptions surface. Not understanding why the champion model was chosen or how a particular score was calculated make it difficult to meet regulatory requirements, which can result in penalties, fines and loss of reputation.

SAS Model Manager solves these problems by enabling all stakeholders to collaborate as they manage analytic

modeling workflow in a cost-effective manner to derive the most ROI.

Key Benefits

- **Reduces time to manage and deploy models into production.** SAS Model Manager provides an easy-to-use graphical user interface that guides users through a repeatable process for registering, validating, deploying and retraining models. Accountability metrics and version control status reports track who changes what, when control is passed from one area to another, etc. Models can be monitored from their creation to deployment into real-time or batch scoring systems until they are retired.
- **Provides an integrated environment for tracking and monitoring model performance.** With its iterative framework, SAS Model Manager ensures analytical models are functionally performing as intended throughout the model life cycle. As models are tested and compared, performance benchmarking reports are generated. As they are deployed, performance metrics are pushed over established reporting channels. Modelers can easily collaborate and reuse models, and automated alerts can be set to detect when the scoring results are changing over time, indicating model decay.
- **Enables compliance with regulatory requirements.** The unique compliance and validation reporting capabilities in SAS Model Manager are highly sought-after by those facing increasing regulatory requirements. Valuable best practices can be captured via the patented centralized



data repository, lifecycle templates and metadata management system. Users are guided through the difficult steps of deploying analytic models into the operational environment.

- **Streamline analytical modeling processes in an effective manner.** SAS Model Manager allows users to design a workflow that offers control, collaboration and visibility as they forward and manage an analytic model throughout its life cycle. Users can create multiple, customized workflows for different types of models. Different users touching or interpreting a model will get a unified view of its current stage with access to meaningful information that will help them take the best actions.

Product Overview

SAS Model Manager enables organizations to register, validate, deploy, monitor and retrain analytic models to ensure accuracy and usefulness. SAS Model Manager provides a common framework for various stakeholders to collaborate, manage and treat analytic models as high-value assets throughout their life cycles.

It offers a patented, secure analytic model repository complemented by a rich metadata structure and project templates. Extensive tracking, validation and auditing reports are produced as analytical models are deployed against operational applications and databases until the time of model refinement or retirement. Model retraining allows the execution of model refinements from the same deployment environment, streamlining the process.

Integration with SAS Scoring Accelerator for Teradata, SAS Scoring Accelerator for Netezza and SAS Scoring Accelerator for IBM DB2 enable the registration and validation of in-database scoring functions within those databases.

Central, secure repository for managing analytical models

The SAS Model Manager repository stores extensive documentation about the model, scoring code and associated metadata by allowing collaborative sharing of models coupled with users' group authentication, 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 deployment of these models.

Model management is organized around business structures that regularly use analytical models as integral parts of their business processes. A project collects all necessary information for model deployment and performance monitoring based on a time-phased model management life cycle. SAS Model Manager provides a collaborative, secure repository for cataloging analytical models and also includes several reports for monitoring model performance.

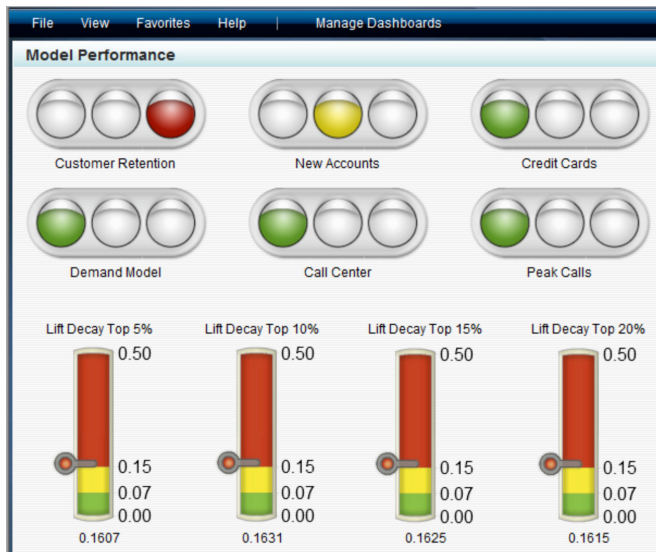
Analytical workflow management

A Web interface, SAS Workflow Studio, provides the ability to define and track custom workflows for model lifecycle management. This can include all phases from problem statement creation through development and deployment of models.

Scoring-logic validation before models are exported to production

Scoring officers using SAS Model Manager have a template to follow and a system to record each test that the scoring engine goes through to ensure 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 the risk exposure of making 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.

The SAS Metadata Repository can deploy the scoring engine from SAS Enterprise Data Integration Server or



Performance monitoring dashboards allow users to track the performance across multiple projects quickly, and enable teams to focus on projects that need the most immediate attention. The software includes an easy-to-use GUI to define the indicators and ranges.

any other SAS component that produces analytical scoring engines. An automated publishing event is launched to notify assigned individuals (via various channels such as email or Web-generated alerts) when it is their turn to act.

SAS Model Manager can be integrated with SAS Real-Time Decision Manager for scoring and managing analytical models for customer retention, acquisition or loyalty programs. The SAS Real-Time Decision Manager scoring activity allows the user to choose any of the scoring projects (published by SAS Model Manager); whenever a decision flow that includes scoring activities is run, those activities execute the referenced score code in real time.

