

## › Solution Overview



Predictive analytics has never been more relevant, and easier, than it is now. Big data, gobs of compute power, and modern tools are making predictive models more efficient, accurate, and accessible to enterprises. Why do it? Because enterprises that predict will win, retain and serve customers better than those that don't. That's the bottom line of every business - serve customers better than your competitors.

- The Forrester Wave™: Big Data Predictive Analytics Solutions, Q2, 2015, Forrester Research

# SAS® Predictive Analytics

Turning your data into timely insights for better, faster decision making

## Overview

Is your organization overflowing with data but struggling to turn it into useful, timely insights that help people make better, faster decisions? It's a common problem with potentially huge impacts. Without fact-based answers to complex questions, you're forced to make best-guess decisions about:

- What products will different customers purchase and when?
- Which customers are leaving, and what can be done to keep them?
- How should prices be set to ensure profitability and competitiveness?
- How are maintenance schedules affecting time to failure?
- How can fraudulent transactions be prevented?

To accurately answer such questions, you need powerful, multipurpose predictive analytics solutions that can turn data into insights using state-of-the-art statistical and machine-learning algorithms. That's why SAS offers a variety of predictive analytics solutions. These integrated solutions are designed to meet the needs of all types of users - from business managers and business analysts to data stewards and data scientists to chief scoring officers and IT staff.

## Our Approach

Whether you are just getting started with predictive analytics or you've been using it for years, our solutions can help you take analytical decision making to the next level.

With SAS predictive analytics, accurate insights are delivered at the right time, dramatically increasing the reach and value of your data. And, you can make evidence-based decisions every day - instead of occasionally or reactively. SAS solutions can be easily configured for any line of business or group of users so they can:

- Discover relevant insights with speed and flexibility.
- Analyze data to find results that can be confidently acted upon.
- Act quickly to make better decisions that drive better actions.
- Monitor and evaluate predictions and decisions to verify continued relevance and accuracy.
- Manage a growing portfolio of predictive assets effectively.

## Challenges

- **Delivering trusted data that's ready to model and analyze.** Data comes from different sources and is stored in multiple formats. As a result, your data management team may be spending an inordinate amount of time on analytical data preparation. If so, you are not alone. These professionals not only have to set up, treat and modify data for predictive models, but also keep models current and updated by providing the latest data. This is no small task for organizations that are generating more data and more models each day. What's needed is a way to quickly and routinely acquire, profile, aggregate, transform, augment and load analysis-ready data.
- **Discovering and understanding relationships in complex data.** Business analysts struggle to understand complex data relationships and interpret analytical results. Unfortunately, unless people can quickly uncover relationships in data and share information, the data will remain relatively useless. You also need ways to visualize data during the exploratory and model-building phases, and be able to easily share results with others.
- **Keeping pace with the demand for predictive models.** Big data-driven insights help people make decisions that are more precise – and they help your organization compete and differentiate more effectively. But to have the most impact, predictive models must be tailored for specific needs and objectives. And with more data and increasing requests for analyses, building more models faster for more granular segments is a challenge. You need a wide selection of analytical methods and approaches to choose from (including innovative machine-learning techniques), a way to speed up model creation, and a way to accurately compare models and choose the champion performer.
- **Deploying models takes too long and integrating models with operational systems is difficult.** With increased competition and rapidly changing market conditions, who has time to wait before making a decision? For many, however, deploying models is manual and cumbersome, so people don't get what they need, when they need it. To lock in performance and accuracy gains, you need to monitor model performance and guard against the risks associated with model degradation. Also, to speed up the decision-making process, outputs from models must be used as inputs to business rules for governed and automated decision flows.

## Capabilities

As shown in Figure 1, SAS offers solutions that cross the predictive modeling life cycle, including data preparation, visualization, descriptive and predictive analysis, model deployment, governance and operationalization.

