Maximum Entropy And Bayesian Methods In Inverse P

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COLON SHYANN

Maximum Entropy and Bayesian Methods Springer Science & Business Media
This work is essentially an extensive revision of my Ph.D. dissertation, [1J. It 1S primarily a research document on the application of probability theory to the parameter estimation problem. The people who will be interested in this material are physicists, economists, and engineers who have to deal with data on a daily basis; consequently, we have included a great deal of introductory and tutorial material. Any person with the equivalent of the mathematics background required for the graduate level study of physics should be able to follow the material contained in this book, though not without elfort. From the time the dissertation was written until now (approximately one year) our understanding of the parameter estimation problem has changed extensively. We have tried to incorporate what we have learned into this book. I am indebted to a number of people who have aided me in preparing this docu ment: Dr. C. Ray Smith, Steve Finney, Juana Sunchez, Matthew Self, and Dr. Pat Gibbons who acted as readers and editors. In addition, I must extend my deepest thanks to Dr. Joseph Ackerman for his support during the time this manuscript was being prepared.
E.T. Jaynes Springer Science & Business Media
This volume has its origin in the third ·Workshop on Maximum-Entropy and Bayesian Methods in Applied Statistics,· held at the University of Wyoming, August 1 to 4, 1983. It was anticipated that the proceedings of this workshop could not be prepared in a timely fashion, so most of the papers were not collected until a year or so ago. Because most of the papers are in the nature of advancing theory or solving specific problems, as opposed to status reports, it is believed that the contents of this volume will be of lasting interest to the Bayesian community. The workshop was organized to bring together researchers from differ ent fields to examine critically maximum-entropy and Bayesian methods in science, engineering, medicine, economics, and other disciplines. Some of the papers were chosen specifically to kindle interest in new areas that may offer new tools or insight to the reader or to stimulate work on pressing problems that appear to be ideally suited to the maximum-entropy or Bayes ian method.
Statistical Rethinking Springer Science & Business Media
This collection of papers by leading researchers in their respective fields contains contributions showing the use of the maximum entropy method in many of the fields in which it finds application. In the physical, mathematical and biological sciences it is often necessary to make inferences based on insufficient data. The problem of choosing one among the many possible conclusions or models which are compatible with the data may be resolved in a variety of ways. A particularly appealing method is to choose the solution which maximizes entropy in the sense that the conclusion or model honours the observed data but implies no further assumptions not warranted by the data. The maximum entropy principle has been growing in importance and acceptance in many fields, perhaps most notably statistical physics, astronomy, geophysics, signal processing, image analysis and physical chemistry. The papers included in this volume touch on most of the current areas of research activity and application, and will be of interest to research workers in all fields in which the maximum entropy method may be applied.
Bayesian Inference and Maximum Entropy Methods in Science and Engineering Cambridge University Press
This book is a collection of introductory, interdisciplinary articles and lectures covering the fundamentals of the maximum entropy approach, a powerful new technique that provides a much needed extension of the established principles of rational inference in the sciences. Maximum entropy allows the interpretation of incomplete and "noisy" data, providing a description of the underlying physical systems. It has found application in both practical and theoretical studies ranging from image enhancement to nuclear physics, and from statistical mechanics to economics. The work explores these applications with specific problems of data analysis taken from the physical sciences. It will interest all physical scientists who deal with data and its interpretation, including statisticians and statistical physicists.
Maximum Entropy and Bayesian Methods Springer Science & Business Media
Bayesian inference provides a simple and unified approach to data analysis, allowing experimenters to assign probabilities to competing hypotheses of interest, on the basis of the current state of knowledge. By incorporating relevant prior information, it can sometimes improve model parameter estimates by many orders of magnitude. This book provides a clear exposition of the underlying concepts with many worked examples and problem sets. It also discusses implementation, including an introduction to Markov chain Monte-Carlo integration and linear and nonlinear model fitting. Particularly extensive coverage of spectral analysis (detecting and measuring periodic signals) includes a self-contained introduction to Fourier and discrete Fourier methods. There is a chapter devoted to Bayesian inference with Poisson sampling, and three chapters on frequentist methods help to bridge the gap between the frequentist and Bayesian approaches. Supporting Mathematica® notebooks with solutions to selected problems, additional worked examples, and a Mathematica tutorial are available at www.cambridge.org/9780521150125.
Maximum Entropy and Bayesian Methods in Applied Statistics Springer Science & Business Media
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.

