Bayesian Semiparametric Inference in Multiple Equation Models

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ABSTRACT: This paper outlines an approach to Bayesian semiparametric regression in multiple equation models which can be used to carry out inference in seemingly unrelated regressions or simultaneous equations models with nonparametric components. The approach treats the points on each nonparametric regression line as unknown parameters and uses a prior on the degree of smoothness of each line to ensure valid posterior inference despite the fact that the number of parameters is greater than the number of observations. We derive an empirical Bayesian approach that allows us to estimate the prior smoothing hyperparameters from the data. An advantage of our semiparametric model is that it is written as a seemingly unrelated regressions model with independent Normal-Wishart prior. Since this model is a common one, textbook results for posterior inference, model comparison, prediction and posterior computation are immediately available. We use this model in an application involving a two-equation structural model drawn from the labor and returns to schooling literatures.

Bayesian Semiparametric Structural Equation Models With

Jin-Ying Zhang

Bayesian Semiparametric Structural Equation Models With:

Basic and Advanced Bayesian Structural Equation Modeling Sik-Yum Lee,Xin-Yuan Song,2012-07-05 This book provides clear instructions to researchers on how to apply Structural Equation Models SEMs for analyzing the inter relationships between observed and latent variables Basic and Advanced Bayesian Structural Equation Modeling introduces basic and advanced SEMs for analyzing various kinds of complex data such as ordered and unordered categorical data multilevel data mixture data longitudinal data highly non normal data as well as some of their combinations In addition Bayesian semiparametric SEMs to capture the true distribution of explanatory latent variables are introduced whilst SEM with a nonparametric structural equation to assess unspecified functional relationships among latent variables are also explored Statistical methodologies are developed using the Bayesian approach giving reliable results for small samples and allowing the use of prior information leading to better statistical results Estimates of the parameters and model comparison statistics are obtained via powerful Markov Chain Monte Carlo methods in statistical computing Introduces the Bayesian approach to SEMs including discussion on the selection of prior distributions and data augmentation Demonstrates how to utilize the recent powerful tools in statistical computing including but not limited to the Gibbs sampler the Metropolis Hasting algorithm and path sampling for producing various statistical results such as Bayesian estimates and Bayesian model comparison statistics in the analysis of basic and advanced SEMs Discusses the Bayes factor Deviance Information Criterion DIC and L_ nu measure for Bayesian model comparison Introduces a number of important generalizations of SEMs including multilevel and mixture SEMs latent curve models and longitudinal SEMs semiparametric SEMs and those with various types of discrete data and nonparametric structural equations Illustrates how to use the freely available software WinBUGS to produce the results Provides numerous real examples for illustrating the theoretical concepts and computational procedures that are presented throughout the book Researchers and advanced level students in statistics biostatistics public health business education psychology and social science will benefit from this book **Structural Equation Modeling** Gregory R. Hancock,Ralph O. Mueller,2013-03-21 This second edition updates Hancock and Mueller s 2006 volume adding four new chapters It serves as a resource for graduate students and research professionals covering advanced topics in structural equation modeling SEM to enhance understanding and explore new research questions with a focus on clear explanations and applications **Structural Equation Modeling** Sik-Yum Lee,2007-04-04 Winner of the 2008 Ziegel Prize for outstanding new book of the year Structural equation modeling SEM is a powerful multivariate method allowing the evaluation of a series of simultaneous hypotheses about the impacts of latent and manifest variables on other variables taking measurement errors into account As SEMs have grown in popularity in recent years new models and statistical methods have been developed for more accurate analysis of more complex data A Bayesian approach to SEMs allows the use of prior information resulting in improved parameter estimates latent variable estimates and statistics for model comparison as well

