

Bayesian Methods Wiley Home

Medical decision making has evolved in recent years, as more complex problems are being faced and addressed based on increasingly large amounts of data. In parallel, advances in computing have led to a host of new and powerful statistical tools to support decision making. Simulation-based Bayesian methods are especially promising, as they provide a unified framework for data collection, inference, and decision making. In addition, these methods are simple to interpret, and can help to address the most pressing practical and ethical concerns arising in medical decision making. *

Provides an overview of the necessary methodological background, including Bayesian inference, Monte Carlo simulation, and utility theory. * Driven by three real applications, presented as extensively detailed case studies. * Case studies include simplified versions of the analysis, to approach complex modelling in stages. * Features coverage of meta-analysis, decision analysis, and comprehensive decision modeling. * Accessible to readers with only a basic statistical knowledge. Primarily aimed at students and practitioners of biostatistics, the book will also appeal to those working in statistics, medical informatics, evidence-based medicine, health economics, health services research, and health policy. Presents an introduction to Bayesian statistics, presents an emphasis on Bayesian methods (prior and posterior), Bayes estimation, prediction, MCMC, Bayesian regression, and Bayesian analysis of statistical models of dependence, and features a focus on copulas for risk management Introduction to Bayesian Estimation and Copula Models of Dependence emphasizes the applications of Bayesian analysis to copula modeling and equips readers with the tools needed to implement the procedures of Bayesian estimation in copula models of dependence. This book is structured in two parts: the first four chapters serve as a general introduction to Bayesian statistics with a clear emphasis on parametric estimation and the following four chapters stress statistical models of dependence with a focus of copulas. A review of the main concepts is discussed along with the basics of Bayesian statistics including prior information and experimental data, prior and posterior distributions, with an emphasis on Bayesian parametric estimation. The basic mathematical background of both Markov chains and Monte Carlo integration and simulation is also provided. The authors discuss statistical models of dependence with a focus on copulas and present a brief survey of pre-copula dependence models. The main definitions and notations of copula models are summarized followed by discussions of real-world cases that address particular risk management problems. In addition, this book includes:

- Practical examples of copulas in use including within the Basel Accord II documents that regulate the world banking system as well as examples of Bayesian methods within current FDA recommendations
- Step-by-step procedures of multivariate data analysis and copula modeling, allowing readers to gain insight for their own applied research and studies
- Separate reference lists within each chapter and end-of-the-chapter exercises within Chapters 2 through 8
- A companion website containing appendices: data files and demo files in Microsoft® Office Excel®, basic code in R, and selected exercise solutions

Introduction to Bayesian Estimation and Copula Models of Dependence is a reference and resource for statisticians who need to learn formal Bayesian analysis as well as professionals within analytical and risk management departments of banks and insurance companies who are involved in quantitative analysis and forecasting. This book can also be used as a textbook for upper-undergraduate and graduate-level courses in Bayesian statistics and analysis. ARKADY SHEMYAKIN, PhD, is Professor in the Department of Mathematics and Director of the Statistics Program at the University of St. Thomas. A member of the American Statistical Association and the International Society for Bayesian Analysis, Dr. Shemyakin's research interests include information theory, Bayesian methods of parametric estimation, and copula models in actuarial mathematics, finance, and engineering. ALEXANDER KNIAZEV, PhD, is Associate Professor and Head of the Department of Mathematics at Astrakhan State University in Russia. Dr. Kniazev's research interests include representation theory of Lie algebras and finite groups, mathematical statistics, econometrics, and financial mathematics.

Presents the Bayesian approach to statistical signal processing for a variety of useful model sets This book aims to give readers a unified Bayesian treatment starting from the basics (Baye's rule) to the more advanced (Monte Carlo sampling), evolving to the next-generation model-based techniques (sequential Monte Carlo sampling). This next edition incorporates a new chapter on "Sequential Bayesian Detection," a new section on "Ensemble Kalman Filters" as well as an expansion of Case Studies that detail Bayesian solutions for a variety of applications. These studies illustrate Bayesian approaches to real-world problems incorporating detailed particle filter designs, adaptive particle filters and sequential Bayesian detectors. In addition to these major developments a variety of sections are expanded to "fill-in-the gaps" of the first edition. Here metrics for particle filter (PF) designs with emphasis on classical "sanity testing" lead to ensemble techniques as a basic requirement for performance analysis. The expansion of information theory metrics and their application to PF designs is fully developed and applied. These expansions of the book have been updated to provide a more cohesive discussion of Bayesian processing with examples and applications enabling the comprehension of alternative approaches to solving estimation/detection problems. The second edition of Bayesian Signal Processing features: "Classical" Kalman filtering for linear, linearized, and nonlinear systems; "modern" unscented and ensemble Kalman filters; and the "next-generation" Bayesian particle filters Sequential Bayesian detection techniques incorporating model-based schemes for a variety of real-world problems Practical Bayesian processor designs including comprehensive methods of performance analysis ranging from simple sanity testing and ensemble techniques to sophisticated information metrics New case studies on adaptive particle filtering and sequential Bayesian detection are covered detailing more Bayesian approaches to applied problem solving MATLAB® notes at the end of each chapter help readers solve complex problems using readily available software commands and point out other software packages available Problem sets included to test readers' knowledge and help them put their new skills into practice Bayesian Signal Processing, Second Edition is written for all students, scientists, and engineers who investigate and apply signal

processing to their everyday problems.

