

applied analytics using sas enterprise miner course notes

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Applied Analytics Using SAS Enterprise Miner: Comprehensive Course Notes

In today's data driven world, the ability to turn raw data into actionable insights is a prized skill. Whether you're a business analyst, data scientist, or aspiring analytics professional, mastering a powerful tool like SAS Enterprise Miner can set you apart. These course notes are designed to walk you through every essential topic—from the fundamentals of applied analytics to advanced modeling techniques—so you can confidently apply SAS Enterprise Miner in real world scenarios.

Why SAS Enterprise Miner Matters for Applied Analytics

SAS Enterprise Miner (EM) is a robust, graphical platform that simplifies the entire analytics workflow. It supports:

- Data import and cleaning
- Exploratory data analysis (EDA)
- Feature engineering
- Predictive modeling
- Model validation and deployment

By integrating these stages into one environment, EM reduces the friction between data preparation and model building, allowing analysts to focus on interpretation and decision making.

Course Outline: What You'll Learn

1. Introduction to Applied Analytics
2. Getting Started with SAS Enterprise Miner
3. Data Preparation and Cleaning
4. Exploratory Data Analysis
5. Feature Engineering Techniques
6. Model Building & Selection
7. Model Evaluation & Validation
8. Model Deployment & Reporting
9. Advanced Topics & Best Practices
10. Capstone Project & Exam Preparation

Each module includes detailed notes, step by step screenshots, sample code snippets, and practical exercises to reinforce learning.

1. Introduction to Applied Analytics

Applied analytics refers to the systematic use of data, statistical methods, and machine learning to solve business problems. The key stages are:

- Problem Definition
- Data Acquisition
- Data Processing

- Modeling
- Interpretation & Action

Throughout this course, we'll anchor each stage within SAS Enterprise Miner's framework, ensuring that you see how theory translates into practice.

2. Getting Started with SAS Enterprise Miner

Installation & Configuration

To begin, you need a working SAS Enterprise Miner license. If you're part of an educational institution, you may have access to a student license. Otherwise, SAS offers a free trial for evaluation purposes.

1. Download the installer from the SAS website.
2. Run the installer and follow the wizard prompts.
3. Configure the SAS/STAT and SAS/ETS modules, which are essential for statistical modeling.
4. Verify the installation by launching EM and opening the Help menu.

Project Structure Overview

When you create a new project, EM organizes your work into the following components:

- Data Sources: Connect to databases, spreadsheets, or SAS datasets.
- Data Flow: Visual representation of data transformations.
- Model Nodes: Statistical and machine learning algorithms.
- Output Nodes: Reports, tables, and visualizations.

Understanding this structure will help you navigate the platform efficiently.

3. Data Preparation and Cleaning

Clean data is the foundation of accurate models. In SAS Enterprise Miner, you'll use several nodes to prepare your dataset:

3.1 Data Source Node

Import your dataset from CSV, Excel, or a database. Configure the node to handle missing values, data types, and variable formats.

3.2 Data Cleansing Node

- Identify and remove duplicate rows.
- Handle missing values using methods like mean imputation, median, or k nearest neighbors.
- Detect outliers via boxplots or z scores.
- Standardize variable names and ensure consistent data types.

3.3 Transformation Node

Apply transformations such as:

- Logarithmic or square root scaling for skewed data.
- Normalization or standardization (z score).
- Creation of derived variables (e.g., age groups, income brackets).

3.4 Data Partitioning

Split the dataset into training, validation, and testing sets. Common splits include:

- 70% training, 15% validation, 15% testing.
- 80% training, 20% testing.

Use the **Data Partition** node to enforce reproducibility with a fixed random seed.

4. Exploratory Data Analysis (EDA)

EDA helps you uncover patterns, relationships, and potential pitfalls. SAS Enterprise Miner offers several visual nodes:

4.1 Scatter Plot Matrix

Visualize pairwise relationships between variables. Look for linear or nonlinear trends.

4.2 Correlation Matrix

Identify multicollinearity. Variables with high correlation may be redundant.

4.3 Variable Distribution

Use histograms and density plots to assess normality. Skewed distributions may benefit from transformation.

4.4 Box Plots

Spot outliers and compare distributions across categorical groups.

