THE POWER TO KNOW®

SAS® Predictive Analytics Suite

Derive useful insights to make evidence-based decisions

Overview

Turning increasingly large amounts of data into useful insights and finding how to better utilize those insights in decision making remains a challenge for most organizations.

- What products will which customers purchase and when?
- Which customers are leaving and what can be done to retain them?
- How should insurance rates be set to ensure profitability?
- How are maintenance schedules and operational influences affecting a component's time-to-failure?
- What if we are able to accurately predict fraudulent transactions and automatically send those to a special investigative unit?

To get answers to complex questions and gain an edge in today's marketplace, powerful, multipurpose predictive analytic solutions are required so you can learn from, utilize and improve on knowledge gained from vast stores of data. The SAS Predictive Analytics Suite provides a wide range of software solutions for exploring and analyzing data to help uncover unknown patterns, opportunities and insights that can drive proactive, evidence-based decision making within your organization.

Challenges

- Data is acquired from various sources, scattered in multiple formats across the organization and not properly structured for different types of analysis.
- Analytic modelers, statisticians and analysts are often stymied by inflexible and inadequate tools and algorithms.
- Business analysts have difficulty interpreting complex relationships and understanding analytical results.
- Too often, organizations are replicating data in silos, reducing the accuracy and timeliness of results and introducing governance risk.
- Deploying models often is cumbersome and manual in nature, causing delays in decision making.
- Retaining outdated or poorly performing models can result in inaccurate projections and poor business decisions.
- Not understanding why a model was chosen or how a particular score was calculated makes it difficult to meet regulatory requirements.

Create and Deliver More Business Value with Evidence-Based Decisions

The SAS® Solution

The SAS Predictive Analytics Suite puts the right software in the hands of the right people at the right time, increasing the reach and effect across the organization. Whether you are just getting started with predictive analytics or have been using it for years, the SAS Predictive Analytics Suite can add value and help you take your analytical decision making to the next level.

The SAS Predictive Analytics Suite enables you to deliver more business value by making evidence-based decisions a normal, everyday occurrence rather than something that happens only occasionally or in a reactive manner. It provides powerful, multipurpose predictive analytics software that is easily configured for any line of business and appropriate set of users. Only the SAS Predictive Analytics Suite offers the range of capabilities your organization needs and can use, now and in the future. With the SAS Predictive Analytics Suite, you can:

- Discover relevant new insights with speed and flexibility.
- Analyze data to find useful results with confidence.
- Act to quickly make better decisions and drive better actions.
- Monitor analyses and results to verify continued relevance and accuracy.
- Manage a growing portfolio of predictive assets effectively.

Benefits

Deliver Valid and Analysis-Ready Data to Support Decision Making

Robust data exploration and management capabilities are prerequisite for any predictive modeling. And, the mandate to spread analytic usage across organizations means that the high availability of analysis-ready data is elevated to a critical success factor.

Challenges

- Data management and preparation of analytical base tables are not well synchronized for model development and deployment.
- Algorithms used in predictive analytics typically require a very specific data structure, and there is constant need to adjust the structure to fit the needs of analyses.
- Analytic data preparation can be time consuming and often incurs unnecessary movement of data between databases and the modeling environment.

Our approach

Unmatched in the number of data sources that can be accessed and ease with which data can be manipulated in one environment, SAS data management capabilities provide extreme flexibility and allow profiling and transformations, including the visual subsetting of data, not possible with other software.

Discover, Explore and Understand Relationships in Complex Sets of Data

The value of organizational data assets remains latent unless domain experts and analysts are able to quickly uncover relationships. Additionally, visualization plays a key role in the exploratory and model-building phases, including sharing results with other analytic professionals to build consensus.

Challenges

- It is difficult to discern the valuable elements hidden within large quantities of data.
- There is a need to combine structured data and unstructured data, including documents, email, call-center notes, blogs, RSS feeds and more to increase the overall accuracy of predictive models.
- An environment is needed that supports visual discovery and learning for diverse sets of users and applications.
- Decision makers are unable to interpret the modeling results in the business context they need.

Our approach

The SAS visualization landscape produces a variety of graphical displays for a complete set of user personas spanning the information producer to the information consumer. SAS provides an interactive environment that is optimized for discovery, visual exploration and

understanding relationships in a point-and-click environment with dynamically linked tables and graphics. This adds value as well as complements later phases of analysis, including model building and validation.

Use Predictive Analytics to Fully Evaluate Options and Scenarios to Drive Evidence-Based Decisions

Every day, there are strategic, tactical and operational decisions that must be made. The common thread? Data-driven evidence can make them better. Predictive analytics provide the valuable insights needed to manage risks appropriately and support a continual circle of learning and improvement. Predictive analytics produce the insights that can differentiate your business from your competitors.