A hands-on introduction to computational statistics from a Bayesian point of view Providing a solid grounding in statistics while uniquely covering the topics from a Bayesian perspective, *Understanding Computational Bayesian Statistics* successfully guides readers through this new, cutting-edge approach. With its hands-on treatment of the topic, the book shows how samples can be drawn from the posterior distribution when the formula giving its shape is all that is known, and how Bayesian inferences can be based on these samples from the posterior. These ideas are illustrated on common statistical models, including the multiple linear regression model, the hierarchical mean model, the logistic regression model, and the proportional hazards model. The book begins with an outline of the similarities and differences between Bayesian and the likelihood approaches to statistics. Subsequent chapters present key techniques for using computer software to draw Monte Carlo samples from the incompletely known posterior distribution and performing the Bayesian inference calculated from these samples. Topics of coverage include: Direct ways to draw a random sample from the posterior by reshaping a random sample drawn from an easily sampled starting distribution The distributions from the one-dimensional exponential family Markov chains and their long-run behavior The Metropolis-Hastings algorithm Gibbs sampling algorithm and methods for speeding up convergence Markov chain Monte Carlo sampling Using numerous graphs and diagrams, the author emphasizes a step-by-step approach to computational Bayesian statistics. At each step, important aspects of application are detailed, such as how to choose a prior for logistic regression model, the Poisson regression model, and the proportional hazards model. A related Web site houses R functions and Minitab macros for Bayesian analysis and Monte Carlo simulations, and detailed appendices in the book guide readers through the use of these software packages. *Understanding Computational Bayesian Statistics* is an excellent book for courses on computational statistics at the upper-level undergraduate and graduate levels. It is also a valuable reference for researchers and practitioners who use computer programs to conduct statistical analyses of data and solve problems in their everyday work.

This new edition continues to serve as a comprehensive guide to modern and classical methods of statistical computing. The book is comprised of four main parts spanning the field: Optimization Integration and Simulation Bootstrapping Density Estimation and Smoothing Within these sections, each chapter includes a comprehensive introduction and step-by-step implementation summaries to accompany the explanations of key methods. The new edition includes updated coverage and existing topics as well as new topics such as adaptive MCMC and bootstrapping for correlated data. The book website now includes comprehensive R code for the entire book. There are extensive exercises, real examples, and helpful insights about how to use the methods in practice.

Bayesian nonparametrics works - theoretically, computationally. The theory provides highly flexible models whose complexity grows appropriately with the amount of data. Computational issues, though challenging, are no longer intractable. All that is needed is an entry point: this intelligent book is the perfect guide to what can seem a forbidding landscape. Tutorial chapters by Ghosal, Lijoi and Prünster, Teh and Jordan, and Dunson advance from theory, to basic models and hierarchical modeling, to applications and implementation, particularly in computer science and biostatistics. These are complemented by companion chapters by the editors and Griffin and Quintana, providing additional models, examining computational issues, identifying future growth areas, and giving links to related topics. This coherent text gives ready access both to underlying principles and to state-of-the-art practice. Specific examples are drawn from information retrieval, NLP, machine vision, computational biology, biostatistics, and bioinformatics.

Bayesian methods are a powerful tool in many areas of science and engineering, especially statistical physics, medical sciences, electrical engineering, and information sciences. They are also ideal for civil engineering applications, given the numerous types of modeling and parametric uncertainty in civil engineering problems. For example, earthquake ground motion cannot be predetermined at the structural design stage. Complete wind pressure profiles are difficult to measure under operating conditions. Material properties can be difficult to determine to a very precise level – especially concrete, rock, and soil. For air quality prediction, it is difficult to measure the hourly/daily pollutants generated by cars and factories within the area of concern. It is also difficult to obtain the updated air quality information of the surrounding cities. Furthermore, the meteorological conditions of the day for prediction are also uncertain. These are just some of the civil engineering examples to which Bayesian probabilistic methods are applicable. Familiarizes readers with the latest developments in the field Includes identification problems for both dynamic and static systems Addresses challenging civil engineering problems such as modal/model updating Presents methods applicable to mechanical and aerospace engineering Gives engineers and engineering students a concrete sense of implementation Covers real-world case studies in civil engineering and beyond, such as: structural health monitoring seismic attenuation finite-element model updating hydraulic jump artificial neural network for damage detection air quality prediction Includes other insightful daily-life examples Companion website with MATLAB code downloads for independent practice Written by a leading expert in the use of Bayesian methods for civil engineering problems This book is ideal for researchers and graduate students in civil and mechanical engineering or applied probability and statistics. Practicing engineers interested in the application of statistical methods to solve engineering problems will also find this to be a valuable text. MATLAB code and lecture materials for instructors available at <http://www.wiley.com/go/yuen>