as offering more reliable results for smaller samples Structural Equation Modeling introduces the Bayesian approach to SEMs including the selection of prior distributions and data augmentation and offers an overview of the subject s recent advances Demonstrates how to utilize powerful statistical computing tools including the Gibbs sampler the Metropolis Hasting algorithm bridge sampling and path sampling to obtain the Bayesian results Discusses the Bayes factor and Deviance Information Criterion DIC for model comparison Includes coverage of complex models including SEMs with ordered categorical variables and dichotomous variables nonlinear SEMs two level SEMs multisample SEMs mixtures of SEMs SEMs with missing data SEMs with variables from an exponential family of distributions and some of their combinations Illustrates the methodology through simulation studies and examples with real data from business management education psychology public health and sociology Demonstrates the application of the freely available software WinBUGS via a supplementary website featuring computer code and data sets Structural Equation Modeling A Bayesian Approach is a multi disciplinary text ideal for researchers and students in many areas including statistics biostatistics business education medicine psychology public health and social science Moving Beyond Non-Informative Prior Distributions: Achieving the Full Potential of Bayesian Methods for Psychological Research Christoph Koenig,Sarah Depaoli,Haiyan Liu,Rens Van De Schoot,2022-02-01 *Issues in Psychology and Psychiatry Research and Practice: 2012 Edition* ,2013-01-10 Issues in Psychology and Psychiatry Research and Practice 2012 Edition is a ScholarlyEditions eBook that delivers timely authoritative and comprehensive information about Psychology The editors have built Issues in Psychology and Psychiatry Research and Practice 2012 Edition on the vast information databases of ScholarlyNews You can expect the information about Psychology in this eBook to be deeper than what you can access anywhere else as well as consistently reliable authoritative informed and relevant The content of Issues in Psychology and Psychiatry Research and Practice 2012 Edition has been produced by the world s leading scientists engineers analysts research institutions and companies All of the content is from peer reviewed sources and all of it is written assembled and edited by the editors at ScholarlyEditions and available exclusively from us You now have a source you can cite with authority confidence and credibility More information is available at http www ScholarlyEditions com **Bayesian Non-linear Methods for Survival Analysis and Structural Equation Models** Zhenyu Wang (Statistician),2014 High dimensional data are more common nowadays because the collection of such data becomes larger and more complex due to the technology advance of the computer science biology etc The analysis of high dimensional data is different from traditional data analysis and variable selection for high dimensional data becomes very challenging Structural equation modeling SEM analyzes the relationship between manifest variables and latent variables The structural equation focuses on analyzing the relationship between latent variables New proposed methods of these topics are discussed in the dissertation In the first chapter we review the basic concept of survival analysis SEM and current method of variable selection in those two scenarios We also introduce the available software package for current methods and relevant

data set In the second chapter we develop a Bayesian kernel machine model with incorporating existing information on pathways and gene networks in the analysis of DNA microarray data Each pathway is modeled nonparametrically using reproducing kernel Hilbert space The pathways and the genes are selected via assigning mixture priors on the pathway indicator variable and the gene indicator variable This approach helped us in flexible modeling of the pathway effects which can capture both linear and non linear effect Moreover the model can also pinpoint the important pathways and the important active genes within each pathway We have also developed an efficient Markov Chain Monte Carlo MCMC algorithm to fit our model We used simulations and a real data analysis van t Veer et al 2002 breast cancer microarray data to illustrate the proposed method In the third chapter we extend the idea of semiparametric structural equation model where the nonlinear functional relationships are approximated using basis expansions Guo et al 2012 Many basis expansion methods including cubic splines are known to induce correlations In this chapter we compare standard Lasso Fused Lasso and Elastic Net to account for correlations in both the covariate and basis expansions To illustrate the usefulness of the proposed methods a simulation study and a real data study have been performed The semiparametric structural equation models based on Bayesian fused Lasso and Bayesian elastic net outperform the Bayesian Lasso model In the fourth chapter we apply Bayesian Graph Laplacian Model developed by Liu et al 2014 and generalized the graph Laplacian allowing both positively and negatively correlated variable to analyze gene expression data from Michigan prostate cancer study Dhanasekaran et al 2001 We find out the underlie gene network and interaction related to prostate cancer and discuss the possible extensions for Bayesian Graph Laplacian Model including analyzing multiple pathways simultaneously and pathways selection right censored data as response variable and binomial or multinomial data as response variable **Issues in Bioengineering and Bioinformatics: 2013 Edition** ,2013-05-01 Issues in Bioengineering and Bioinformatics 2013 Edition is a ScholarlyEditions book that delivers timely authoritative and comprehensive information about Lifetime Data Analysis The editors have built Issues in Bioengineering and Bioinformatics 2013 Edition on the vast information databases of ScholarlyNews You can expect the information about Lifetime Data Analysis in this book to be deeper than what you can access anywhere else as well as consistently reliable authoritative informed and relevant The content of Issues in Bioengineering and Bioinformatics 2013 Edition has been produced by the world s leading scientists engineers analysts research institutions and companies All of the content is from peer reviewed sources and all of it is written assembled and edited by the editors at ScholarlyEditions and available exclusively from us You now have a source you can cite with authority confidence and credibility More information is available at http www ScholarlyEditions com *Longitudinal Multivariate Psychology* Emilio Ferrer,Steven M. Boker,Kevin J. Grimm,2018-10-09 This volume presents a collection of chapters focused on the study of multivariate change As people develop and change multivariate measurement of that change and analysis of those measures can illuminate the regularities in the trajectories of individual development as well as time dependent