Challenges

- Modelers and analysts lack a wide repertoire of analytical methods, and are provided only a few options for tuning the models.
- It is difficult to compare models simultaneously in order to select the best model for decision making.
- Modelers need to share, integrate and reuse analytic assets, including data, transformation logic, models, results and reports.
- Modeling results cannot be effectively interpreted in a business context for review and collaboration with business constituents.
- Organizations need a scalable and efficient infrastructure for model development and deployment.

Our approach

SAS provides a diversified set of predictive analytics that includes comprehensive, feature-rich statistical and data mining algorithms, as well as model validation tools that use multiple approaches to assess how well models fit the data. You can combine methods to solve more complex problems and use the self-documenting process for repeatability and archiving, all in one environment. Model profiling is also supported to provide an understanding of how the predictor variables contribute to the outcome being modeled. In addition, SAS offers the ability to analyze data in-memory to produce immediate results and enables you to scale up to client-server configurations to analyze extremely large amounts of data.

Integrate with Operational Systems and Business Processes to Mistake-Proof Your Evidence-Based Approach

With increased competition and rapidly changing market conditions, it is imperative to reduce the time it takes to respond to and learn from evidence. Model deployment and management are vital steps to getting analytic results and making quick decisions that provide the most value. Continuous monitoring of model performance is important throughout its life cycle for better results.

Challenges

- As more people come to rely on analytics, efforts to create, deploy and manage models become more redundant. Mistakes occur and results are not delivered in a timely manner.
- Roles and responsibilities in relation to the different steps of the analytics life cycle are not clearly defined. Overlaps and gaps lead to loss of efficiency in implementing evidence-based business processes.
- Model deployment takes too long and requires many resources.
- Model degradation leads to the inability to recognize and respond to changing market conditions.

Our approach

To manage the plethora of different types of models, SAS provides a wide range of tools, features and best practices to support a full lifecycle governance of models. You can also deploy models to score data stored inside the database to get faster time to results. SAS supports an iterative approach for the selection, maintenance and continuous enhancement of analytical models for proactive decision making.

Take Decision Making to the Next Level with Integrated Capabilities

How SAS® Can Help

Whether used to predict customer behavior and intentions, reduce customer churn, minimize credit risk, combat fraud, reduce asset downtime, anticipate patients at risk or identify intervention methods, SAS predictive analytics reach across industries and provide the ability to model multiple scenarios.

- By selecting, exploring, transforming and modeling large quantities of data using a variety of classical and modern analytic algorithms, SAS enables you to identify opportunities and mitigate risks quickly and reliably.
- A data discovery and visualization environment, powered by JMP® Pro, lets you interactively explore data and continually discover new insights.
- Developing repeatable, collaborative predictive modeling processes that can be shared and updated with new data supports moving from a discovery environment to operational analytics.
- A patented, secure model repository with a rich metadata structure and easy-to-use project templates streamlines the tedious and often error-prone steps of deploying and managing models.
- Model monitoring features and version control reports help you manage the entire life cycle of models, from their creation, to deployment into production systems, until they are retired.
- High-performance analytics provide the power you need to solve complex problems faster and more efficiently.

Capabilities

Analytic Data Preparation

Data preparation and data quality are key components of the predictive modeling process. This is where systems spanning multiple platforms and containing multiple data sources are integrated and synchronized into a clear and coherent format.

- Structure data sets, transpose them and aggregate values into representative modeling tables.
- Optionally sample a representative set of data to speed processing time and often produce more reliable predictive models.
- Segment observations into groups, interactively bin variable values, filter outliers, replace missing values and derive new variable transformations.

Visualization and Exploration

Discovery is a key activity of any successful data analysis, and a key component of discovery is visualization. The SAS Predictive Analytics Suite 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. Discovery should occur during each step of the modeling process to continually evaluate, explain and validate results.

- See your data and gain instantaneous insights into the relationships it contains using interactive and dynamic graphics.
- Explore data from every possible angle and move rapidly from one visualization to another to quickly discover the information needed to fuel the next step of the analysis process.

Statistical Analysis

Statistical analysis provides the foundation of the SAS Predictive Analytics Suite. It includes techniques that range from simple descriptive statistics to complex Bayesian analyses, including analysis of variance, categorical data analysis, survival analysis, regression modeling, experimental design, time series analysis, clustering and survey data analysis.

- Quantify uncertainty, make inferences and drive decisions by applying the right method of analysis to the right data at the right time.

Predictive Modeling

To build predictive models that will generalize to new data, it is crucial to have a wide selection of analysis tools at hand. The SAS Predictive Analytics Suite provides users with superior analytical depth and a broad set of predictive and descriptive modeling algorithms, including 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 being added to enhance the stability and accuracy of predictions and include state-of-the-art methods such as gradient boosting, hierarchical market baskets, least angle regression and random forests. Model profiling is also supported so you can understand how predictor variables contribute to the outcome being modeled.

