

Statistical Rethinking By Richard McElreath

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Large-Scale Inference - Bradley Efron
2012-11-29

We live in a new age for statistical inference, where modern scientific technology such as

microarrays and fMRI machines routinely produce thousands and sometimes millions of parallel data sets, each with its own estimation or testing problem. Doing thousands of problems

at once is more than repeated application of classical methods. Taking an empirical Bayes approach, Bradley Efron, inventor of the bootstrap, shows how information accrues across problems in a way that combines Bayesian and frequentist ideas. Estimation, testing and prediction blend in this framework, producing opportunities for new methodologies of increased power. New difficulties also arise, easily leading to flawed inferences. This book takes a careful look at both the promise and pitfalls of large-scale statistical inference, with particular attention to false discovery rates, the most successful of the new statistical techniques. Emphasis is on the inferential ideas underlying technical developments, illustrated using a large number of real examples.

Bayesian Networks - Marco Scutari 2021-07-22
Bayesian Networks: With Examples in R, Second Edition introduces Bayesian networks using a hands-on approach. Simple yet meaningful examples illustrate each step of the modelling

process and discuss side by side the underlying theory and its application using R code. The examples start from the simplest notions and gradually increase in complexity. In particular, this new edition contains significant new material on topics from modern machine-learning practice: dynamic networks, networks with heterogeneous variables, and model validation. The first three chapters explain the whole process of Bayesian network modelling, from structure learning to parameter learning to inference. These chapters cover discrete, Gaussian, and conditional Gaussian Bayesian networks. The following two chapters delve into dynamic networks (to model temporal data) and into networks including arbitrary random variables (using Stan). The book then gives a concise but rigorous treatment of the fundamentals of Bayesian networks and offers an introduction to causal Bayesian networks. It also presents an overview of R packages and other software implementing Bayesian networks.

The final chapter evaluates two real-world examples: a landmark causal protein-signalling network published in *Science* and a probabilistic graphical model for predicting the composition of different body parts. Covering theoretical and practical aspects of Bayesian networks, this book provides you with an introductory overview of the field. It gives you a clear, practical understanding of the key points behind this modelling approach and, at the same time, it makes you familiar with the most relevant packages used to implement real-world analyses in R. The examples covered in the book span several application fields, data-driven models and expert systems, probabilistic and causal perspectives, thus giving you a starting point to work in a variety of scenarios. Online supplementary materials include the data sets and the code used in the book, which will all be made available from <https://www.bnlearn.com/book-crc-2ed/>
Bayesian Data Analysis, Third Edition -

Andrew Gelman 2013-11-01

Now in its third edition, this classic book is widely considered the leading text on Bayesian methods, lauded for its accessible, practical approach to analyzing data and solving research problems. *Bayesian Data Analysis, Third Edition* continues to take an applied approach to analysis using up-to-date Bayesian methods. The authors—all leaders in the statistics community—introduce basic concepts from a data-analytic perspective before presenting advanced methods. Throughout the text, numerous worked examples drawn from real applications and research emphasize the use of Bayesian inference in practice. New to the Third Edition Four new chapters on nonparametric modeling Coverage of weakly informative priors and boundary-avoiding priors Updated discussion of cross-validation and predictive information criteria Improved convergence monitoring and effective sample size calculations for iterative simulation

Presentations of Hamiltonian Monte Carlo, variational Bayes, and expectation propagation. New and revised software code. The book can be used in three different ways. For undergraduate students, it introduces Bayesian inference starting from first principles. For graduate students, the text presents effective current approaches to Bayesian modeling and computation in statistics and related fields. For researchers, it provides an assortment of Bayesian methods in applied statistics. Additional materials, including data sets used in the examples, solutions to selected exercises, and software instructions, are available on the book's web page.

Bayesian Models - N. Thompson Hobbs

2015-08-04

Bayesian modeling has become an indispensable tool for ecological research because it is uniquely suited to deal with complexity in a statistically coherent way. This textbook provides a comprehensive and accessible

introduction to the latest Bayesian methods—in language ecologists can understand. Unlike other books on the subject, this one emphasizes the principles behind the computations, giving ecologists a big-picture understanding of how to implement this powerful statistical approach. *Bayesian Models* is an essential primer for non-statisticians. It begins with a definition of probability and develops a step-by-step sequence of connected ideas, including basic distribution theory, network diagrams, hierarchical models, Markov chain Monte Carlo, and inference from single and multiple models. This unique book places less emphasis on computer coding, favoring instead a concise presentation of the mathematical statistics needed to understand how and why Bayesian analysis works. It also explains how to write out properly formulated hierarchical Bayesian models and use them in computing, research papers, and proposals. This primer enables ecologists to understand the statistical principles behind Bayesian modeling