4.5 Summary Statistics

Generate mean, median, standard deviation, min, and max for each variable. Use the **Summary** node.

5. Feature Engineering Techniques

Feature engineering can dramatically improve model performance. Here are key techniques to apply within SAS Enterprise Miner:

5.1 Variable Creation

Derive new variables from existing ones. For example:

- Create a Debt-to-Income Ratio by dividing total debt by income.
- Generate a Customer Tenure variable based on account start dates.

5.2 Interaction Terms

Model interactions between variables to capture synergistic effects. Use the **Interaction** node.

5.3 Polynomial Features

Introduce quadratic or cubic terms to model nonlinear relationships. The **Polynomial** node handles this automatically.

5.4 Variable Transformation

Apply log, square, or Box-Cox transformations to reduce skewness.

5.5 Feature Selection

Use methods such as:

- Filter: Correlation thresholds or variance inflation factor (VIF).
- Wrapper: Recursive Feature Elimination (RFE) via the Variable Selection node.

- Embedded: LASSO or Elastic Net regularization within modeling nodes.

6. Model Building & Selection

After preparing the data, you can build predictive models. SAS Enterprise Miner supports a wide array of algorithms:

6.1 Classification Models

- Logistic Regression
- Decision Trees (C5.0, CART)
- Random Forest
- Gradient Boosting Machines (GBM)
- Neural Networks
- Support Vector Machines (SVM)

6.2 Regression Models

- Linear Regression
- Stepwise Regression
- Regularized Regression (LASSO, Ridge, Elastic Net)
- Polynomial Regression
- Neural Networks

6.3 Clustering Models

- K Means
- Hierarchical Clustering
- Gaussian Mixture Models

6.4 Model Selection Strategies

Choose the best model using:

- Cross validation (k fold or repeated).
- Performance metrics: Accuracy, Precision, Recall, F1 Score, ROC AUC for classification; RMSE, MAE, R^2 for regression.
- Model interpretability and business relevance.

6.5 Building a Model Node

Drag the desired model node onto the canvas, connect it to the processed data, and configure hyperparameters. For example, when using a Random Forest:

1. Set the number of trees (e.g., 500).
2. Define the maximum depth and minimum node size.
3. Enable variable importance extraction.

7. Model Evaluation & Validation

Robust evaluation ensures that your model generalizes well.

7.1 Confusion Matrix

For classification, analyze true positives, false positives, true negatives, and false negatives.

7.2 ROC Curve & AUC

Plot the Receiver Operating Characteristic curve and compute the Area Under the Curve to gauge discrimination power.

7.3 Lift & Gain Charts

Visualize model performance relative to random guessing.

7.4 Calibration Plots

Assess how well predicted probabilities align with actual outcomes.

7.5 Regression Diagnostics

Examine residual plots, leverage, and Cook's distance to detect influential observations.

7.6 Overfitting Checks

Compare training vs. validation performance. If the training error is significantly lower, consider regularization or pruning.

8. Model Deployment & Reporting

Once validated, you can deploy the model and share insights.

8.1 Model Export

Export the model to:

- SAS Predictive Model Markup Language (PMML)
- Python or R scripts via the Code Export node.

8.2 Integration with SAS Enterprise Guide

Use the exported model in SAS Enterprise Guide for batch scoring or real time scoring.

8.3 Dashboard Creation

Leverage SAS Visual Analytics to build interactive dashboards that display key metrics, predictions, and data visualizations.

8.4 Reporting

Generate comprehensive reports using the **Report** node, including:

- Executive summaries
- Model performance tables
- Feature importance charts
- Recommendations

9. Advanced Topics & Best Practices

9.1 Time Series Analysis

Apply ARIMA, Exponential Smoothing, or Prophet models within EM for forecasting tasks.

9.2 Text Mining

Use the **Text Mining** node to preprocess unstructured text, extract features, and build sentiment or topic models.

9.3 Big Data Integration

Connect EM to Hadoop or Spark clusters via SAS Viya for scalable analytics.

9.4 Model Governance

Implement version control, audit trails, and compliance checks to maintain model integrity.

9.5 Performance Optimization

- Use parallel processing options.

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