Non Bayesian Decision Theory

#non-bayesian decision theory #frequentist decision making #classical statistical inference #decision making under uncertainty #statistical decision rules

Non Bayesian Decision Theory encompasses frameworks for making choices and evaluating outcomes without relying on subjective prior probabilities or Bayesian updating. This approach often utilizes frequentist principles, focusing on the long-run performance of decision rules, objective statistical methods, and robust analysis of risks and uncertainties, making it crucial in fields like classical hypothesis testing and statistical quality control.

Non-Bayesian Decision Theory

For quite some time, philosophers, economists, and statisticians have endorsed a view on rational choice known as Bayesianism. The work on this book has grown out of a feeling that the Bayesian view has come to dominate the academic com- nitytosuchanextentthatalternative,non-Bayesianposi-tionsareseldomextensively researched. Needless to say, I think this is a pity. Non-Bayesian positions deserve to be examined with much greater care, and the present work is an attempt to defend what I believe to be a coherent and reasonably detailed non-Bayesian account of decision theory. The main thesis I defend can be summarised as follows. Rational agents m- imise subjective expected utility, but contrary to what is claimed by Bayesians, ut- ity and subjective probability should not be de?ned in terms of preferences over uncertain prospects. On the contrary, rational decision makers need only consider preferences over certain outcomes. It will be shown that utility and probability fu- tions derived in a non-Bayesian manner can be used for generating preferences over uncertain prospects, that support the principle of maximising subjective expected utility. To some extent, this non-Bayesian view gives an account of what modern - cision theory could have been like, had decision theorists not entered the Bayesian path discovered by Ramsey, de Finetti, Savage, and others. I will not discuss all previous non-Bayesian positions presented in the literature.

An Introduction to Decision Theory

A comprehensive and accessible introduction to all aspects of decision theory, now with new and updated discussions and over 140 exercises.

Bayesian Theory

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 authors 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

Frontiers of Statistical Decision Making and Bayesian Analysis

Research in Bayesian analysis and statistical decision theory is rapidly expanding and diversifying, making it increasingly more difficult for any single researcher to stay up to date on all current research frontiers. This book provides a review of current research challenges and opportunities. While the book can not exhaustively cover all current research areas, it does include some exemplary discussion of most research frontiers. Topics include objective Bayesian inference, shrinkage estimation and other decision based estimation, model selection and testing, nonparametric Bayes, the interface of Bayesian and frequentist inference, data mining and machine learning, methods for categorical and spatio-temporal data analysis and posterior simulation methods. Several major application areas are covered: computer models, Bayesian clinical trial design, epidemiology, phylogenetics, bioinformatics, climate modeling and applications in political science, finance and marketing. As a review of current research in Bayesian analysis the book presents a balance between theory and applications. The lack of a clear demarcation between theoretical and applied research is a reflection of the highly interdisciplinary and often applied nature of research in Bayesian statistics. The book is intended as an update for researchers in Bayesian statistics, including non-statisticians who make use of Bayesian inference to address substantive research questions in other fields. It would also be useful for graduate students and research scholars in statistics or biostatistics who wish to acquaint themselves with current research frontiers.

Statistical Decision Theory and Bayesian Analysis

In this new edition the author has added substantial material on Bayesian analysis, including lengthy new sections on such important topics as empirical and hierarchical Bayes analysis, Bayesian calculation, Bayesian communication, and group decision making. With these changes, the book can be used as a self-contained introduction to Bayesian analysis. In addition, much of the decision-theoretic portion of the text was updated, including new sections covering such modern topics as minimax multivariate (Stein) estimation.

Strategic Economic Decision-Making

Strategic Economic Decision-Making: Using Bayesian Belief Networks to Solve Complex Problems is a quick primer on the topic that introduces readers to the basic complexities and nuances associated with learning Bayes' theory and inverse probability for the first time. This brief is meant for non-statisticians who are unfamiliar with Bayes' theorem, walking them through the theoretical phases of set and sample set selection, the axioms of probability, probability theory as it pertains to Bayes' theorem, and posterior probabilities. All of these concepts are explained as they appear in the methodology of fitting a Bayes' model, and upon completion of the text readers will be able to mathematically determine posterior probabilities of multiple independent nodes across any system available for study. Very little has been published in the area of discrete Bayes' theory, and this brief will appeal to non-statisticians conducting research in the fields of engineering, computing, life sciences, and social sciences.