Maximum Entropy and Bayesian Methods American Institute of Physics

This volume records papers given at the fourteenth international maximum entropy conference, held at St John's College Cambridge, England. It seems hard to believe that just thirteen years have passed since the first in the series, held at the University of Wyoming in 1981, and six years have passed since the meeting last took place here in Cambridge. So much has happened. There are two major themes at these meetings, inference and physics. The inference work uses the confluence of Bayesian and maximum entropy ideas to develop and explore a wide range of scientific applications, mostly concerning data analysis in one form or another. The physics work uses maximum entropy ideas to explore the thermodynamic world of macroscopic phenomena. Of the two, physics has the deeper historical roots, and much of the inspiration behind the inference work derives from physics. Yet it is no accident that most of the papers at these meetings are on the inference side. To develop new physics, one must use one's brains alone. To develop inference, computers are used as well, so that the stunning advances in computational power render the field open to rapid advance. Indeed, we have seen a revolution. In the larger world of statistics beyond the maximum entropy movement as such, there is now an explosion of work in Bayesian methods, as the inherent superiority of a defensible and consistent logical structure becomes increasingly apparent in practice.

Maximum Entropy and Bayesian Methods Springer Science & Business Media

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.

Bayesian Probability Theory Springer Science & Business Media

In 1978 Edwin T. Jaynes and Myron Tribus initiated a series of workshops to exchange ideas and recent developments in technical aspects and applications of Bayesian probability theory. The first workshop was held at the University of Wyoming in 1981 organized by C.R. Smith and W.T. Grandy. Due to its success, the workshop was held annually during the last 18 years. Over the years, the emphasis of the workshop shifted gradually from fundamental concepts of Bayesian probability theory to increasingly realistic and challenging applications. The 18th international workshop on Maximum Entropy and Bayesian Methods was held in Garching / Munich (Germany) (27-31. July 1998). Opening lectures by G. Larry Bretthorst and by Myron Tribus were dedicated to one of th the pioneers of Bayesian probability theory who died on the 30 of April 1998: Edwin Thompson Jaynes. Jaynes revealed and advocated the correct meaning of 'probability' as the state of knowledge rather than a physical property. This inter pretation allowed him to unravel longstanding mysteries and paradoxes. Bayesian probability theory, "the logic of science" - as E.T. Jaynes called it - provides the framework to make the best possible scientific inference given all available exper imental and theoretical information. We gratefully acknowledge the efforts of Tribus and Bretthorst in commemorating the outstanding contributions of E.T. Jaynes to the development of probability theory.

Maximum Entropy in Action Springer Science & Business Media

One of the strengths of this book is the author's ability to motivate the use of Bayesian methods through simple yet effective examples. - Katie St. Clair MAA Reviews.

Maximum-entropy and Bayesian Spectral Analysis and Estimation Problems Oxford : Clarendon Press ; New York : Oxford University Press

Bayesian probability theory and maximum entropy methods are at the core of a new view of scientific inference. These `new' ideas, along with the revolution in computational methods afforded by modern computers, allow astronomers, electrical engineers, image processors of any type, NMR chemists and physicists, and anyone at all who has to deal with incomplete and noisy data, to take advantage of methods that, in the past, have been applied only in some areas of theoretical physics. This volume records the Proceedings of Eleventh Annual `Maximum Entropy' Workshop, held at Seattle University in June, 1991. These workshops have been the focus of a group of researchers from many different fields, and this diversity is evident in this volume. There are tutorial papers, theoretical papers, and applications in a very wide variety of fields. Almost any instance of dealing with incomplete and noisy data can be usefully treated by these methods, and many areas of theoretical research are being enhanced by the thoughtful application of Bayes' theorem.

The contributions contained in this volume present a state-of-the-art review that will be influential and useful for many years to come.

Bayesian Theory Springer Science & Business Media

This book is about modeling as a prinicipal component of scientific investigations. In general terms, modeling is the funamental process of combining intellectual creativity with physical knowledge and mathematical techniques in order to learn the properties of the mechanisms underlying a physical phenomenon and make predictions. The book focuses on a specific class of models, namely, random field models and certain of their physical applications in the context of a stochastic data analysis and processing research program. The term application is considered here in the sense wherein the mathematical random field model is shaping, but is also being shaped by, its objects. Key Features * This book explores the application of random field models and stochastic data processing to problems in hydrogeology, geostatistics, climate modeling, and oil reservoir engineering, among others Researchers in the geosciences who work with models of natural processes will find discussion of; * Spatiotemporal random fields * Space transformation * Multidimensional estimation * Simulation * Sampling design * Stochastic partial differential equations

Maximum Entropy and Bayesian Methods Santa Barbara, California, U. S. A. 1993 CRC Press

Covering all aspects of probability theory, statistics and data analysis from a Bayesian perspective for graduate students and researchers.