and apply them to research, teaching, policy, and management. Presents the mathematical and statistical foundations of Bayesian modeling in language accessible to non-statisticians Covers basic distribution theory, network diagrams, hierarchical models, Markov chain Monte Carlo, and more Deemphasizes computer coding in favor of basic principles Explains how to write out properly factored statistical expressions representing Bayesian models [bookdown](#) - Yihui Xie 2016-12-12

bookdown: Authoring Books and Technical Documents with R Markdown presents a much easier way to write books and technical publications than traditional tools such as LaTeX and Word. The bookdown package inherits the simplicity of syntax and flexibility for data analysis from R Markdown, and extends R Markdown for technical writing, so that you can make better use of document elements such as figures, tables, equations, theorems, citations, and references. Similar to LaTeX, you can

number and cross-reference these elements with bookdown. Your document can even include live examples so readers can interact with them while reading the book. The book can be rendered to multiple output formats, including LaTeX/PDF, HTML, EPUB, and Word, thus making it easy to put your documents online. The style and theme of these output formats can be customized. We used books and R primarily for examples in this book, but bookdown is not only for books or R. Most features introduced in this book also apply to other types of publications: journal papers, reports, dissertations, course handouts, study notes, and even novels. You do not have to use R, either. Other choices of computing languages include Python, C, C++, SQL, Bash, Stan, JavaScript, and so on, although R is best supported. You can also leave out computing, for example, to write a fiction. This book itself is an example of publishing with bookdown and R Markdown, and its source is fully available on GitHub.

Bayesian Population Analysis using WinBUGS - Marc Kery 2011-10-11

Bayesian statistics has exploded into biology and its sub-disciplines, such as ecology, over the past decade. The free software program WinBUGS, and its open-source sister OpenBUGs, is currently the only flexible and general-purpose program available with which the average ecologist can conduct standard and non-standard Bayesian statistics. Comprehensive and richly commented examples illustrate a wide range of models that are most relevant to the research of a modern population ecologist. All WinBUGS/OpenBUGS analyses are completely integrated in software R. Includes complete documentation of all R and WinBUGS code required to conduct analyses and shows all the necessary steps from having the data in a text file out of Excel to interpreting and processing the output from WinBUGS in R.

The Adaptive Character of Thought - John R. Anderson 2013-01-11

This important volume examines the phenomena of cognition from an adaptive perspective. Rather than adhering to the typical practice in cognitive psychology of trying to predict behavior from a model of cognitive mechanisms, this book develops a number of models that successfully predict behavior from the structure of the environment to which cognition is adapted. The methodology -- called rational analysis -- involves specifying the information-processing goals of the system, the structure of the environment, and the computational constraints on the system, allowing predictions about behavior to be made by determining what behavior would be optimal under these assumptions. The Adaptive Character of Thought applies this methodology in great detail to four cognitive phenomena: memory, categorization, causal inference, and problem solving.

Introduction to Probability - Joseph K. Blitzstein 2014-07-24

Developed from celebrated Harvard statistics

lectures, Introduction to Probability provides essential language and tools for understanding statistics, randomness, and uncertainty. The book explores a wide variety of applications and examples, ranging from coincidences and paradoxes to Google PageRank and Markov chain Monte Carlo (MCMC). Additional

Bayesian Cognitive Modeling - Michael D. Lee
2014-04-03

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

Introduction to WinBUGS for Ecologists - Marc Kery
2010-07-19

Introduction to WinBUGS for Ecologists introduces applied Bayesian modeling to ecologists using the highly acclaimed, free WinBUGS software. It offers an understanding of statistical models as abstract representations of the various processes that give rise to a data set. Such an understanding is basic to the development of inference models tailored to

specific sampling and ecological scenarios. The book begins by presenting the advantages of a Bayesian approach to statistics and introducing the WinBUGS software. It reviews the four most common statistical distributions: the normal, the uniform, the binomial, and the Poisson. It describes the two different kinds of analysis of variance (ANOVA): one-way and two- or multiway. It looks at the general linear model, or ANCOVA, in R and WinBUGS. It introduces generalized linear model (GLM), i.e., the extension of the normal linear model to allow error distributions other than the normal. The GLM is then extended contain additional sources of random variation to become a generalized linear mixed model (GLMM) for a Poisson example and for a binomial example. The final two chapters showcase two fairly novel and nonstandard versions of a GLMM. The first is the site-occupancy model for species distributions; the second is the binomial (or N-) mixture model for estimation and modeling of abundance.