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. We all like to know how reliable and how risky certain situations are, and our increasing reliance on technology has led to the need for more precise assessments than ever before. Such precision has resulted in efforts both to sharpen the notions of risk and reliability, and to quantify them. Quantification is required for normative decision-making, especially decisions pertaining to our safety and wellbeing. Increasingly in recent years Bayesian methods have become key to such quantifications. Reliability and Risk provides a comprehensive overview of the mathematical and statistical aspects of risk and reliability analysis, from a Bayesian perspective. This book sets out to change the way in which we think about reliability and survival analysis by casting them in the broader context of decision-making. This is achieved by: Providing a broad coverage of the diverse aspects of reliability, including: multivariate failure models, dynamic reliability, event history analysis, non-parametric Bayes, competing risks, co-operative and competing systems, and signature analysis. Covering the essentials of Bayesian statistics and exchangeability, enabling readers who are unfamiliar with Bayesian inference to benefit from the book. Introducing the notion of “composite reliability”, or the collective reliability of a population of items. Discussing the relationship between notions of reliability and survival analysis and econometrics and financial risk. Reliability and Risk can most profitably be used by practitioners and research workers in reliability and survivability as a source of information, reference, and open problems. It can also form the basis of a graduate level course in reliability and risk analysis for students in statistics, biostatistics, engineering (industrial, nuclear, systems), operations research, and other mathematically oriented scientists, wherein the instructor could supplement the material with examples and problems.

"...this edition is useful and effective in teaching Bayesian inference at both elementary and intermediate levels. It is a well-written book on elementary Bayesian inference, and the material is easily accessible. It is both concise and timely, and provides a good collection of overviews and reviews of important tools used in Bayesian statistical methods." There is a strong upsurge in the use of Bayesian methods in applied statistical analysis, yet most introductory statistics texts only present frequentist methods. Bayesian statistics has many important advantages that students should learn about if they are going into fields where statistics will be used. In this third Edition, four newly-added chapters address topics that reflect the rapid advances in the field of Bayesian statistics. The authors continue to provide a Bayesian treatment of introductory statistical topics, such as scientific data gathering, discrete random variables, robust Bayesian methods, and Bayesian approaches to inference for discrete random variables, binomial proportions, Poisson, and normal means, and simple linear regression. In addition, more advanced topics in the field are presented in four new chapters: Bayesian inference for a normal with unknown mean and variance; Bayesian inference for a Multivariate Normal mean vector; Bayesian inference for the Multiple Linear Regression Model; and Computational Bayesian Statistics including Markov Chain Monte Carlo. The inclusion of these topics will facilitate readers' ability to advance from a minimal understanding of Statistics to the ability to tackle topics in more applied, advanced level books. Minitab macros and R functions are available on the book's related website to assist with chapter exercises. Introduction to Bayesian Statistics, Third Edition also features: Topics including the Joint Likelihood function and inference using independent Jeffreys priors and joint conjugate prior The cutting-edge topic of computational Bayesian Statistics in a new chapter, with a unique focus on Markov Chain Monte Carlo methods Exercises throughout the book that have been updated to reflect new applications and the latest software applications Detailed appendices that guide readers through the use of R and Minitab software for Bayesian analysis and Monte Carlo simulations, with all related macros available on the book's website Introduction to Bayesian Statistics, Third Edition is a textbook for upper-undergraduate or first-year graduate level courses on introductory statistics course with a Bayesian emphasis. It can also be used as a reference work for statisticians who require a working knowledge of Bayesian statistics.

Published by the American Geophysical Union as part of the Geophysical Monograph Series, Volume 200. Trajectory-based (“Lagrangian”) atmospheric transport and dispersion modeling has gained in popularity and sophistication over the previous several decades. It is common practice now for researchers around the world to apply Lagrangian models to a wide spectrum of issues. Lagrangian Modeling of the Atmosphere is a comprehensive volume that includes sections on Lagrangian modeling theory, model applications, and tests against observations. Published by the American Geophysical Union as part of the Geophysical Monograph Series. Comprehensive coverage of trajectory-based atmospheric dispersion modeling Important overview of a widely used modeling tool Sections look at modeling theory, application of models, and tests against observations

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 Δ_{L}^{ν} -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.