- Develop models interactively to enable what-if scenarios, and incorporate business rules.
- Schedule processing in batch mode for large problems that may also require periodic updates.
- Compare models side-by-side to see which approach produces the best fit.

Model Deployment

Once a model has been created, organizations often need to deploy the model to score new data for implementation into an operational environment. The process can be time consuming and introduce potentially costly mistakes, especially when it entails manually rewriting or converting code.

- Automatically generate score code in SAS, C, Java and PMML.
- Deploy scoring code in a variety of real-time or batch environments within SAS, on the Web or directly in databases and data warehouses.

Model Management and Monitoring

Moving a model from a development environment to an operational environment often requires a handoff from the analytical team to the IT team. The SAS Predictive Analytics Suite facilitates collaboration between all stakeholders as they manage the analytic modeling and deployment process, enabling consistent validation and the deployment of best models to improve business performance. A repeatable process for registering, testing and validating models – monitored from creation through deployment to retirement – ensures that analytical models are performing as intended throughout their life cycle.

- Easily collaborate and reuse models.
- Set automated alerts to detect when the scoring results are changing over time, possibly indicating model decay.
- Efficiently map the entire data mining process using a self-documenting process flow diagram.
- Produce the flexible and unique compliance and validation reporting that is required by increasing regulations.
- Capture valuable best practices via a patented centralized data repository, lifecycle templates and a metadata management system.

High-Performance Analytics

The SAS Predictive Analytics Suite takes full advantage of the SAS high-performance analytics environment. From in-memory analytics on the desktop to distributed computing on the server, the suite enables you to utilize all of the computing power available to you to solve bigger problems, faster.

- Achieve speed and process efficiencies and help IT to scale up processing power to solve many different problems.
- Submit jobs to a shared pool of resources rather than an individual server to enable parallel processing, balance workloads and leverage a centrally managed grid infrastructure.
- Eliminate unnecessary data movement, reduce data latency and yield faster time to results by leveraging the massive parallel processing (MPP) architecture offered by databases.

"SAS provides a diversified portfolio that includes a comprehensive feature-rich set of statistical, data mining, forecasting, and optimization tools complemented with a model and data governance platform for analyzing complex structured and unstructured information."

"The Forrester Wave™: Predictive Analytics And Data Mining Solutions, Q1 2010," Forrester Research, Inc. February 2010

Put the Right Software in the Right Hands at the Right Time

The SAS® Difference

SAS provides an integrated predictive modeling process so you can solve complex problems, get higher returns from your data assets and gain better organizational performance. With the SAS Predictive Analytics Suite, you can:

- Move from pockets of analytic 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 and data mining.
- 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 a comprehensive, feature-rich set of statistical and data mining tools complemented with cross-domain model governance capabilities.
- Achieve better response time with in-memory, in-database and grid capabilities.
- Streamline the exchange of required assets via an integrated metadata repository that provides documentation for each step in the modeling process.

Components

JMP® Pro

JMP Pro brings the power of dynamic visualization and exploratory data analysis to the desktop. It includes advanced statistical techniques as well as core data mining functionality. JMP Pro holds data in-memory for immediate and responsive analysis. The dynamic and compelling graphics in JMP Pro enable users to easily communicate results.

Best suited for ...

JMP Pro is the entry-level software of the SAS Predictive Analytics Suite and is best suited for individual contributors working on personal desktops, including the Macintosh, who require a powerful set of dynamic visualizations along with in-memory modeling. Organizations that are just getting started with predictive analytics should also consider JMP Pro. When used in conjunction with other SAS predictive analytics, JMP Pro enables you to experience the best of both worlds – the unique visualization capabilities of JMP and the unparalleled depth of SAS Analytics.

SAS® Enterprise Miner™ for Desktop

SAS provides modelers and business analysts in small to midsized firms or those who work independently in departments within larger organizations with a data mining workbench option that runs entirely on a Windows PC. SAS Enterprise Miner for Desktop has the same user interface as the client-server version and delivers the power of data mining to users' Windows desktops. It provides optimized SAS score code for easily putting models into production environments.

Best suited for ...

Those who require a single desktop implementation of SAS Enterprise Miner to support only a few users should select SAS Enterprise Miner Desktop for Windows. JMP Pro can provide complementary exploratory data analysis and model validation.

"Thanks to SAS Analytics, our total fraud loss has been reduced by 15 percent."

Marcel Bieler, Business Analyst, Viseca Card Services

SAS® Enterprise Miner™

SAS Enterprise Miner offers a rich, easy-to-use suite of integrated data mining tools for creating and sharing insights that can be used to drive better decisions across the organization.

