

Predictive Modeling for Imbalanced Big Data in SAS Enterprise Miner and R

Son Nguyen, Bryant University, Smithfield, USA

Alan Olinsky, Bryant University, Smithfield, USA

John Quinn, Bryant University, Smithfield, USA

Phyllis Schumacher, Bryant University, Smithfield, USA

ABSTRACT

There have been a variety of predictive models capable of handling binary targets, ranging from traditional logistic regression to modern neural networks. However, when the target variable represents a rare event, these models might not be appropriate as they assume that the distribution in the target variable is balanced. In this article, the impact of multiple resampling methods on conventional predictive models is studied. These resampling techniques include the methods of oversampling of the rare events, undersampling of the common events in the data, and synthetic minority over-sampling technique (SMOTE). The predictive models of decision trees, logistic regression and rule induction are applied with SAS Enterprise Miner (EM) software to the revised data. The studied data set is of home mortgage applications which includes a target variable with an occurrence rate of the rare event being 0.8%. The authors varied the percentage of the rare event from the original of 0.8% up to 50% and monitored the associated performances of the three predictive models to see which one worked the best.

KEYWORDS

Data Mining, Imbalanced Data, Oversampling, Predictive Modeling, Rare Events, SAS Enterprise Miner, Synthetic Minority Over-Sampling Technique (SMOTE), Undersampling

1. INTRODUCTION

In binary classification, when the proportion of one class in the target variable is significantly smaller than the other class (imbalanced data), one faces the problem of classifying a rare event, or imbalanced classification. Traditional classification modeling techniques such as logistic regression and decision trees generally work quite well with a balanced data. However, with a rare event variable, when the data set is very large, and the event of interest is very small, most of these classification methods typically fail to detect the rare event. This can be particularly true when the percentage of the rare event is extremely small, as in the example presented here, where the rare event occurs in less than 1% of the observations. In this situation, all observations are predicted as being in the group consisting of the more dominant or common event.

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Predictive Modeling with SAS Enterprise Miner Kattamuri S. Sarma, 2017-07-20 A step by step guide to predictive modeling Kattamuri Sarma's Predictive Modeling with SAS Enterprise Miner Practical Solutions for Business Applications Third Edition will show you how to develop and test predictive models quickly using SAS Enterprise Miner Using realistic data the book explains complex methods in a simple and practical way to readers from different backgrounds and industries Incorporating the latest version of Enterprise Miner this third edition also expands the section on time series Written for business analysts data scientists statisticians students predictive modelers and data miners this comprehensive text provides examples that will strengthen your understanding of the essential concepts and methods of predictive modeling Topics covered include logistic regression regression decision trees neural networks variable clustering observation clustering data imputation binning data exploration variable selection variable transformation and much more including analysis of textual data Develop predictive models quickly learn how to test numerous models and compare the results gain an in depth understanding of predictive models and multivariate methods and discover how to do in depth analysis Do it all with Predictive Modeling with SAS Enterprise Miner

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Data Quality for Analytics Using SAS Gerhard Svolba,2012-04-01 Analytics offers many capabilities and options to measure and improve data quality and SAS is perfectly suited to these tasks Gerhard Svolba s Data Quality for Analytics Using SAS focuses on selecting the right data sources and ensuring data quantity relevancy and completeness The book is made up of three parts The first part which is conceptual defines data quality and contains text definitions explanations and examples The second part shows how the data quality status can be profiled and the ways that data quality can be improved with analytical methods The final part details the consequences of poor data quality for predictive modeling and time series forecasting With this book you will learn how you can use SAS to perform advanced profiling of data quality status and how SAS can help improve your data quality This book is part of the SAS Press program **Getting Started with SAS**

Enterprise Miner for Machine Learning Jeff Thompson,2018 SAS Enterprise Miner is SAS s premier tool for data mining and predictive modeling This course introduces Enterprise Miner while demonstrating two common applications segmentation and predictive modeling It starts with a brief overview of the software and then covers segmentation and predictive modeling using a case study approach based on real world data Upon completing the course learners will have a basic working knowledge of how to use Enterprise Miner to perform data mining and machine learning tasks Participants should have a quantitative background and ideally some basic understanding of predictive models including regression Resource description page **SAS Enterprise Miner Exercise and Assignment Book** Varol Onur Kayhan,2020-04-07