Making Better Decisions

Making Better Decisions introduces readers to some of theprincipal aspects of decision theory, and examines how these mightlead us to make better decisions. Introduces readers to key aspects of decision theory andexamines how they might help us make better decisions Presentation of material encourages readers to imagine asituation and make a decision or a judgment Offers a broad coverage of the subject including major insightsfrom several sub-disciplines: microeconomic theory, decisiontheory, game theory, social choice, statistics, psychology, andphilosophy Explains these insights informally in a language that hasminimal mathematical notation or jargon, even when describing andinterpreting

mathematical theorems Critically assesses the theory presented within the text, aswell as some of its critiques Includes a web resource for teachers and students

Frontiers of Statistical Decision Making and Bayesian Analysis

Research in Bayesian analysis and statistical decision theory is rapidly expanding and diversifying, making it increasingly more difficult for any single researcher to stay up to date on all current research frontiers. This book provides a review of current research challenges and opportunities. While the book can not exhaustively cover all current research areas, it does include some exemplary discussion of most research frontiers. Topics include objective Bayesian inference, shrinkage estimation and other decision based estimation, model selection and testing, nonparametric Bayes, the interface of Bayesian and frequentist inference, data mining and machine learning, methods for categorical and spatio-temporal data analysis and posterior simulation methods. Several major application areas are covered: computer models, Bayesian clinical trial design, epidemiology, phylogenetics, bioinformatics, climate modeling and applications in political science, finance and marketing. As a review of current research in Bayesian analysis the book presents a balance between theory and applications. The lack of a clear demarcation between theoretical and applied research is a reflection of the highly interdisciplinary and often applied nature of research in Bayesian statistics. The book is intended as an update for researchers in Bayesian statistics, including non-statisticians who make use of Bayesian inference to address substantive research questions in other fields. It would also be useful for graduate students and research scholars in statistics or biostatistics who wish to acquaint themselves with current research frontiers.

Statistical Decision Theory

Decision theory is generally taught in one of two very different ways. When of opti taught by theoretical statisticians, it tends to be presented as a set of mathematical techniques mality principles, together with a collection of various statistical procedures. When useful in establishing the optimality taught by applied decision theorists, it is usually a course in Bayesian analysis, showing how this one decision principle can be applied in various practical situations. The original goal I had in writing this book was to find some middle ground. I wanted a book which discussed the more theoretical ideas and techniques of decision theory, but in a manner that was constantly oriented towards solving statistical problems. In particular, it seemed crucial to include a discussion of when and why the various decision prin ciples should be used, and indeed why decision theory is needed at all. This original goal seemed indicated by my philosophical position at the time, which can best be described as basically neutral. I felt that no one approach to decision theory (or statistics) was clearly superior to the others, and so planned a rather low key and impartial presentation of the competing ideas. In the course of writing the book, however, I turned into a rabid Bayesian. There was no single cause for this conversion; just a gradual realization that things seemed to ultimately make sense only when looked at from the Bayesian viewpoint.

Rethinking the Foundations of Statistics

A synthesis of foundational studies in Bayesian decision theory and statistics.

Contemporary Bayesian Econometrics and Statistics

Tools to improve decision making in an imperfect world This publication provides readers with a thor- ough understanding ofBayesian analysis that is grounded in the theory of inference andoptimal decision making. Contemporary Bayesian Econometrics andStatistics provides readers with state-of-the-art simulationmethods and models that are used to solve complex real-worldproblems. Armed with a strong foundation in both theory andpractical problem-solving tools, readers discover how to optimizedecision making when faced with problems that involve limited orimperfect data. The book begins by examining the theoretical and mathematicalfoundations of Bayesian statistics to help readers understand howand why it is used in problem solving. The author then describeshow modern simulation methods make Bayesian approaches practicalusing widely available mathematical applications software. Inaddition, the author details how models can be applied to specificproblems, 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 decadeof classroom experience, and readers will find the author'sapproach very engaging and accessible. There are nearly 200examples and exercises to help readers see how effective use ofBayesian statistics enables them to make optimal decisions. MATLAB?and R computer programs

are integrated throughout the book. Anaccompanying Web site provides readers with computer code for manyexamples and datasets. This publication is tailored for research professionals who useeconometrics and similar statistical methods in their work. Withits emphasis on practical problem solving and extensive use ofexamples and exercises, this is also an excellent textbook forgraduate-level students in a broad range of fields, includingeconomics, statistics, the social sciences, business, and publicpolicy.