Introduction to the essential theories of key models used by ecologists Complete juxtaposition of classical analyses in R and Bayesian analysis of the same models in WinBUGS Provides every detail of R and WinBUGS code required to conduct all analyses Companion Web Appendix that contains all code contained in the book and additional material (including more code and solutions to exercises)

Bayesian Modeling and Computation in

Python - Osvaldo A. Martin 2021-12-28

Bayesian Modeling and Computation in Python aims to help beginner Bayesian practitioners to become intermediate modelers. It uses a hands on approach with PyMC3, Tensorflow Probability, ArviZ and other libraries focusing on the practice of applied statistics with references to the underlying mathematical theory. The book starts with a refresher of the Bayesian Inference concepts. The second chapter introduces modern methods for Exploratory Analysis of Bayesian Models. With an understanding of

these two fundamentals the subsequent chapters talk through various models including linear regressions, splines, time series, Bayesian additive regression trees. The final chapters include Approximate Bayesian Computation, end to end case studies showing how to apply Bayesian modelling in different settings, and a chapter about the internals of probabilistic programming languages. Finally the last chapter serves as a reference for the rest of the book by getting closer into mathematical aspects or by extending the discussion of certain topics. This book is written by contributors of PyMC3, ArviZ, Bambi, and Tensorflow Probability among other libraries.

Bayesian Essentials with R - Jean-Michel Marin 2013-10-28

This Bayesian modeling book provides a self-contained entry to computational Bayesian statistics. Focusing on the most standard statistical models and backed up by real datasets and an all-inclusive R (CRAN) package called

bayess, the book provides an operational methodology for conducting Bayesian inference, rather than focusing on its theoretical and philosophical justifications. Readers are empowered to participate in the real-life data analysis situations depicted here from the beginning. Special attention is paid to the derivation of prior distributions in each case and specific reference solutions are given for each of the models. Similarly, computational details are worked out to lead the reader towards an effective programming of the methods given in the book. In particular, all R codes are discussed with enough detail to make them readily understandable and expandable. Bayesian Essentials with R can be used as a textbook at both undergraduate and graduate levels. It is particularly useful with students in professional degree programs and scientists to analyze data the Bayesian way. The text will also enhance introductory courses on Bayesian statistics. Prerequisites for the book are an undergraduate

background in probability and statistics, if not in Bayesian statistics.

[A Student's Guide to Bayesian Statistics](#) - Ben Lambert 2018-04-20

Supported by a wealth of learning features, exercises, and visual elements as well as online video tutorials and interactive simulations, this book is the first student-focused introduction to Bayesian statistics. Without sacrificing technical integrity for the sake of simplicity, the author draws upon accessible, student-friendly language to provide approachable instruction perfectly aimed at statistics and Bayesian newcomers. Through a logical structure that introduces and builds upon key concepts in a gradual way and slowly acclimatizes students to using R and Stan software, the book covers: An introduction to probability and Bayesian inference Understanding Bayes' rule Nuts and bolts of Bayesian analytic methods Computational Bayes and real-world Bayesian analysis Regression analysis and hierarchical

methods This unique guide will help students develop the statistical confidence and skills to put the Bayesian formula into practice, from the basic concepts of statistical inference to complex applications of analyses.

Nonlife Actuarial Models - Yiu-Kuen Tse
2009-09-17

This class-tested undergraduate textbook covers the entire syllabus for Exam C of the Society of Actuaries (SOA).

Regression and Other Stories - Andrew Gelman
2020-07-23

A practical approach to using regression and computation to solve real-world problems of estimation, prediction, and causal inference.

Statistical Thinking from Scratch - M. D. Edge
2019-06-07

Researchers across the natural and social sciences find themselves navigating tremendous amounts of new data. Making sense of this flood of information requires more than the rote application of formulaic statistical methods. The

premise of *Statistical Thinking from Scratch* is that students who want to become confident data analysts are better served by a deep introduction to a single statistical method than by a cursory overview of many methods. In particular, this book focuses on simple linear regression—a method with close connections to the most important tools in applied statistics—using it as a detailed case study for teaching resampling-based, likelihood-based, and Bayesian approaches to statistical inference. Considering simple linear regression in depth imparts an idea of how statistical procedures are designed, a flavour for the philosophical positions one assumes when applying statistics, and tools to probe the strengths of one's statistical approach. Key to the book's novel approach is its mathematical level, which is gentler than most texts for statisticians but more rigorous than most introductory texts for non-statisticians. *Statistical Thinking from Scratch* is suitable for senior undergraduate and beginning

graduate students, professional researchers, and practitioners seeking to improve their understanding of statistical methods across the natural and social sciences, medicine, psychology, public health, business, and other fields.