Bayesian Statistics is the school of thought that uses all information surrounding the likelihood of an event rather than just that collected experimentally. Among statisticians the Bayesian approach continues to gain adherents and this new edition of Peter Lee's well-established introduction maintains the clarity of exposition and use of examples for which this text is known and praised. In addition, there is extended coverage of the Metropolis-Hastings algorithm as well as an introduction to the use of BUGS (Bayesian Inference Using Gibbs Sampling) as this is now the standard computational tool for such numerical work. Other alterations include new material on generalized linear modelling and Bernardo's theory of reference points.

Statistics in Practice A new series of practical books outlining the use of statistical techniques in a wide range of application areas: * Human and Biological Sciences * Earth and Environmental Sciences * Industry, Commerce and Finance The authors of this important text explore the processes through which archaeologists analyse their data and how these can be made more rigorous and effective by sound statistical modelling. They assume relatively little previous statistical or mathematical knowledge. Introducing the idea underlying the Bayesian approach to the statistical analysis of data and their subsequent interpretation, the authors demonstrate the major advantage of this approach, i.e. that it allows the incorporation of relevant prior knowledge or beliefs into the analysis. By doing so it provides a logical and coherent way of updating beliefs from those held before observing the data to those held after taking the data into account. To illustrate the power and effectiveness of mathematical and statistical modelling within the Bayesian framework, a variety of real case studies are presented covering areas of common interest to archaeologists. These case studies cover applications in areas such as radiocarbon dating, spatial analysis, provenance studies and other dating methods. Background to these case studies is provided for those readers not so familiar with the subject. Thus, the book provides an examination of the theoretical and practical consequences of Bayesian analysis for examining problems in archaeology. Students of archaeology and related disciplines and professional archaeologists will find the book an informative and practical introduction to the subject.

Tools to improve decision making in an imperfect world This publication provides readers with a thorough understanding of Bayesian analysis that is grounded in the theory of inference and optimal decision making. Contemporary Bayesian Econometrics and Statistics provides readers with state-of-the-art simulation methods and models that are used to solve complex real-world problems. Armed with a strong foundation in both theory and practical problem-solving tools, readers discover how to optimize decision making when faced with problems that involve limited or imperfect data. The book begins by examining the theoretical and mathematical foundations of Bayesian statistics to help readers understand how and why it is used in problem solving. The author then describes how modern simulation methods make Bayesian approaches practical using widely available mathematical applications software. In addition, the author details how models can be applied to specific problems, including: * Linear models and policy choices * Modeling with latent variables and missing data * Time series models and prediction * Comparison and evaluation of models The publication has been developed and fine-tuned through a decade of classroom experience, and readers will find the author's approach very engaging and accessible. There are nearly 200 examples and exercises to help readers see how effective use of Bayesian statistics enables them to make optimal decisions. MATLAB and R computer programs are integrated throughout the book. An accompanying Web site provides readers with computer code for many examples and datasets. This publication is tailored for research professionals who use econometrics and similar statistical methods in their work. With its emphasis on practical problem solving and extensive use of examples and exercises, this is also an excellent textbook for graduate-level students in a broad range of fields, including economics, statistics, the social sciences, business, and public policy. READ ALL ABOUT IT! David Spiegelhalter has recently joined the ranks of Isaac Newton, Charles Darwin and Stephen Hawking by becoming a fellow of the Royal Society. Originating from the Medical Research Council's biostatistics unit, David has played a leading role in the Bristol heart surgery and Harold Shipman inquiries. Order a copy of this author's comprehensive text TODAY! The Bayesian approach involves synthesising data and judgement in order to reach conclusions about unknown quantities and make predictions. Bayesian methods have become increasingly popular in recent years, notably in medical research, and although there are a number of books on Bayesian analysis, few cover clinical trials and biostatistical applications in any detail. Bayesian Approaches to Clinical Trials and Health-Care Evaluation provides a valuable overview of this rapidly evolving field, including basic Bayesian ideas, prior distributions, clinical trials, observational studies, evidence synthesis and cost-effectiveness analysis. Covers a broad array of essential topics, building from the basics to more advanced techniques. Illustrated throughout by detailed case studies and worked examples Includes exercises in all chapters Accessible to anyone with a basic knowledge of statistics Authors are at the forefront of research into Bayesian methods in medical research Accompanied by a Web site featuring data sets and worked examples using Excel and WinBUGS - the most widely used Bayesian modelling package Bayesian Approaches to Clinical Trials and Health-Care Evaluation is suitable for students and researchers in medical statistics, statisticians in the pharmaceutical industry, and anyone involved in conducting clinical trials and assessment of health-care technology.

