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Ludwig Fahrmeir
Gerhard Tutz

Multivariate Statistical Modelling Based on Generalized Linear Models

基于广义线性模型的多元统计建模

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With Contributions by Wolfgang Hennevogl

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Preface

Classical statistical models for regression, time series and longitudinal data provide well–established tools for approximately normally distributed variables. Enhanced by the availability of software packages these models dominated the field of applications for a long time. With the introduction of generalized linear models (GLM) a much more flexible instrument for statistical modelling has been created. The broad class of GLM's includes some of the classical linear models as special cases but is particularly suited for categorical discrete or nonnegative responses.

The last decade has seen various extensions of GLM's: multivariate and multicategorical models have been considered, longitudinal data analysis has been developed in this setting, random effects and nonparametric predictors have been included. These extended methods have grown around generalized linear models but often are no longer GLM's in the original sense. The aim of this book is to bring together and review a large part of these recent advances in statistical modelling. Although the continuous case is sketched sometimes, thoughout the book the focus is on categorical data. The book deals with regression analysis in a wider sense including not only cross-sectional analysis but also time series and longitudinal data situations. We do not consider problems of symmetrical nature, like the investigation of the association structure in a given set of variables. For example, log-linear models for contingency tables, which can be treated as special cases of GLM's are totally omitted. The estimation approach that is primarily considered in this book is likelihood–based.

The book is aimed at applied statisticians, graduate students of statistics, and students and researchers with a strong interest in statistics and data

analysis from areas like econometrics, biometrics and social sciences. It is written on an intermediate mathematical level with emphasis on basic ideas. Technical and mathematical details are often deferred to starred sections, and for rigorous proofs the reader is referred to the literature.

In preliminary versions of this book Wolfgang Hennevogl was the third author. A new job and its challenges reduced his involvement. Nevertheless he made valuable contributions, in particular to parts of Section 2.3, Section 4.2, Chapter 7, Section 8.3, Appendices A3, A4 and A5, and to many of the examples. In the final stage of the manuscript Thomas Kurtz made helpful contributions, by working out examples and Appendix B.

We are grateful to various colleagues and students in our courses for discussions and suggestions. Discussions with A. Agresti were helpful when the second author visited the University of Florida, Gainesville. We would like to thank Renate Meier-Reusch and Marietta Dostert for the skilful typing of the first version. Moreover, we thank Wolfgang Schneider, Clemens Biller, Martin Krauß, Thomas Scheuchenpflug and Michael Scholz for the preparation of later versions. Further we acknowledge the computational assistance of Christian Gieger, Arthur Klinger, Harald Nase and Stefan Wagenpfeil. We gratefully acknowledge support from Deutsche Forschungsgemeinschaft. For permission to use Tables 1.5, 3.12, 3.13 and 6.1 we are grateful to the Royal Statistical Society and Biometrika Trust.

We hope you will enjoy the book.

München and Berlin, 26.02.1994

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