Bayesian Analysis for the Social Sciences -

Simon Jackman 2009-10-27

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.

[Statistical Rethinking](#) - Richard McElreath

2018-01-03

Statistical Rethinking: A Bayesian Course with Examples in R and Stan builds readers' knowledge of and confidence in statistical modeling. Reflecting the need for even minor programming in today's model-based statistics, the book pushes readers to perform step-by-step calculations that are usually automated. This unique computational approach ensures that readers understand enough of the details to make reasonable choices and interpretations in their own modeling work. The text presents generalized linear multilevel models from a Bayesian perspective, relying on a simple logical interpretation of Bayesian probability and maximum entropy. It covers from the basics of regression to multilevel models. The author also discusses measurement error, missing data, and

Gaussian process models for spatial and network autocorrelation. By using complete R code examples throughout, this book provides a practical foundation for performing statistical inference. Designed for both PhD students and seasoned professionals in the natural and social sciences, it prepares them for more advanced or specialized statistical modeling. Web Resource The book is accompanied by an R package (rethinking) that is available on the author's website and GitHub. The two core functions (map and map2stan) of this package allow a variety of statistical models to be constructed from standard model formulas.

Probability and Bayesian Modeling - Jim Albert
2019-12-19

Probability and Bayesian Modeling is an introduction to probability and Bayesian thinking for undergraduate students with a calculus background. The first part of the book provides a broad view of probability including foundations, conditional probability, discrete and continuous

distributions, and joint distributions. Statistical inference is presented completely from a Bayesian perspective. The text introduces inference and prediction for a single proportion and a single mean from Normal sampling. After fundamentals of Markov Chain Monte Carlo algorithms are introduced, Bayesian inference is described for hierarchical and regression models including logistic regression. The book presents several case studies motivated by some historical Bayesian studies and the authors' research. This text reflects modern Bayesian statistical practice. Simulation is introduced in all the probability chapters and extensively used in the Bayesian material to simulate from the posterior and predictive distributions. One chapter describes the basic tenets of Metropolis and Gibbs sampling algorithms; however several chapters introduce the fundamentals of Bayesian inference for conjugate priors to deepen understanding. Strategies for constructing prior distributions are described in situations when

one has substantial prior information and for cases where one has weak prior knowledge. One chapter introduces hierarchical Bayesian modeling as a practical way of combining data from different groups. There is an extensive discussion of Bayesian regression models including the construction of informative priors, inference about functions of the parameters of interest, prediction, and model selection. The text uses JAGS (Just Another Gibbs Sampler) as a general-purpose computational method for simulating from posterior distributions for a variety of Bayesian models. An R package ProbBayes is available containing all of the book datasets and special functions for illustrating concepts from the book.

Bayesian Methods for Hackers - Cameron Davidson-Pilon 2015-09-30

Master Bayesian Inference through Practical Examples and Computation-Without Advanced Mathematical Analysis Bayesian methods of inference are deeply natural and extremely

powerful. However, most discussions of Bayesian inference rely on intensely complex mathematical analyses and artificial examples, making it inaccessible to anyone without a strong mathematical background. Now, though, Cameron Davidson-Pilon introduces Bayesian inference from a computational perspective, bridging theory to practice-freeing you to get results using computing power. Bayesian Methods for Hackers illuminates Bayesian inference through probabilistic programming with the powerful PyMC language and the closely related Python tools NumPy, SciPy, and Matplotlib. Using this approach, you can reach effective solutions in small increments, without extensive mathematical intervention. Davidson-Pilon begins by introducing the concepts underlying Bayesian inference, comparing it with other techniques and guiding you through building and training your first Bayesian model. Next, he introduces PyMC through a series of detailed examples and intuitive explanations that

have been refined after extensive user feedback. You'll learn how to use the Markov Chain Monte Carlo algorithm, choose appropriate sample sizes and priors, work with loss functions, and apply Bayesian inference in domains ranging from finance to marketing. Once you've mastered these techniques, you'll constantly turn to this guide for the working PyMC code you need to jumpstart future projects. Coverage includes

- Learning the Bayesian "state of mind" and its practical implications
- Understanding how computers perform Bayesian inference
- Using the PyMC Python library to program Bayesian analyses
- Building and debugging models with PyMC
- Testing your model's "goodness of fit"
- Opening the "black box" of the Markov Chain Monte Carlo algorithm to see how and why it works
- Leveraging the power of the "Law of Large Numbers"
- Mastering key concepts, such as clustering, convergence, autocorrelation, and thinning
- Using loss functions to measure an estimate's weaknesses

based on your goals and desired outcomes

- Selecting appropriate priors and understanding how their influence changes with dataset size
- Overcoming the "exploration versus exploitation" dilemma: deciding when "pretty good" is good enough
- Using Bayesian inference to improve A/B testing
- Solving data science problems when only small amounts of data are available

Cameron Davidson-Pilon has worked in many areas of applied mathematics, from the evolutionary dynamics of genes and diseases to stochastic modeling of financial prices. His contributions to the open source community include lifelines, an implementation of survival analysis in Python. Educated at the University of Waterloo and at the Independent University of Moscow, he currently works with the online commerce leader Shopify.