The use of Bayesian methods for the analysis of data has grown substantially in areas as diverse as applied statistics,

psychology, economics and medical science. Bayesian Methods for Categorical Data sets out to demystify modern Bayesian methods, making them accessible to students and researchers alike. Emphasizing the use of statistical computing and applied data analysis, this book provides a comprehensive introduction to Bayesian methods of categorical outcomes. * Reviews recent Bayesian methodology for categorical outcomes (binary, count and multinomial data). * Considers missing data models techniques and non-standard models (ZIP and negative binomial). * Evaluates time series and spatio-temporal models for discrete data. * Features discussion of univariate and multivariate techniques. * Provides a set of downloadable worked examples with documented WinBUGS code, available from an ftp site. The author's previous 2 bestselling titles provided a comprehensive introduction to the theory and application of Bayesian models. Bayesian Models for Categorical Data continues to build upon this foundation by developing their application to categorical, or discrete data - one of the most common types of data available. The author's clear and logical approach makes the book accessible to a wide range of students and practitioners, including those dealing with categorical data in medicine, sociology, psychology and epidemiology.

Its main objective is to examine the application and relevance of Bayes' theorem to problems that arise in scientific investigation in which inferences must be made regarding parameter values about which little is known a priori. Begins with a discussion of some important general aspects of the Bayesian approach such as the choice of prior distribution, particularly noninformative prior distribution, the problem of nuisance parameters and the role of sufficient statistics, followed by many standard problems concerned with the comparison of location and scale parameters. The main thrust is an investigation of questions with appropriate analysis of mathematical results which are illustrated with numerical examples, providing evidence of the value of the Bayesian approach.

An essential introductory text linking traditional biostatistics with bayesian methods In recent years, Bayesian methods have seen an explosion of interest, with applications in fields including biochemistry, ecology, medicine, oncology, pharmacology, and public health. As an interpretive system integrating data with observation, the Bayesian approach provides a nuanced yet mathematically rigorous means of conceptualizing biomedical statistics—from diagnostic tests to DNA evidence. Biostatistics: A Bayesian Introduction offers a pioneering approach by presenting the foundations of biostatistics through the Bayesian lens. Using easily understood, classic Dutch Book thought experiments to derive subjective probability from a simple principle of rationality, the book connects statistical science with scientific reasoning. The author shows how to compute, interpret, and report Bayesian statistical analyses in practice, and illustrates how to reinterpret traditional statistical reporting—such as confidence intervals, margins of error, and one-sided p-values—in Bayesian terms. Topics covered include: Probability and subjective probability Distributions and descriptive statistics Continuous probability distributions Comparing rates and means Linear models and statistical adjustment Logistic regression and adjusted odds ratios Survival analysis Hierarchical models and meta-analysis Decision theory and sample size determination The book includes extensive problem sets and references in each chapter, as well as complete instructions on computer analysis with the versatile SAS and WinBUGS software packages as well as the Excel spreadsheet program. For professionals and students, Biostatistics: A Bayesian Introduction offers an unique, real-world entry point into a remarkable alternative method of interpreting statistical data.

A balanced treatment of the theories, methodologies, and design issues involved in clinical trials using statistical methods There has been enormous interest and development in Bayesian adaptive designs, especially for early phases of clinical trials. However, for phase III trials, frequentist methods still play a dominant role through controlling type I and type II errors in the hypothesis testing framework. From practical perspectives, Clinical Trial Design: Bayesian and Frequentist Adaptive Methods provides comprehensive coverage of both Bayesian and frequentist approaches to all phases of clinical trial design. Before underpinning various adaptive methods, the book establishes an overview of the fundamentals of clinical trials as well as a comparison of Bayesian and frequentist statistics. Recognizing that clinical trial design is one of the most important and useful skills in the pharmaceutical industry, this book provides detailed discussions on a variety of statistical designs, their properties, and operating characteristics for phase I, II, and III clinical trials as well as an introduction to phase IV trials. Many practical issues and challenges arising in clinical trials are addressed. Additional topics of coverage include: Risk and benefit analysis for toxicity and efficacy trade-offs Bayesian predictive probability trial monitoring Bayesian adaptive randomization Late onset toxicity and response Dose finding in drug combination trials Targeted therapy designs The author utilizes cutting-edge clinical trial designs and statistical methods that have been employed at the world's leading medical centers as well as in the pharmaceutical industry. The software used throughout the book is freely available on the book's related website, equipping readers with the necessary tools for designing clinical trials. Clinical Trial Design is an excellent book for courses on the topic at the graduate level. The book also serves as a valuable reference for statisticians and biostatisticians in the pharmaceutical industry as well as for researchers and practitioners who design, conduct, and monitor clinical trials in their everyday work.