It streamlines the entire data mining process, enabling business analysts, statisticians and modelers to create accurate predictive and descriptive models based on the analysis of vast amounts of data from across the enterprise. The user interface is based on a process flow diagram designed to support the iterative, interactive development of predictive models, and the system is customizable and extensible. Users can integrate their code and build new tools for redistribution. With multithreaded algorithms and support for in-database processing and grid computing, execution time is reduced and hardware resources are used more efficiently. Complete, optimized scoring code is delivered in SAS, C, Java and PMML for scoring in SAS as well as other environments.

With an automated and intelligent method for tuning predictive models, SAS Enterprise Miner selects the best model from many different types and complexities. It focuses on building the least complex model with the most predictive power.

Best suited for ...

SAS Enterprise Miner is suitable for organizations that need to deploy distributable and collaborative data mining capabilities throughout the enterprise. These organizations typically are focused on repeatable data mining that is often administered through multiple user-workgroup collaborations. Those who need to score new data in batch and real time should also select SAS Enterprise Miner.

SAS® Model Manager

SAS Model Manager helps to organize and track the tasks of model creation and development, model verification and validation, comparative model performance benchmarking and model deployment in a production environment. It enables organizations to effectively create, manage and deploy statistical, predictive, classification and analytical scoring models in an enterprise environment. By facilitating the handoff between modelers and the IT department, it reduces the time required to manage and deploy models into production. It supports the tracking of models through each stage of their life cycle by creating and managing rich metadata on each model. Model comparison and profile reports and model-monitoring performance views are also provided.

Best suited for ...

SAS Model Manager is appropriate for any organization that needs to manage and monitor large collections of predictive and descriptive models developed using JMP Pro or SAS Enterprise Miner.

SAS® Scoring Accelerator for Teradata, SAS® Scoring Accelerator for Netezza, SAS® Scoring Accelerator for DB2, SAS® Scoring Accelerator for Aster nCluster and SAS® Scoring Accelerator for Greenplum

The scoring accelerators enable users to publish scoring models created in SAS Enterprise Miner into database-scoring functions to score new data directly within the databases. This automates model-scoring processes, reduces data movement and leverages the parallel-processing capabilities offered by the databases to produce quick, timely results.

Best suited for ...

For organizations that use Teradata, IBM Netezza, IBM DB2, Aster Data or EMC Greenplum databases or data warehouses, the scoring accelerators offer a great opportunity to further leverage IT investments. In-database scoring is a best practice for high-performance analytic deployments, and enterprises can choose one of the accelerator engines to get faster results for more timely decision making.

SAS® Predictive Analytics: Empowering Organizations Around the World

- **Credit card, banking and financial services companies** use SAS predictive analytics to detect and reduce fraud, measure credit risk, maximize cross-sell/up-sell opportunities, retain customers and optimize marketing campaigns.
- **Insurance companies** use SAS predictive analytics for determining insurance premium rates, detecting claims fraud, optimizing claims processes, retaining customers, improving profitability and optimizing marketing campaigns.
- **Governments and the public sector** use SAS predictive analytics to improve service and performance; detect and prevent fraud, improper payments and the misuse of funds and taxpayer dollars; and detect criminal activities and patterns.
- **Telecommunication companies** use SAS predictive analytics for segmenting customers, reducing customer churn, retaining profitable customers and developing effective cross-sell/up-sell campaigns.
- **Health care providers** use SAS Analytics to predict the effectiveness of new procedures, medical tests and medications, and improve services or outcomes by providing safe and effective patient care.
- **Health insurers** use SAS predictive analytics for detecting and handling insurance claims fraud, identifying which patients are most at risk of chronic diseases and knowing which interventions make the most medical and financial sense.
- **Manufacturers** use SAS predictive analytics to identify factors leading to reduced quality and production failures, as well as to optimize parts, service resources and distribution.
- **Media and entertainment companies** use SAS predictive analytics to deepen their insight into audiences by identifying influencing attributes, trends, drivers and desires across properties, and scoring visitors to determine appropriate audience segments and behavior value.
- **Oil, gas and utility companies** use SAS predictive analytics to get a unified view of facility assets, diagnose problems, predict failures, mitigate safety and reliability risks, and improve performance.
- **Retailers** use SAS predictive analytics to assess the effectiveness of promotional events and campaigns, predict which offers are most appropriate for consumers, determine which products to stock where and how to build brand loyalty.

About SAS

SAS is the leader in business analytics software and services, and the largest independent vendor in the business intelligence market. Through innovative solutions, SAS helps customers at more than 55,000 sites improve performance and deliver value by making better decisions faster. Since 1976 SAS has been giving customers around the world THE POWER TO KNOW®.
For more information on SAS® Business Analytics software and services, visit **sas.com**.

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