Think Stats - Allen B. Downey 2011-07-01

If you know how to program, you have the skills to turn data into knowledge using the tools of probability and statistics. This concise

introduction shows you how to perform statistical analysis computationally, rather than mathematically, with programs written in Python. You'll work with a case study throughout the book to help you learn the entire data analysis process—from collecting data and generating statistics to identifying patterns and testing hypotheses. Along the way, you'll become familiar with distributions, the rules of probability, visualization, and many other tools and concepts. Develop your understanding of probability and statistics by writing and testing code Run experiments to test statistical behavior, such as generating samples from several distributions Use simulations to understand concepts that are hard to grasp mathematically Learn topics not usually covered in an introductory course, such as Bayesian estimation Import data from almost any source using Python, rather than be limited to data that has been cleaned and formatted for statistics tools Use statistical inference to answer

questions about real-world data

A First Course in Bayesian Statistical Methods - Peter D. Hoff 2009-06-02

A self-contained introduction to probability, exchangeability and Bayes' rule provides a theoretical understanding of the applied material. Numerous examples with R-code that can be run "as-is" allow the reader to perform the data analyses themselves. The development of Monte Carlo and Markov chain Monte Carlo methods in the context of data analysis examples provides motivation for these computational methods.

Statistical Rethinking - Richard McElreath 2018-01-03

Statistical Rethinking: A Bayesian Course with Examples in R and Stan builds readers' knowledge of and confidence in statistical modeling. Reflecting the need for even minor programming in today's model-based statistics, the book pushes readers to perform step-by-step calculations that are usually automated. This

unique computational approach ensures that readers understand enough of the details to make reasonable choices and interpretations in their own modeling work. The text presents generalized linear multilevel models from a Bayesian perspective, relying on a simple logical interpretation of Bayesian probability and maximum entropy. It covers from the basics of regression to multilevel models. The author also discusses measurement error, missing data, and Gaussian process models for spatial and network autocorrelation. By using complete R code examples throughout, this book provides a practical foundation for performing statistical inference. Designed for both PhD students and seasoned professionals in the natural and social sciences, it prepares them for more advanced or specialized statistical modeling. Web Resource The book is accompanied by an R package (rethinking) that is available on the author's website and GitHub. The two core functions (map and map2stan) of this package allow a

variety of statistical models to be constructed from standard model formulas.

Statistical Rethinking - Richard McElreath

2016-01-05

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Doing Bayesian Data Analysis - John Kruschke
2014-11-11

Doing Bayesian Data Analysis: A Tutorial with R, JAGS, and Stan, Second Edition provides an accessible approach for conducting Bayesian data analysis, as material is explained clearly with concrete examples. Included are step-by-step instructions on how to carry out Bayesian data analyses in the popular and free software R

and WinBugs, as well as new programs in JAGS and Stan. The new programs are designed to be much easier to use than the scripts in the first edition. In particular, there are now compact high-level scripts that make it easy to run the programs on your own data sets. The book is divided into three parts and begins with the basics: models, probability, Bayes' rule, and the R programming language. The discussion then moves to the fundamentals applied to inferring a binomial probability, before concluding with chapters on the generalized linear model. Topics include metric-predicted variable on one or two groups; metric-predicted variable with one metric predictor; metric-predicted variable with multiple metric predictors; metric-predicted variable with one nominal predictor; and metric-predicted variable with multiple nominal predictors. The exercises found in the text have explicit purposes and guidelines for accomplishment. This book is intended for first-year graduate students or advanced

undergraduates in statistics, data analysis, psychology, cognitive science, social sciences, clinical sciences, and consumer sciences in business. Accessible, including the basics of essential concepts of probability and random sampling Examples with R programming language and JAGS software Comprehensive coverage of all scenarios addressed by non-Bayesian textbooks: t-tests, analysis of variance (ANOVA) and comparisons in ANOVA, multiple regression, and chi-square (contingency table analysis) Coverage of experiment planning R and JAGS computer programming code on website Exercises have explicit purposes and guidelines for accomplishment Provides step-by-step instructions on how to conduct Bayesian data analyses in the popular and free software R and WinBugs