This highly acclaimed text, now available in paperback, provides a thorough account of key concepts and theoretical results, with particular emphasis on viewing statistical inference as a special case of decision theory. Information-theoretic concepts play a central role in the development of the theory, which provides, in particular, a detailed discussion of the problem of specification of so-called prior ignorance. The work is written from the author's committed Bayesian perspective, but an overview of non-Bayesian theories is also provided, and each chapter contains a wide-ranging critical re-examination of controversial issues. The level of mathematics used is such that most material is accessible to readers with knowledge of advanced calculus. In particular, no knowledge of abstract measure theory is assumed, and the emphasis throughout is on statistical concepts rather than rigorous mathematics. The book will be an ideal source for all students and researchers in statistics, mathematics, decision analysis, economic and business studies, and all branches of science and engineering, who wish to further their understanding of Bayesian statistics

The past decade has seen a dramatic increase in the use of Bayesian methods in marketing due, in part, to computational and modelling breakthroughs, making its implementation ideal for many marketing problems. Bayesian analyses can now be conducted over a wide range of marketing problems, from new product introduction to pricing, and with a wide variety of different data sources. Bayesian Statistics and Marketing describes the basic advantages of the Bayesian approach, detailing the nature of the computational revolution. Examples contained include household and consumer panel data on product purchases and survey data, demand models based on micro-economic theory and random effect models used to pool data among respondents. The book also discusses the theory and practical use of MCMC methods. Written by the leading experts in the field, this unique book: Presents a unified treatment of Bayesian methods in marketing, with common notation and algorithms for estimating the models. Provides a self-contained introduction to Bayesian methods. Includes case studies drawn from the authors' recent research to illustrate how Bayesian methods can be extended to apply to many important marketing problems. Is accompanied by an R package, bayesm, which implements all of the models and methods in the book and includes many datasets. In addition the book's website hosts datasets and R code for the case studies. Bayesian Statistics and Marketing provides a platform for researchers in marketing to analyse their data with state-of-the-art methods and develop new models of consumer behaviour. It provides a unified reference for cutting-edge marketing researchers, as well as an invaluable guide to this growing area for both graduate students and professors, alike.

The focus of this book is on "ill-posed inverse problems". These problems cannot be solved only on the basis of observed data. The building of solutions involves the recognition of other pieces of a priori information. These solutions are then specific to the pieces of information taken into account. Clarifying and taking these pieces of information into account is necessary for grasping the domain of validity and the field of application for the solutions built. For too long, the interest in these problems has remained very limited in the signal-image community. However, the community has since recognized that these matters are more interesting and they have become the subject of much greater enthusiasm. From the application field's point of view, a significant part of the book is devoted to conventional subjects in the field of inversion: biological and medical imaging, astronomy, non-destructive evaluation, processing of video sequences, target tracking, sensor networks and digital communications. The variety of chapters is also clear, when we examine the acquisition modalities at stake: conventional modalities, such as tomography and NMR, visible or infrared optical imaging, or more recent modalities such as atomic force imaging and polarized light imaging.

Intriguing examination of works by Aristotle, Galileo, Newton, Pasteur, Einstein, Margaret Mead, and other scientists in terms of subjectivity and the Bayesian approach to statistical analysis. "An insightful work." — Choice. 2001 edition.

The use of Bayesian statistics has grown significantly in recent years, and will undoubtedly continue to do so. Applied Bayesian Modelling is the follow-up to the author's best selling book, Bayesian Statistical Modelling, and focuses on the potential applications of Bayesian techniques in a wide range of important topics in the social and health sciences. The applications are illustrated through many real-life examples and software implementation in WINBUGS – a popular software package that offers a simplified and flexible approach to statistical modelling. The book gives detailed explanations for each example – explaining fully the choice of model for each particular problem. The book · Provides a broad and comprehensive account of applied Bayesian modelling. · Describes a variety of model assessment methods and the flexibility of Bayesian prior specifications. · Covers many application areas, including panel data models, structural equation and other multivariate structure models, spatial analysis, survival analysis and epidemiology. · Provides detailed worked examples in WINBUGS to illustrate the practical application of the techniques described. All WINBUGS programs are available from an ftp site. The book provides a good introduction to Bayesian modelling and data analysis for a wide range of people involved in applied statistical analysis, including researchers and students from statistics, and the health and social sciences. The wealth of examples makes this book an ideal reference for anyone involved in statistical modelling and analysis.

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.

This book is a definitive work that captures the current state of knowledge of Bayesian Analysis in Statistics and Econometrics and attempts to move it forward. It covers such topics as foundations, forecasting inferential matters,

regression, computation and applications.

This book provides an authoritative account of Bayesian methodology, from its most basic elements to its practical implementations, with an emphasis on healthcare techniques. Contains introductory explanations of Bayesian principles common to all areas.