Bayesian Methods in Reliability

When data is collected on failure or survival a list of times is obtained. Some of the times are failure times and others are the times at which the subject left the experiment. These times both give information about the performance of the system. The two types will be referred to as failure and censoring times (cf. Smith section 5). * A censoring time, t, gives less information than a failure time, for it is * known only that the item survived past t and not when it failed. The data is tn and of censoring thus collected as a list of failure times t , . . . , l * * * times t , t , . . . , t • 1 z m 2. 2. Classical methods The failure times are assumed to follow a parametric distribution F(t;B) with and reliability R(t;B). There are several methods of estimating density f(t;B) the parameter B based only on the data in the sample without any prior assumptions about B. The availability of powerful computers and software packages has made the method of maximum likelihood the most popular. Descriptions of most methods can be found in the book by Mann, Schafer and Singpurwalla (1974). In general the method of maximum likelihood is the most useful of the classical approaches. The likelihood approach is based on constructing the joint probability distrilmtion or density for a sample.

Robustness of Bayesian Analyses

It is widely held that Bayesian decision theory is the final word on how a rational person should make decisions. However, Leonard Savage--the inventor of Bayesian decision theory--argued that it would be ridiculous to use his theory outside the kind of small world in which it is always possible to "look before you leap." If taken seriously, this view makes Bayesian decision theory inappropriate for the large worlds of scientific discovery and macroeconomic enterprise. When is it correct to use Bayesian decision theory--and when does it need to be modified? Using a minimum of mathematics, Rational Decisions clearly explains the foundations of Bayesian decision theory and shows why Savage restricted the theory's application to small worlds. The book is a wide-ranging exploration of standard theories of choice and belief under risk and uncertainty. Ken Binmore discusses the various philosophical attitudes related to the nature of probability and offers resolutions to paradoxes believed to hinder further progress. In arguing that the Bayesian approach to knowledge is inadequate in a large world, Binmore proposes an extension to Bayesian decision theory--allowing the idea of a mixed strategy in game theory to be expanded to a larger set of what Binmore refers to as "muddled" strategies. Written by one of the world's leading game theorists, Rational Decisions is the touchstone for anyone needing a concise, accessible, and expert view on Bayesian decision making.

Statistical Decision Theory

Statistical Decision Theory and Related Topics is a collection of the papers presented at the Symposium on Statistical Decision Theory and Related Topics which was held on November 23-25, 1970 at Purdue University. The conference brought together research workers in decision theory and related topics. This volume contains twenty papers presented during the symposium and includes works on molecular studies of evolution, globally optimal procedure for one-sided comparisons, multiple decision theory, outlier detection, empirical Bayes slippage tests, and non-optimality of likelihood ratio tests for sequential detection of signals in Gaussian noise. Mathematicians and statisticians will find the book highly insightful.

Rational Decisions

Kaplan presents an accessible new variant on Bayesian decision theory.

Statistical Decision Theory and Related Topics

Set that includes three works covering statistical decision theory and analysis The three books within this set are Optimal Statistical Decisions, Bayesian Inference in Statistical Analysis, and Applied Statistical Decision Theory. Optimal Statistical Decisions discusses the theory and methodology of decision-making in the field. The volume stands as a clear introduction to Bayesian statistical decision

theory. A second book, Bayesian Inference in Statistical Analysis, examines the application and relevance of Bayes' theorem to problems that occur during scientific investigations, where inferences must be made regarding parameter values about which little is known. Key aspects of the Bayesian approach are discussed, including the choice of prior distribution, the problem of nuisance parameters, and the role of sufficient statistics. Applied Statistical Decision Theory covers the development of analytic techniques in the field of statistical decision theory. This classic book was first published in the 1960s.

Decision Theory as Philosophy

This is a collection of the author's contributions to the philosophy, theory and application of Bayesian analysis as it relates to statistics, econometrics, and economics. It shows how Bayesians have helped researchers and analysts to become more effective in learning from data and making decisions. Bayesian and non-Bayesian approaches are compared in several papers.

Optimal Statistical Decision & Bayesian Inference in Statistical Analysis & Applied Statistical Decision Theory

No descriptive material is available for this title.

Bayesian Analysis in Econometrics and Statistics

The primary objective of this volume is to describe the impact of Professor Bruno de Finetti's contributions on statistical theory and practice, and to provide a selection of recent and applied research in Bayesian statistics and econometrics. Included are papers (all previously unpublished) from leading econometricians and statisticians from several countries. Part I of this book relates most directly to de Finetti's interests whilst Part II deals specifically with the implications of the assumption of finitely additive probability. Parts III & IV discuss applications of Bayesian methodology in econometrics and economic forecasting, and Part V examines assessment of prior parameters in specific parametric setting and foundational issues in probability assessment. The following section deals with state of the art for comparing probability functions and gives an assessment of prior distributions and utility functions. In Parts VII & VIII are a collection of papers on Bayesian methodology for general linear models and time series analysis (the most often used tools in economic modelling), and papers relevant to modelling and forecasting. The remaining two Parts examine, respectively, optimality considerations and the effectiveness of the Conditionality-Likelihood Principle as a vehicle to convince the non-Bayesians about the usefulness of the Bayesian paradigm.