Small Area Estimation - J. N. K. Rao 2005-02-25
An accessible introduction to indirect estimation methods, both traditional and model-based. Readers will also find the latest methods for

measuring the variability of the estimates as well as the techniques for model validation. Uses a basic area-level linear model to illustrate the methods Presents the various extensions including binary response data through generalized linear models and time series data through linear models that combine cross-sectional and time series features Provides recent applications of SAE including several in U.S. Federal programs Offers a comprehensive discussion of the design issues that impact SAE
Bayesian inference with INLA - Virgilio Gomez-Rubio 2020-02-20

The integrated nested Laplace approximation (INLA) is a recent computational method that can fit Bayesian models in a fraction of the time required by typical Markov chain Monte Carlo (MCMC) methods. INLA focuses on marginal inference on the model parameters of latent Gaussian Markov random fields models and exploits conditional independence properties in the model for computational speed. Bayesian

Inference with INLA provides a description of INLA and its associated R package for model fitting. This book describes the underlying methodology as well as how to fit a wide range of models with R. Topics covered include generalized linear mixed-effects models, multilevel models, spatial and spatio-temporal models, smoothing methods, survival analysis, imputation of missing values, and mixture models. Advanced features of the INLA package and how to extend the number of priors and latent models available in the package are discussed. All examples in the book are fully reproducible and datasets and R code are available from the book website. This book will be helpful to researchers from different areas with some background in Bayesian inference that want to apply the INLA method in their work. The examples cover topics on biostatistics, econometrics, education, environmental science, epidemiology, public health, and the social sciences.

Linear Mixed Models - Brady T. West
2006-11-22

Simplifying the often confusing array of software programs for fitting linear mixed models (LMMs), *Linear Mixed Models: A Practical Guide Using Statistical Software* provides a basic introduction to primary concepts, notation, software implementation, model interpretation, and visualization of clustered and longitudinal data. This easy-to-nav

The BUGS Book - David Lunn 2012-10-02
Bayesian statistical methods have become widely used for data analysis and modelling in recent years, and the BUGS software has become the most popular software for Bayesian analysis worldwide. Authored by the team that originally developed this software, *The BUGS Book* provides a practical introduction to this program and its use. The text presents complete coverage of all the functionalities of BUGS, including prediction, missing data, model criticism, and prior sensitivity. It also features a large number

of worked examples and a wide range of applications from various disciplines. The book introduces regression models, techniques for criticism and comparison, and a wide range of modelling issues before going into the vital area of hierarchical models, one of the most common applications of Bayesian methods. It deals with essentials of modelling without getting bogged down in complexity. The book emphasises model criticism, model comparison, sensitivity analysis to alternative priors, and thoughtful choice of prior distributions—all those aspects of the "art" of modelling that are easily overlooked in more theoretical expositions. More pragmatic than ideological, the authors systematically work through the large range of "tricks" that reveal the real power of the BUGS software, for example, dealing with missing data, censoring, grouped data, prediction, ranking, parameter constraints, and so on. Many of the examples are biostatistical, but they do not require domain knowledge and are generalisable to a wide range

of other application areas. Full code and data for examples, exercises, and some solutions can be found on the book's website.

Generalized Linear Models for Insurance

Data - Piet de Jong 2008-02-28

This is the only book actuaries need to understand generalized linear models (GLMs) for insurance applications. GLMs are used in the insurance industry to support critical decisions. Until now, no text has introduced GLMs in this context or addressed the problems specific to insurance data. Using insurance data sets, this practical, rigorous book treats GLMs, covers all standard exponential family distributions, extends the methodology to correlated data structures, and discusses recent developments which go beyond the GLM. The issues in the book are specific to insurance data, such as model selection in the presence of large data sets and the handling of varying exposure times. Exercises and data-based practicals help readers to consolidate their skills, with solutions and

data sets given on the companion website. Although the book is package-independent, SAS code and output examples feature in an appendix and on the website. In addition, R code and output for all the examples are provided on the website.