Bayesian methods combine information available from data with any prior information available from expert knowledge. The Bayes linear approach follows this path, offering a quantitative structure for expressing beliefs, and systematic methods for adjusting these beliefs, given observational data. The methodology differs from the full Bayesian methodology in that it establishes simpler approaches to belief specification and analysis based around expectation judgements. Bayes Linear Statistics presents an authoritative account of this approach, explaining the foundations, theory, methodology, and practicalities of this important field. The text provides a thorough coverage of Bayes linear analysis, from the development of the basic language to the collection of algebraic results needed for efficient implementation, with detailed practical examples. The book covers: The importance of partial prior specifications for complex problems where it is difficult to supply a meaningful full prior probability specification. Simple ways to use partial prior specifications to adjust beliefs, given observations. Interpretative and diagnostic tools to display the implications of collections of belief statements, and to make stringent comparisons between expected and actual observations. General approaches to statistical modelling based upon partial exchangeability judgements. Bayes linear graphical models to represent and display partial belief specifications, organize computations, and display the results of analyses. Bayes Linear Statistics is essential reading for all statisticians concerned with the theory and practice of Bayesian methods. There is an accompanying website hosting free software and guides to the calculations within the book.

Provides a one-stop resource for engineers learning biostatistics using MATLAB® and WinBUGS Through its scope and depth of coverage, this book addresses the needs of the vibrant and rapidly growing bio-oriented engineering fields while implementing software packages that are familiar to engineers. The book is heavily oriented to computation and hands-on approaches so readers understand each step of the programming. Another dimension of this book is in parallel coverage of both Bayesian and frequentist approaches to statistical inference. It avoids taking sides on the classical vs. Bayesian paradigms, and many examples in this book are solved using both methods. The results are then compared and commented upon. Readers have the choice of MATLAB® for classical data analysis and WinBUGS/OpenBUGS for Bayesian data analysis. Every chapter starts with a box highlighting what is covered in that chapter and ends with exercises, a list of software scripts, datasets, and references. Engineering Biostatistics: An Introduction using MATLAB® and WinBUGS also includes: parallel coverage of classical and Bayesian approaches, where appropriate substantial coverage of Bayesian approaches to statistical inference material that has been classroom-tested in an introductory statistics course in bioengineering over several years exercises at the end of each chapter and an accompanying website with full solutions and hints to some exercises, as well as additional materials and examples Engineering Biostatistics: An Introduction using MATLAB® and WinBUGS can serve as a textbook for introductory-to-intermediate applied statistics courses, as well as a useful reference for engineers interested in biostatistical approaches.

Shorter, more concise chapters provide flexible coverage of the subject. Expanded coverage includes: uncertainty and randomness, prior distributions, predictivism, estimation, analysis of variance, and classification and imaging. Includes topics not covered in other books, such as the de Finetti Transform. Author S. James Press is the modern guru of Bayesian statistics.

Bayesian methods are increasingly being used in the social sciences, as the problems encountered lend themselves so naturally to the subjective qualities of Bayesian methodology. This book provides an accessible introduction to Bayesian methods, tailored specifically for social science students. It contains lots of real examples from political science, psychology, sociology, and economics, exercises in all chapters, and detailed descriptions of all the key concepts, without assuming any background in statistics beyond a first course. It features examples of how to implement the methods using WinBUGS – the most-widely used Bayesian analysis software in the world – and R – an open-source statistical software. The book is supported by a Website featuring WinBUGS and R code, and data sets.

Bayesian analysis of complex models based on stochastic processes has in recent years become a growing area. This book provides a unified treatment of Bayesian analysis of models based on stochastic processes, covering the main classes of stochastic processing including modeling, computational, inference, forecasting, decision making and important applied models. Key features: Explores Bayesian analysis of models based on stochastic processes, providing a unified treatment. Provides a thorough introduction for research students. Computational tools to deal with complex problems are illustrated along with real life case studies Looks at inference, prediction and decision making. Researchers, graduate and advanced undergraduate students interested in stochastic processes in fields such as statistics, operations research (OR), engineering, finance, economics, computer science and Bayesian analysis will benefit from reading this book. With numerous applications included, practitioners of OR, stochastic modelling and applied statistics will also find this book useful.

Using a practical, hands-on approach, this book will teach anyone how to carry out Bayesian analyses and interpret the results.

Bayesian Methods in Finance provides a detailed overview of the theory of Bayesian methods and explains their real-world applications to financial modeling. While the principles and concepts explained throughout the book can be used in financial modeling and decision making in general, the authors focus on portfolio management and market risk management—since these are the areas in finance where Bayesian methods have had the greatest penetration to date.