### Analytical Data Preparation

Data preparation and data quality are key enablers of predictive modeling processes. Your input data, which may span multiple platforms and contain multiple big data sources, must be integrated and synchronized into a clear, coherent format. But manually transforming data into properly structured, representative modeling tables can take a great deal of time. With SAS, you can save time by using the software to:

- Structure data sets, transpose them and aggregate values into representative modeling tables.
- Optionally sample a representative set of data to speed processing time.
- Segment observations into groups, interactively bin variable values, filter outliers, replace missing values and derive new variable transformations.
- Automatically generate the required score code to apply predictive models to new data, including all data preparation transformations, on many different operational processing platforms, including Hadoop.

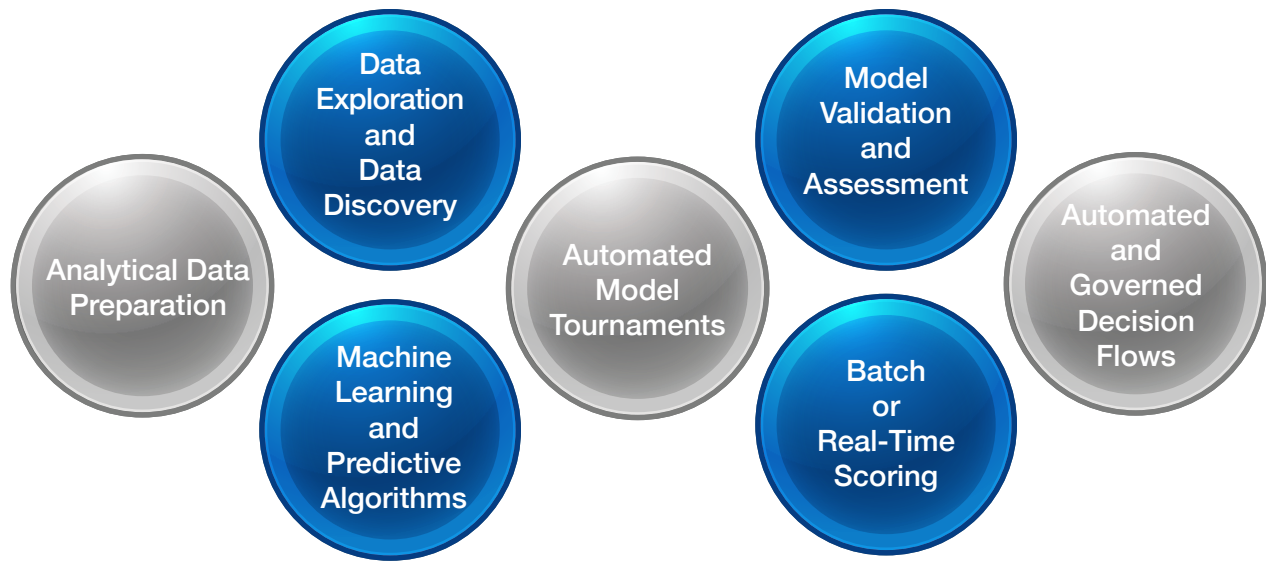
### Visualization and Exploration

Data discovery and visualization should be supported during each step of the modeling process so you can continually evaluate, explain and validate results. SAS enables you to interact with your data to explore relationships, spot trends, dig into areas that interest you and move in directions that you hadn't considered before. Our solutions provide interactive, dynamic and visually appealing graphics to help you:

- Quickly understand data, see important relationships and trends, and make better, faster decisions.
- Explore data from all angles and move rapidly from one visualization to another to identify relevant variables and discover the information needed to fuel the next step in the analysis process.

### Statistical Analysis

Powerful statistical analysis is the foundation of SAS solutions. Use it to perform everything from simple descriptive statistics to complex Bayesian analyses, including variance analysis, categorical data analysis, survival analysis, predictive modeling, experimental design, time series analysis, clustering and survey data analysis.



**Figure 1: SAS predictive analytics key functional areas.**

With SAS statistical analysis software, you can:

- Quantify uncertainty, make inferences and drive decisions by applying the right method to the right data.
- Measure how well models are performing against test and validation data sets, as well as when models need to be updated (or retired) to ensure accurate results.

### Machine Learning for Predictive Modeling

To build predictive models that will generalize to new data, you must have a wide selection of analysis tools at your disposal. SAS provides superior analytical depth and a broad set of modeling algorithms: decision trees, bagging and boosting, linear and logistic regression, neural networks, memory-based reasoning, partial least squares, hierarchical clustering, self-organizing maps, associations, sequence and web path analysis, and more.