Bayesian Statistical Methods - Brian J. Reich
2019-04-12

Bayesian Statistical Methods provides data scientists with the foundational and computational tools needed to carry out a Bayesian analysis. This book focuses on Bayesian methods applied routinely in practice including multiple linear regression, mixed effects models and generalized linear models (GLM). The authors include many examples with complete R code and comparisons with analogous frequentist procedures. In addition to the basic concepts of Bayesian inferential methods, the book covers many general topics: Advice on selecting prior distributions Computational methods including Markov chain Monte Carlo

(MCMC) Model-comparison and goodness-of-fit measures, including sensitivity to priors Frequentist properties of Bayesian methods Case studies covering advanced topics illustrate the flexibility of the Bayesian approach: Semiparametric regression Handling of missing data using predictive distributions Priors for high-dimensional regression models Computational techniques for large datasets Spatial data analysis The advanced topics are presented with sufficient conceptual depth that the reader will be able to carry out such analysis and argue the relative merits of Bayesian and classical methods. A repository of R code, motivating data sets, and complete data analyses are available on the book's website. Brian J. Reich, Associate Professor of Statistics at North Carolina State University, is currently the editor-in-chief of the Journal of Agricultural, Biological, and Environmental Statistics and was awarded the LeRoy & Elva Martin Teaching Award. Sujit K. Ghosh, Professor of Statistics at North

Carolina State University, has over 22 years of research and teaching experience in conducting Bayesian analyses, received the Cavell Brownie mentoring award, and served as the Deputy Director at the Statistical and Applied Mathematical Sciences Institute.

Statistical Rethinking - Richard McElreath

2020-03-13

Statistical Rethinking: A Bayesian Course with Examples in R and Stan builds your knowledge of and confidence in making inferences from data. Reflecting the need for scripting in today's model-based statistics, the book pushes you to perform step-by-step calculations that are usually automated. This unique computational approach ensures that you understand enough of the details to make reasonable choices and interpretations in your own modeling work. The text presents causal inference and generalized linear multilevel models from a simple Bayesian perspective that builds on information theory and maximum entropy. The core material ranges

from the basics of regression to advanced multilevel models. It also presents measurement error, missing data, and Gaussian process models for spatial and phylogenetic confounding. The second edition emphasizes the directed acyclic graph (DAG) approach to causal inference, integrating DAGs into many examples. The new edition also contains new material on the design of prior distributions, splines, ordered categorical predictors, social relations models, cross-validation, importance sampling, instrumental variables, and Hamiltonian Monte Carlo. It ends with an entirely new chapter that goes beyond generalized linear modeling, showing how domain-specific scientific models can be built into statistical analyses. Features Integrates working code into the main text Illustrates concepts through worked data analysis examples Emphasizes understanding assumptions and how assumptions are reflected in code Offers more detailed explanations of the mathematics in optional sections Presents

examples of using the dagitty R package to analyze causal graphs Provides the rethinking R package on the author's website and on GitHub
Bayesian Hierarchical Models - Peter D. Congdon 2019-09-16

An intermediate-level treatment of Bayesian hierarchical models and their applications, this book demonstrates the advantages of a Bayesian approach to data sets involving inferences for collections of related units or variables, and in methods where parameters can be treated as random collections. Through illustrative data analysis and attention to statistical computing, this book facilitates practical implementation of Bayesian hierarchical methods. The new edition is a revision of the book Applied Bayesian Hierarchical Methods. It maintains a focus on applied modelling and data analysis, but now using entirely R-based Bayesian computing options. It has been updated with a new chapter on regression for causal effects, and one on computing options and strategies. This latter

chapter is particularly important, due to recent advances in Bayesian computing and estimation, including the development of rjags and rstan. It also features updates throughout with new examples. The examples exploit and illustrate the broader advantages of the R computing environment, while allowing readers to explore alternative likelihood assumptions, regression structures, and assumptions on prior densities. Features: Provides a comprehensive and accessible overview of applied Bayesian hierarchical modelling Includes many real data examples to illustrate different modelling topics R code (based on rjags, jagsUI, R2OpenBUGS, and rstan) is integrated into the book, emphasizing implementation Software options and coding principles are introduced in new chapter on computing Programs and data sets available on the book's website

Bayesian Statistics the Fun Way - Will Kurt 2019-07-09

Fun guide to learning Bayesian statistics and

probability through unusual and illustrative examples. Probability and statistics are increasingly important in a huge range of professions. But many people use data in ways they don't even understand, meaning they aren't getting the most from it. Bayesian Statistics the Fun Way will change that. This book will give you a complete understanding of Bayesian statistics through simple explanations and un-boring examples. Find out the probability of UFOs landing in your garden, how likely Han Solo is to survive a flight through an asteroid shower, how to win an argument about conspiracy theories, and whether a burglary really was a burglary, to name a few examples. By using these off-the-beaten-track examples, the author actually makes learning statistics fun. And you'll learn real skills, like how to: - How to measure your own level of uncertainty in a conclusion or belief - Calculate Bayes theorem and understand what it's useful for - Find the posterior, likelihood, and prior to check the

accuracy of your conclusions - Calculate distributions to see the range of your data - Compare hypotheses and draw reliable conclusions from them Next time you find yourself with a sheaf of survey results and no idea what to do with them, turn to Bayesian Statistics the Fun Way to get the most value from your data.