How to conduct clinical trials in an ethical and scientifically responsible manner This book presents a methodology for clinical trials that produces improved health outcomes for patients while obtaining sound and unambiguous scientific data. It centers around a real-world test case—involving a treatment for hypertension after open heart surgery—and explains how to use Bayesian methods to accommodate both ethical and scientific imperatives. The book grew out of the direct involvement in the project by a diverse group of experts in medicine, statistics, philosophy, and the law. Not only do they contribute essays on the scientific, technological, legal, and ethical aspects of clinical trials, but they also critique and debate each other's opinions, creating an interesting, personalized text. Bayesian Methods and Ethics in a Clinical Trial Design * Answers commonly raised questions about Bayesian methods * Describes the advantages and disadvantages of this method compared with other methods * Applies current ethical theory to a particular class of design for clinical trials * Discusses issues of informed consent and how to serve a patient's best interest while still obtaining uncontaminated scientific data * Shows how to use Bayesian probabilistic methods to create computer models from elicited prior opinions of medical experts on the best treatment for a type of patient * Contains several chapters on the process, results, and computational aspects of the test case in question * Explores American law and the legal ramifications of using human subjects For statisticians and biostatisticians, and for anyone involved with medicine and public health, this book provides both a practical guide and a unique perspective on the connection between technological developments, human factors, and some of the larger ethical issues of our times.

Nonlinear Bayesian modelling is a relatively new field, but one that has seen a recent explosion of interest. Nonlinear models offer more flexibility than those with linear assumptions, and their implementation has now become much easier due to increases in computational power. Bayesian methods allow for the incorporation of prior information, allowing the user to make coherent inference. Bayesian Methods for Nonlinear Classification and Regression is the first book to bring together, in a consistent statistical framework, the ideas of nonlinear modelling and Bayesian methods. * Focuses on the problems of classification and regression using flexible, data-driven approaches. * Demonstrates how Bayesian ideas can be used to improve existing statistical methods. * Includes coverage of Bayesian additive models, decision trees, nearest-neighbour, wavelets, regression splines, and neural networks. * Emphasis is placed on sound implementation of nonlinear models. * Discusses medical, spatial, and economic applications. * Includes problems at the end of most of the chapters. *

Supported by a web site featuring implementation code and data sets. Primarily of interest to researchers of nonlinear statistical modelling, the book will also be suitable for graduate students of statistics. The book will benefit researchers involved in regression and classification modelling from electrical engineering, economics, machine learning and computer science.

A risk measurement and management framework that takes model risk seriously Most financial risk models assume the future will look like the past, but effective risk management depends on identifying fundamental changes in the marketplace as they occur. Bayesian Risk Management details a more flexible approach to risk management, and provides tools to measure financial risk in a dynamic market environment. This book opens discussion about uncertainty in model parameters, model specifications, and model-driven forecasts in a way that standard statistical risk measurement does not. And unlike current machine learning-based methods, the framework presented here allows you to measure risk in a fully-Bayesian setting without losing the structure afforded by parametric risk and asset-pricing models. Recognize the assumptions embodied in classical statistics Quantify model risk along multiple dimensions without backtesting Model time series without assuming stationarity Estimate state-space time series models online with simulation methods Uncover uncertainty in workhorse risk and asset-pricing models Embed Bayesian thinking about risk within a complex organization Ignoring uncertainty in risk modeling creates an illusion of mastery and fosters erroneous decision-making. Firms who ignore the many dimensions of model risk measure too little risk, and end up taking on too much. Bayesian Risk Management provides a roadmap to better risk management through more circumspect measurement, with comprehensive treatment of model uncertainty.

Spatial and Spatio-Temporal Bayesian Models with R-INLA provides a much needed, practically oriented & innovative presentation of the combination of Bayesian methodology and spatial statistics. The authors combine an introduction to Bayesian theory and methodology with a focus on the spatial and spatio-temporal models used within the Bayesian framework and a series of practical examples which allow the reader to link the statistical theory presented to real data problems. The numerous examples from the fields of epidemiology, biostatistics and social science all are coded in the R package R-INLA, which has proven to be a valid alternative to the commonly used Markov Chain Monte Carlo simulations

Essential Practical Prescribing is an important new textbook with a clinical, ward-based focus. It is specifically designed to help new foundation doctors working on the hospital wards and in the community, as well as medical students preparing for the Prescribing Safety Assessment. Using an accessible format, Essential Practical Prescribing demonstrates how to manage common medical conditions, and explains the logic behind each decision. It also emphasises common pitfalls leading to drug errors, and highlights drugs that could cause harm in certain situations. Organised by hospital department, it outlines the correct management of conditions, as well as highlighting the typical trials of a junior doctor. Essential Practical Prescribing: Contains a range of learning methods within each chapter including: key topics, learning objectives, case studies, DRUGS checklists, "Top-Tips", advice on guidelines and evidence, and key learning points Uses patient histories to set the scene and enhance the clinical emphasis Offers examples of correctly completed drug charts throughout, which are also available online Is an ideal companion for Prescribing Safety Assessment (PSA) preparation Includes a companion website at www.wileyessential.com/prescribing featuring MCQs and downloadable DRUGS checklists and drug charts

Bayesian Methods for Structural Dynamics and Civil Engineering John Wiley & Sons

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