

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

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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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Timina Liu, Shuangzhe Liu, Lei Shi



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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 [Advanced Predictive Modeling Using SAS Enterprise Miner](#) SAS Institute, 2014

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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 **Predictive**

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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

SAS Enterprise Miner Exercise and Assignment Handbook for Higher Education Varol Onur Kayhan, This handbook is written for students in higher education Instructors teaching predictive analytics courses can assign this handbook to their students to expose them to predictive analytics techniques using SAS Enterprise Miner The handbook is developed using SAS Enterprise Miner version 12.1 but it should apply to other versions with little to no changes This handbook does not require students to have any previous knowledge of SAS Enterprise Miner It walks students through different predictive analytics techniques using step by step by instructions Even though the contents of this handbook can be completed by anyone who has access to SAS Enterprise Miner knowledge of predictive analytics concepts is essential for this handbook to be helpful Also this handbook is not a substitute for any lecture or textbook It is best if this handbook is used in parallel to lectures

Applied Analytics Using SAS® Enterprise Miner™ SAS Institute, 2011

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Time Series Analysis Using SAS Enterprise Guide Timina Liu, Shuangzhe Liu, Lei Shi, 2020-02-19 This is the first book to present time series analysis using the SAS Enterprise Guide software It includes some starting background and theory to various time series analysis techniques and demonstrates the data analysis process and the final results via step by step extensive illustrations of the SAS Enterprise Guide software This

book is a practical guide to time series analyses in SAS Enterprise Guide and is valuable resource that benefits a wide variety of sectors **Data Analysis Using SAS Enterprise Guide** Lawrence S. Meyers, Glenn Gamst, A. J. Guarino, 2009-08-17 This book presents the basic procedures for utilizing SAS Enterprise Guide to analyze statistical data SAS Enterprise Guide is a graphical user interface point and click to the main SAS application Each chapter contains a brief conceptual overview and then guides the reader through concrete step by step examples to complete the analyses The eleven sections of the book cover a wide range of statistical procedures including descriptive statistics correlation and simple regression t tests one way chi square data transformations multiple regression analysis of variance analysis of covariance multivariate analysis of variance factor analysis and canonical correlation analysis Designed to be used 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 **Unknown MIR Title** Jim Georges, SAS Publishing, SAS Institute, 1999-01

SAS Enterprise Miner Exercise and Assignment Handbook for Higher Education Varol Kayhan, 2019-01-16 This handbook is written for students in higher education Instructors teaching predictive analytics courses can assign this handbook to their students to expose them to predictive analytics techniques using SAS Enterprise Miner The handbook is developed using SAS Enterprise Miner version 12.1 but it should apply to other versions with little to no changes This handbook does not require students to have any previous knowledge of SAS Enterprise Miner It walks students through different predictive analytics techniques using step by step by instructions Even though the contents of this handbook can be completed by anyone who has access to SAS Enterprise Miner knowledge of predictive analytics concepts is essential for this handbook to be helpful Also this handbook is not a substitute for any lecture or textbook It is best if this handbook is used in parallel to lectures

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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