Response Times - R. Duncan Luce 1991-05-23

This authoritative volume provides a well balanced and comprehensive treatment of the mathematical theory of human response time and the role it plays in our understanding of the mind's organization.

Data Analysis Using Regression and Multilevel/Hierarchical Models - Andrew Gelman 2007

This book, first published in 2007, is for the applied researcher performing data analysis using linear and nonlinear regression and multilevel models.

Statistical Rethinking - Richard McElreath

2015-12-18

This book provides a more elementary introduction to Bayesian analysis than the Gelman book and is more suitable for graduate students in disciplines other than statistics. It uses a lot of examples and discussion to provide a bridge between introductory textbooks and the more mathematical books. Aimed at natural/social scientists and Ph.D. students, it is designed to teach computation and application, not mathematics. Data examples come from anthropology, ecology and social sciences.

Bayesian Analysis with Python - Osvaldo Martin

2016-11-25

Unleash the power and flexibility of the Bayesian framework
About This Book- Simplify the Bayes process for solving complex statistical problems using Python; - Tutorial guide that will take the you through the journey of Bayesian analysis with the help of sample problems and practice exercises; - Learn how and when to use Bayesian analysis in your applications with this guide. Who

This Book Is For Students, researchers and data scientists who wish to learn Bayesian data analysis with Python and implement probabilistic models in their day to day projects.

Programming experience with Python is essential. No previous statistical knowledge is assumed. What You Will Learn- Understand the essentials Bayesian concepts from a practical point of view- Learn how to build probabilistic models using the Python library PyMC3- Acquire the skills to sanity-check your models and modify them if necessary- Add structure to your models and get the advantages of hierarchical models- Find out how different models can be used to answer different data analysis questions - When in doubt, learn to choose between alternative models.- Predict continuous target outcomes using regression analysis or assign classes using logistic and softmax regression.- Learn how to think probabilistically and unleash the power and flexibility of the Bayesian framework
In Detail The purpose of this book is to teach the

main concepts of Bayesian data analysis. We will learn how to effectively use PyMC3, a Python library for probabilistic programming, to perform Bayesian parameter estimation, to check models and validate them. This book begins presenting the key concepts of the Bayesian framework and the main advantages of this approach from a practical point of view. Moving on, we will explore the power and flexibility of generalized linear models and how to adapt them to a wide array of problems, including regression and classification. We will also look into mixture models and clustering data, and we will finish with advanced topics like non-parametrics models and Gaussian processes. With the help of Python and PyMC3 you will learn to implement, check and expand Bayesian models to solve data analysis problems. Style and approach Bayes algorithms are widely used in statistics, machine learning, artificial intelligence, and data mining. This will be a practical guide allowing the readers to use

Bayesian methods for statistical modelling and analysis using Python.

Analytical Skills for AI and Data Science -
Daniel Vaughan 2020-05-21

While several market-leading companies have successfully transformed their business models by following data- and AI-driven paths, the vast majority have yet to reap the benefits. How can your business and analytics units gain a competitive advantage by capturing the full potential of this predictive revolution? This practical guide presents a battle-tested end-to-end method to help you translate business decisions into tractable prescriptive solutions using data and AI as fundamental inputs. Author Daniel Vaughan shows data scientists, analytics practitioners, and others interested in using AI to transform their businesses not only how to ask the right questions but also how to generate value using modern AI technologies and decision-making principles. You'll explore several use cases common to many enterprises,

complete with examples you can apply when working to solve your own issues. Break business decisions into stages that can be tackled using different skills from the analytical toolbox Identify and embrace uncertainty in decision making and protect against common human biases Customize optimal decisions to different customers using predictive and prescriptive methods and technologies Ask business questions that create high value through AI- and data-driven technologies

Mathematical Statistics - Jun Shao 2008-02-03

This graduate textbook covers topics in statistical theory essential for graduate students preparing for work on a Ph.D. degree in

statistics. This new edition has been revised and updated and in this fourth printing, errors have been ironed out. The first chapter provides a quick overview of concepts and results in measure-theoretic probability theory that are useful in statistics. The second chapter introduces some fundamental concepts in statistical decision theory and inference. Subsequent chapters contain detailed studies on some important topics: unbiased estimation, parametric estimation, nonparametric estimation, hypothesis testing, and confidence sets. A large number of exercises in each chapter provide not only practice problems for students, but also many additional results.