

High Breakdown Rank Regression

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June 17, 1998

Abstract

A weighted rank estimate is proposed which has 50% breakdown and is asymptotically normal at rate \sqrt{n} . Based on this theory, inferential procedures, including asymptotic confidence and tests, and diagnostic procedures, such as Studentized residuals, are developed. The influence function of the estimate is derived and it is shown to be continuous and bounded everywhere in (\mathbf{x}, Y) space. Examples show that robustness against outlying high-leverage clusters may approach that of the LMS, while retaining more stability against inliers. The estimator uses weights that correct for both factor and response spaces. A Monte Carlo study shows that the estimate is more efficient than GR, a similar estimate where the weights only correct for factor space. When weights are constant, the estimate reduces to the regular Wilcoxon rank estimate.

KEY WORDS: Rank regression; Weights; GR-estimate; LMS; 50% breakdown; Inlier stability.

1 Introduction

Rank-based estimates of the regression coefficients of a linear model were proposed by Jureckova (1971) and Jaeckel (1972). These estimates based on the Wilcoxon scores generalize the Wilcoxon-Mann-Whitney tests and estimates for simple location problems. In

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RJ Alexander



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Nonparametric Statistical Methods Using R John Kloke, Joseph McKean, 2024-05-20 Praise for the first edition This book would be especially good for the shelf of anyone who already knows nonparametrics but wants a reference for how to apply those techniques in R The American Statistician This thoroughly updated and expanded second edition of Nonparametric Statistical Methods Using R covers traditional nonparametric methods and rank based analyses Two new chapters covering multivariate analyses and big data have been added Core classical nonparametrics chapters on one and two sample problems have been expanded to include discussions on ties as well as power and sample size determination Common machine learning topics including k nearest neighbors and trees have also been included in this new edition Key Features Covers a wide range of models including location linear regression ANOVA type mixed models for cluster correlated data nonlinear and GEE type Includes robust methods for linear model analyses big data time to event analyses timeseries and multivariate Numerous examples illustrate the methods and their computation R packages are available for computation and datasets Contains two completely new chapters on big data and multivariate analysis The book is suitable for advanced undergraduate and graduate students in statistics and data science and students of other majors with a solid background in statistical methods including regression and ANOVA It will also be of use to researchers working with nonparametric and rank based methods in practice Statistical Methods for Mediation, Confounding and Moderation Analysis Using R and SAS Qingzhao Yu, Bin Li, 2022-03-13 Third variable effect refers to the effect transmitted by third variables that intervene in the relationship between an exposure and a response variable Differentiating between the indirect effect of individual factors from multiple third variables is a constant problem for modern researchers Statistical Methods for Mediation Confounding and Moderation Analysis Using R and SAS introduces general definitions of third variable effects that are adaptable to all different types of response categorical or continuous exposure or third variables Using this method multiple third variables of different types can be considered simultaneously and the indirect effect carried by individual third variables can be separated from the total effect Readers of all disciplines familiar with introductory statistics will find this a valuable resource for analysis Key Features Parametric and nonparametric method in third variable analysis Multivariate and Multiple third variable effect analysis Multilevel mediation confounding analysis Third variable effect analysis with high dimensional data Moderation Interaction effect analysis within the third variable analysis R packages and SAS macros to implement methods proposed in the book *Exploratory and Robust Data Analysis* Abdel-Salam G. Abdel-Salam, Jeffrey B. Birch, 2025-09-29 Exploratory and Robust Data Analysis A Modern Applied Statistics Guide Using SPSS and R is an essential resource for students researchers and professionals seeking a comprehensive yet practical approach to modern statistical analysis This book bridges traditional statistical methods with contemporary techniques emphasizing exploratory and robust data analysis while integrating powerful computational tools such as R and SPSS Designed for intermediate level courses and research

applications the book begins with fundamental concepts in exploratory data analysis graphical methods and confirmatory statistical procedures It then introduces robust statistical methods including M estimators high breakdown estimators bootstrap techniques and Monte Carlo simulations equipping readers with tools to handle complex and real world data scenarios Key topics include regression analysis multiple linear models nonparametric regression and generalized linear models ensuring broad applicability across disciplines What sets this book apart is its emphasis on theoretical foundations and hands on applications Annotated computer sessions guide readers through statistical analysis enabling them to apply techniques effectively while understanding their theoretical underpinnings This book fosters an analytical mindset that encourages critical thinking and data driven decision making by combining classical statistical procedures with modern computational methods With real world datasets practical exercises and detailed software integration this book is an indispensable guide for those looking to master data analysis in an era where statistical rigor and computational efficiency are paramount

Outlier Analysis Charu C. Aggarwal, 2016-12-10 This book provides comprehensive coverage of the field of outlier analysis from a computer science point of view It integrates methods from data mining machine learning and statistics within the computational framework and therefore appeals to multiple communities The chapters of this book can be organized into three categories Basic algorithms Chapters 1 through 7 discuss the fundamental algorithms for outlier analysis including probabilistic and statistical methods linear methods proximity based methods high dimensional subspace methods ensemble methods and supervised methods Domain specific methods Chapters 8 through 12 discuss outlier detection algorithms for various domains of data such as text categorical data time series data discrete sequence data spatial data and network data Applications Chapter 13 is devoted to various applications of outlier analysis Some guidance is also provided for the practitioner The second edition of this book is more detailed and is written to appeal to both researchers and practitioners Significant new material has been added on topics such as kernel methods one class support vector machines matrix factorization neural networks outlier ensembles time series methods and subspace methods It is written as a textbook and can be used for classroom teaching

Higher Education Policy Analysis Using Quantitative Techniques Marvin Titus, 2021-05-14 This textbook introduces graduate students in education and policy research to data and statistical methods in state level higher education policy analysis It also serves as a methodological guide to students practitioners and researchers who want a clear approach to conducting higher education policy analysis that involves the use of institutional and state level secondary data and quantitative methods ranging from descriptive to advanced statistical techniques This book is unique in that it introduces readers to various types of data sources and quantitative methods utilized in policy research and in that it demonstrates how results of statistical analyses should be presented to higher education policy makers It helps to bridge the gap between researchers policy makers and practitioners both within education policy and between other fields Coverage includes identifying pertinent data sources the creation and management of customized data

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