Maximum-Entropy and Bayesian Methods in Science and Engineering CRC Press

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.

Bayesian Spectrum Analysis and Parameter Estimation Springer Science & Business Media

The Twelfth International Workshop on Maximum Entropy and Bayesian Methods in Sciences and Engineering (MaxEnt 92) was held in Paris, France, at the Centre National de la Recherche Scientifique (CNRS), July 19-24, 1992. It is important to note that, since its creation in 1980 by some of the researchers of the physics department at the Wyoming University in Laramie, this was the second time that it took place in Europe, the first time was in 1988 in Cambridge. The two specificities of MaxEnt workshops are their spontaneous and informal charac ters which give the participants the possibility to discuss easily and to make very fruitful scientific and friendship relations among each others. This year's organizers had fixed two main objectives: i) to have more participants from the European countries, and ii) to give special interest to maximum entropy and Bayesian methods in signal and image processing. We are happy to see that we achieved these objectives: i) we had about 100 participants with more than 50 per cent from the European coun tries, ii) we received many papers in the signal and image processing subjects and we could dedicate a full day of the workshop to the image modelling, restoration and recon struction problems.

Bayesian Data Analysis, Third Edition Springer

The MaxEnt workshops are devoted to Bayesian inference and maximum entropy methods in science and engineering. In addition, this workshop included all aspects of probabilistic inference, such as foundations, techniques, algorithms, and applications. All papers have been peer-reviewed.

Maximum Entropy and Bayesian Methods Springer Science & Business Media

The 10th International Workshop on Maximum Entropy and Bayesian Methods, MaxEnt 90, was held in Laramie, Wyoming from 30 July to 3 August 1990. This volume contains the scientific presentations given at that meeting. This series of workshops originated in Laramie in 1981, where the first three of what were to become annual workshops were held. The fourth meeting was held in Calgary. the fifth in Laramie, the sixth and seventh in Seattle, the eighth in Cambridge, England, and the ninth at Hanover, New Hampshire. It is most appropriate that the tenth workshop, occurring in the centennial year of Wyoming's statehood, was once again held in Laramie. The original purpose of these workshops was twofold. The first was to bring together workers from diverse fields of scientific research who individually had been using either some form of the maximum entropy method for treating ill-posed problems or the more general Bayesian analysis, but who, because of the narrow focus that intra-disciplinary work tends to impose upon most of us, might be unaware of progress being made by others using these same techniques in other areas. The second was to introduce to those who were somewhat aware of maximum entropy and Bayesian analysis and wanted to learn more, the foundations, the gestalt, and the power of these analyses. To further the first of these ends, presenters at these workshops have included workers from area. s as varied as astronomy, economics, environmenta.

Introduction to Bayesian Statistics John Wiley & Sons

MaxEnt workshops are devoted to Bayesian inference and Maximum Entropy methods in sciences and engineering. This year's meeting was also encompassed all aspects of probabilistic inference such as foundations, techniques, algorithms and applications. As usual, we had tutorials, invited speakers, oral and poster presentations on the following subjects: Information theory, Probability theory, Quantum systems, Source separation, Information geometry, Bayesian networks, Parametric and Nonparametric Bayesian Data and Image processing, Bayesian computation, Entropy computation of Markovian and Semi-markovian process.

Maximum Entropy and Bayesian Methods Springer

Proceedings of the Fifteenth International Workshop on Maximum Entropy and Bayesian Methods, Santa Fe, New Mexico, USA, 1995

Maximum Entropy and Bayesian Methods Springer Science & Business Media

Maximum entropy and Bayesian methods have fundamental, central roles in scientific inference, and, with the growing availability of computer power, are being successfully applied in an increasing number of applications in many disciplines. This volume contains selected papers presented at the Thirteenth International Workshop on Maximum Entropy and Bayesian

Methods. It includes an extensive tutorial section, and a variety of contributions detailing application in the physical sciences, engineering, law, and economics. Audience: Researchers and other professionals whose work requires the application of practical statistical inference.