This book is written for students in higher education Instructors teaching predictive analytics courses can assign this book to their students to expose them to predictive analytics techniques using SAS Enterprise Miner The book is developed using SAS Enterprise Miner 14.3 but it should apply to other versions with little to no changes This book does not require students to have any previous knowledge of SAS Enterprise Miner It walks students through the predictive analytics process using

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either as a stand alone resource or as an accompaniment to a statistics course the book offers a smooth path to statistical analysis with SAS Enterprise Guide for advanced undergraduate and beginning graduate students as well as professionals in psychology education business health social work sociology and many other fields

Practical Business Analytics Using SAS Shailendra Kadre,Venkat Reddy Konasani,2015-02-07 Practical Business Analytics Using SAS A Hands on Guide shows SAS users and businesspeople how to analyze data effectively in real life business scenarios The book begins with an introduction to analytics analytical tools and SAS programming The authors both SAS statistics analytics and big data experts first show how SAS is used in business and then how to get started programming in SAS by importing data and learning how to manipulate it Besides illustrating SAS basic functions you will see how each function can be used to get the information you need to improve business performance Each chapter offers hands on exercises drawn from real business situations The book then provides an overview of statistics as well as instruction on exploring data preparing it for analysis and testing hypotheses You will learn how to use SAS to perform analytics and model using both basic and advanced techniques like multiple regression logistic regression and time series analysis among other topics The book concludes with a chapter on analyzing big data Illustrations from banking and other industries make the principles and methods come to life Readers will find just enough theory to understand the practical examples and case studies which cover all industries Written for a corporate IT and programming audience that wants to upgrade skills or enter the analytics field this book includes More than 200 examples and exercises including code and datasets for practice Relevant examples for all industries Case studies that show how to use SAS analytics to identify opportunities solve complicated problems and chart a course Practical Business Analytics Using SAS A Hands on Guide gives you the tools you need to gain insight into the data at your fingertips predict business conditions for better planning and make excellent decisions Whether you are in retail finance healthcare manufacturing government or any other industry this book will help your organization increase revenue drive down costs improve marketing and satisfy customers better than ever before

First Steps in Data Mining with SAS Enterprise Miner Martha Abell,2014-09-06 SAS Enterprise Miner streamlines the data mining process to create highly accurate predictive and descriptive models based on analysis of vast amounts of data from across an enterprise Data mining is applicable in a variety of industries and provides methodologies for such diverse business problems as fraud detection householding customer retention and attrition database marketing market segmentation risk analysis affinity analysis customer satisfaction bankruptcy prediction and portfolio analysis In SAS Enterprise Miner the data mining process has the following SEMMA steps Sample the data by creating one or more data sets The sample should be large enough to contain significant information yet small enough to process This step includes the use of data preparation tools for data import merge append and filter as well as statistical sampling techniques Explore the data by searching for relationships trends and anomalies in order to gain understanding and ideas This step includes the use of tools for statistical reporting and graphical

exploration variable selection methods and variable clustering Modify the data by creating selecting and transforming the variables to focus the model selection process This step includes the use of tools for defining transformations missing value handling value recoding and interactive binning Model the data by using the analytical tools to train a statistical or machine learning model to reliably predict a desired outcome This step includes the use of techniques such as linear and logistic regression decision trees neural networks partial least squares LARS and LASSO nearest neighbor and importing models defined by other users or even outside SAS Enterprise Miner Assess the data by evaluating the usefulness and reliability of the findings from the data mining process This step includes the use of tools for comparing models and computing new fit statistics cutoff analysis decision support report generation and score code management You might or might not include all of the SEMMA steps in an analysis and it might be necessary to repeat one or more of the steps several times before you are satisfied with the results After you have completed the SEMMA steps you can apply a scoring formula from one or more champion models to new data that might or might not contain the target variable Scoring new data that is not available at the time of model training is the goal of most data mining problems Furthermore advanced visualization tools enable you to quickly and easily examine large amounts of data in multidimensional histograms and to graphically compare modeling results

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