Monitoring and reporting on model performance during test and production life cycles

As the champion model reaches test, stage and production lifecycle milestones, model status and performance information is pushed to the subject-matter experts in the organization who manage the test criteria being evaluated at each milestone. SAS Model Manager uses procedural templates to document the validation performance and the sign-off process. An audit trail is created as the champion model is phased into production and the predecessor champion model is retired. Performance benchmarks are calculated to display the champion model's scoring performance as well as to document conformance to required industry reporting standards.

Several canned reports are provided as well as the flexible user-designed reports that monitor production model performance on an ongoing basis. SAS Model Manager provides an easy-to-use interface to generate the data needed to create a series of performance-monitoring dashboards. It also

Key features

Central, secure repository for managing analytical models

- Project-based storage of models.
 - Set up and maintain separate versions of champion and challenger models within a project:
 - Champion-challenger model promotion.
- Map prerequisite data sources used for model reporting and score code testing.
- Accounting and auditability:
 - Event logging of all major actions.
 - User-defined notes.
 - Attach documents (Microsoft Word documents, Microsoft Excel spreadsheets, HTML files, etc.), and add version control.
- Prebuilt templates for registering standard data mining models:
 - Prediction.
 - Segmentation.
 - Classification.
 - Scorecards.
 - User-defined template.
 - Optional batch model registration support for bulk loading.
 - General properties such as model name, type of algorithm, creation date, modification date, etc.
 - Advanced view of SAS® Enterprise Miner™ process flow diagram.
- Provide more control in setting input and output variables to define the project.
- Import multiple Base SAS, SAS/STAT® and SAS Enterprise Miner models:
 - Training code.
 - Score logic.
 - Estimate tables.
 - Target and input variable.
- Import and export PMML model code with inputs and outputs.
- Register, compare, report, score and monitor models built in R.
- Repository metadata summary report, with information such as:
 - Number of models; number of scoring jobs.
 - Model-aging profiles.
 - Frequency counts of how often each target and input variable has been used across the model portfolio.
- Query the model repository by attributes, such as:
 - Type of algorithm.
 - Input or target variables.
 - Model creator.
 - Model ID.
- Secure, reliable model storage and access administration:
 - Backup and restore capabilities.
 - Overwrite protection.
 - Event logging.
 - User authentication/access privilege administration.

Analytical workflow management

- Create custom processes for each model using SAS Workflow Studio.
 - Automated notifications provide collaboration across teams.
 - Define, manage and track complete analytic life cycles.
 - A Web interface enables enterprise access and collaboration.
 - Process management capabilities create efficiency.

can create an HTML dashboard report that can be deployed throughout the organization. Model-monitoring dashboards and reports allow for a time-series statistical overview of all modeling projects. Metrics include many standard compliance and governance-type statistics. The production champion model remains deployed until business conditions dictate its retirement, or until a new model is created and the predictive model life cycle begins a new iteration.

Overall lifecycle management of analytical models

The Lifecycle Template editor enables you to create custom templates to meet your business process needs. Testing, scoring and sharing of model lifecycle and performance data over established publishing channels are also supported. Accountability metrics and the validation of analytical steps through model creation, deployment and the retirement stage are available.

SAS® Model Manager System Requirements

To learn more about SAS Model Manager system requirements, download white papers, view screenshots and see other related material, please visit www.sas.com/modelmanager.

Key Features (continued)

Scoring-logic validation before models are exported to production

- Define test and production score jobs using required inputs and outputs:
 - Map required inputs and outputs.
 - Add SAS code.
 - View log and results table.
 - Create interactive graphs.
- Export models to SAS Metadata Repository.
- Production scoring:
 - Mining Results Transformation available in SAS Data Integration Studio.
 - Model Scoring Task available in SAS® Enterprise Guide®.
 - Publish models directly to SAS Real-Time Decision Manager.
- Publish model updates to different scoring channels:
 - Email notification sent to subscribers.
 - Store results to a file system or post to a corporate intranet.
- In-database model deployment:
 - Integrated with the SAS Scoring Accelerator for Teradata, SAS Scoring Accelerator for Netezza and SAS Scoring Accelerator for IBM DB2 to publish and validate scoring functions for native scoring in those databases.

Monitoring and reporting on model performance during test and production life cycles

- Model performance reports:
 - Variable distribution plots, characteristic charts, stability charts, lift charts, Receiver Operating Curve (ROC) charts, Kolmogorov-Smirnov charts and Gini charts.
- Model comparison reports:
 - Model profile report, delta report, dynamic lift report, etc.
 - Ad hoc SAS Code Report editor.
 - HTML, RTF, PDF and Microsoft Excel output formats.
- GUI for creating performance-monitoring reports.
- Easy-to-use wizard for creating performance-monitoring dashboards:
 - Update all reports or update reports for projects that have new performance data.
- Model retraining:
 - Create new challenger models based on SAS Enterprise Miner models currently registered in a project, and new data and variables.

Overall lifecycle management of analytical models

- Model lifecycle templates for collaborative project management:
 - Basic, standard, extended and user-defined.
 - Model Lifecycle Template editor for user-defined.
 - Task-oriented milestone completion and approval signoff.
- Progress-completion status reports.