changes in population averages As longitudinal data have recently become much more prevalent in psychology and the social sciences models of change have become increasingly important This collection focuses on methodological statistical and modeling aspects of multivariate change and applications of longitudinal models to the study of psychological processes The volume is divided into three major sections Extension of latent change models Measurement and testing issues in longitudinal modeling and Novel applications of multivariate longitudinal methodology It is intended for advanced students and researchers interested in learning about state of the art techniques for longitudinal data analysis as well as understanding the history and development of such techniques **Consumer Behavior in the Internet Era** Gong Sun,Lester Johnson,Jie Li,2022-11-28 Bayesian Statistics and Its Applications Satyanshu K. Upadhyay,Umesh Singh,Dipak Dey,2007 In the last two decades Bayesian Statistics has acquired immense importance and has penetrated almost every area including those where the application of statistics appeared to be a remote possibility This volume provides both theoretical and practical insights into the subject with detailed up to date material on various aspects It serves two important objectives to offer a thorough background material for theoreticians and gives a variety of applications for applied statisticians and practitioners Consisting of 33 chapters it covers topics on biostatistics econometrics reliability image analysis Bayesian computation neural networks prior elicitation objective Bayesian methodologies role of randomisation in Bayesian analysis spatial data analysis nonparametrics and a lot more The book will serve as an excellent reference work for updating knowledge and for developing new methodologies in a wide variety of areas It will become an invaluable tool for statisticians and the practitioners of Bayesian paradigm **Journal of the American Statistical Association** American Statistical Association,2007 **American Doctoral Dissertations** ,2000 Bayesian Econometrics Gary Koop,2003 Researchers in many fields are increasingly finding the Bayesian approach to statistics to be an attractive one This book introduces the reader to the use of Bayesian methods in the field of econometrics at the advanced undergraduate or graduate level The book is self contained and does not require that readers have previous training in econometrics The focus is on models used by applied economists and the computational techniques necessary to implement Bayesian methods when doing empirical work Topics covered in the book include the regression model and variants applicable for use with panel data time series models models for qualitative or censored data nonparametric methods and Bayesian model averaging The book includes numerous empirical examples and the website associated with it contains data sets and computer programs to help the student develop the computational skills of modern Bayesian econometrics **Current Index to Statistics, Applications, Methods and Theory** ,1999 The Current Index to Statistics CIS is a bibliographic index of publications in statistics probability and related fields *Bayesian Structural Equation Modeling* Sarah Depaoli,2021-07-01 This book offers researchers a systematic and accessible introduction to using a Bayesian framework in structural equation modeling SEM Stand alone chapters on each SEM model clearly explain the Bayesian form of the model and walk the reader through

implementation Engaging worked through examples from diverse social science subfields illustrate the various modeling techniques highlighting statistical or estimation problems that are likely to arise and describing potential solutions For each model instructions are provided for writing up findings for publication including annotated sample data analysis plans and results sections Other user friendly features in every chapter include Major Take Home Points notation glossaries annotated suggestions for further reading and sample code in both Mplus and R The companion website www guilford com depaoli materials supplies data sets annotated code for implementation in both Mplus and R so that users can work within their preferred platform and output for all of the book s examples **Mathematical Reviews** ,2006 **Latent Variable Models for Multiple Longitudinal Outcomes with Non-ignorable Missing Data** Xiaohong Yan,2007 **Statistical Theory and Method Abstracts** ,1997 Bayesian Estimation and Testing of Structural Equation Models Richard Scheines,Herbert Hoijtink,Anne Boomsma,1995 Abstract The Gibbs sampler can be used to obtain samples of arbitrary size from the posterior distribution over the parameters of a structural equation model given covariance data and a prior distribution over the parameters Point estimates standard deviations and interval estimates for the parameters can be computed from these samples If the prior distribution over the parameters is uninformative the posterior is proportional to the likelihood and asymptotically the inferences based on the Gibbs sample are the same as those based on the maximum likelihood solution e g output from LISREL or EQS In small samples however the likelihood surface is not multivariate normal and in some cases not even unimodal Nevertheless the Gibbs sampler draws a sample from the true posterior distribution over the parameters regardless of the sample size and the shape of the likelihood surface With an informative prior distribution over the parameters it can be used to estimate underidentified models as we illustrate on a simple errors in variables model

Structural Equation Models Georgian Federation of Psychologists Academic Team, Structural Equation Modeling has emerged as a powerful statistical technique for analyzing complex relationships in social science research It allows researchers to simultaneously examine the relationships between multiple latent variables while also considering the impact of measurement error Lei Wu 2007 Lee et al 2018 Structural Equation Modeling provides a framework for testing hypotheses about the underlying mechanisms that drive various social phenomena making it a valuable tool for researchers in fields such as psychology sociology and education One of the key benefits of Structural Equation Modeling is its ability to handle latent variables which are unobserved constructs that cannot be directly measured but can be inferred from observable indicators This is particularly useful in the social sciences where many of the variables of interest are not directly observable such as intelligence attitudes or personality traits By incorporating these latent variables into the model researchers can gain a more comprehensive understanding of the relationships between different constructs and how they interact Structural Equation Modeling typically involves two main components the measurement model and the structural model The measurement model specifies the relationships between the latent variables and their observed indicators while the structural model examines

the relationships between the latent variables themselves One of the key steps in conducting a Structural Equation Modeling analysis is the specification of the model This involves the researcher defining the relationships between the variables based on their theoretical understanding of the phenomenon being studied Once the model has been specified the researcher can then estimate the parameters of the model using a variety of statistical techniques such as maximum likelihood or robust weighted least squares A comprehensive understanding of Structural Equation Modeling requires a solid grounding in statistical theory and an understanding of the various assumptions and limitations of the technique

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