New and innovative algorithms are constantly added to the software to enhance the stability and accuracy of predictions. Examples include state-of-the-art methods such as gradient boosting, time series data mining, principal component analysis, net lift modeling, ensembles, random forests, and industry-specific methods such as rate making for insurance and credit scoring. As a result, it's never been easier to:

- Develop models interactively to enable what-if scenarios and incorporate business rules.
- Concurrently create hundreds or thousands of models and run model tournaments to quickly test models at the same time.

- Compare models side by side to see which approach produces the best fit.
- Use model profiling to understand how predictor variables will contribute to the outcome being modeled.

### Model Deployment

Once a model has been validated, you typically need to deploy it to score new data in operational environments. If performed manually, this is not only a time-consuming process that can introduce costly errors into models – especially when it entails manually rewriting or converting code – but it can also delay model implementation. With SAS, you can:

- Automatically generate score code in SAS, C, Java and PMML.
- Deploy the scoring code in a variety of real-time or batch environments within SAS, on the web or directly in databases and data warehouses like Teradata, IBM DB2, IBM Netezza, Aster Data, Pivotal and Oracle, or in Hadoop.

### Model Management and Monitoring

Moving a model from a development environment to an operational environment requires continuous collaboration between analytical teams and IT. SAS facilitates this collaboration to ensure the best models get deployed quickly.

With an easy-to-use web-based workflow console, you can centrally manage models, automate key activities (including registering, validating, publishing, scoring and monitoring models) and track progress through each step of the modeling process.

You can also:

- Easily collaborate and reuse models.
- Automatically retrain predictive models on new incoming data in regular time intervals or based on triggers.
- Use a self-documenting process flow to efficiently map the entire modeling process.
- Set automated alerts to detect when scoring results are changing over time, which may indicate model decay.
- Produce compliance and validation reporting that is increasingly required for regulatory compliance.
- Use a web-based console to create business rules that automate and govern decision flows.
- Capture valuable best practices via a patented centralized data repository, lifecycle templates and a metadata management system.

## High-Performance Analytics

High-performance analytics solutions help you derive value from big data, solve complex business problems and deliver timely insights using a reliable analytics infrastructure. With SAS High-Performance Analytics, you get scalable and reliable analytical processing that makes the best use of your existing IT infrastructure resources.

The key enabler of high-performance analytics is distributed in-memory processing, which gives you concurrent access to data, no matter how big or small. The software is optimized for complex, iterative analytical workloads so you can run analytical computations at blazingly fast speeds. As a result, SAS In-Memory Analytics helps you:

- Gain fast access to deeper insights so you can seize opportunities and mitigate threats in near-real time.
- Run more sophisticated queries and models using all of your data – not just a subset – to generate more precise insights that can improve business performance.
- Run large analytical workloads needed to perform analyses with advanced algorithms and scoring of new data.

## The SAS® Difference

SAS predictive analytics supports an integrated predictive modeling process that helps you solve complex problems, exploit your data assets and drive better performance. You can:

- Move from pockets of analytical excellence to the pervasive use of evidence-based decision making.
- Facilitate continuous enhancement, refinement and maintenance of the analytical models that drive your decision-making processes.
- Grow and standardize on a common platform with multiple entry points for predictive analytics, data mining and machine learning.
- Build models that generalize well and produce superior outcomes by using flexible data preparation and data management capabilities.
- Take advantage of a rich, interactive visualization and data exploration environment to quickly identify the best opportunities.
- Harness the power of comprehensive, feature-rich statistical and machine-learning tools, and cross-domain model governance capabilities.
- Achieve better response time and faster insights with in-memory analytics.
- Streamline the exchange of assets via an integrated metadata repository that documents each step in the modeling process.

“SAS is our standard for predictive analytics. As we continually look for ways to drive revenue for the organization, SAS helps us identify how much to invest and where. SAS gives us the innovative muscle to support the aggressive goals of Kelley Blue Book.”

– Dan Ingle, Vice President of Analytic Insights Technology, Kelley Blue Book