Bayesian Analysis and Uncertainty in Economic Theory

The Fifth Purdue International Symposium on Statistical Decision The was held at Purdue University during the period of ory and Related Topics June 14-19,1992. The symposium brought together many prominent leaders and younger researchers in statistical decision theory and related areas. The format of the Fifth Symposium was different from the previous symposia in that in addition to the 54 invited papers, there were 81 papers presented in contributed paper sessions. Of the 54 invited papers presented at the sym posium, 42 are collected in this volume. The papers are grouped into a total of six parts: Part 1 - Retrospective on Wald's Decision Theory and Sequential Analysis; Part 2 - Asymptotics and Nonparametrics; Part 3 - Bayesian Analysis; Part 4 - Decision Theory and Selection Procedures; Part 5 - Probability and Probabilistic Structures; and Part 6 - Sequential, Adaptive, and Filtering Problems. While many of the papers in the volume give the latest theoretical developments in these areas, a large number are either applied or creative review papers.

Bayesian Inference and Decision Techniques

They then examine the Bernoulli, Poisson, and Normal (univariate and multivariate) data generating processes.

Statistical Decision Theory and Related Topics V

Bayesian decision analysis supports principled decision making in complex domains. This textbook takes the reader from a formal analysis of simple decision problems to a careful analysis of the sometimes very complex and data rich structures confronted by practitioners. The book contains basic material on subjective probability theory and multi-attribute utility theory, event and decision trees,

Bayesian networks, influence diagrams and causal Bayesian networks. The author demonstrates when and how the theory can be successfully applied to a given decision problem, how data can be sampled and expert judgements elicited to support this analysis, and when and how an effective Bayesian decision analysis can be implemented. Evolving from a third-year undergraduate course taught by the author over many years, all of the material in this book will be accessible to a student who has completed introductory courses in probability and mathematical statistics.

Introduction to Statistical Decision Theory

"[This book] proposes new foundations for the Bayesian principle of rational action, and goes on to develop a new logic of desirability and probabtility."—Frederic Schick, Journal of Philosophy

Bayes Decision Theory: Insensitivity to Non-optimal Design

This monograph presents a radical rethinking of how elementary inferences should be made in statistics, implementing a comprehensive alternative to hypothesis testing in which the control of the probabilities of the errors is replaced by selecting the course of action (one of the available options) associated with the smallest expected loss. Its strength is that the inferences are responsive to the elicited or declared consequences of the erroneous decisions, and so they can be closely tailored to the client’s perspective, priorities, value judgments and other prior information, together with the uncertainty about them.

Bayesian Decision Analysis

Uncertain Decisions: Bridging Theory and Experiments presents advanced directions of thinking on decision theory - in particular the more recent contributions on non-expected utility theory, fuzzy decision theory and case-based theory. This work also provides theoretical insights on measures of risk aversion and on new problems for general equilibrium analysis. It analyzes how the thinking that underlies the theories described above spills over into real decisions, and how the thinking that underlies these real decisions can explain the discrepancies between theoretical approaches and actual behavior. This work elaborates on how the most recent laboratory experiments have become an important source both for evaluating the leading theory of choice and decision, and for contributing to the formation of new models regarding the subject.

The Logic of Decision

Bayesian decision analysis supports principled decision making in complex domains. This textbook takes the reader from a formal analysis of simple decision problems to a careful analysis of the sometimes very complex and data rich structures confronted by practitioners. The book contains basic material on subjective probability theory and multi-attribute utility theory, event and decision trees, Bayesian networks, influence diagrams and causal Bayesian networks. The author demonstrates when and how the theory can be successfully applied to a given decision problem, how data can be sampled and expert judgements elicited to support this analysis, and when and how an effective Bayesian decision analysis can be implemented. Evolving from a third-year undergraduate course taught by the author over many years, all of the material in this book will be accessible to a student who has completed introductory courses in probability and mathematical statistics.

Statistical Decision Theory

Explores how decision-makers can manage uncertainty that varies in both kind and severity by extending and supplementing Bayesian decision theory.

Uncertain Decisions

The Fourth Purdue Symposium on Statistical Decision Theory and Related Topics was held at Purdue University during the period June 15-20, 1986. The symposium brought together many prominent leaders and younger researchers in statistical decision theory and related areas. The 65 invited papers and discussions presented at the symposium are collected in this two-volume work. The papers are grouped into a total of seven parts. Volume I has three parts: Part 1 -Conditioning and Likelihood; Part f! - Bayes and Empirical Bayes Analysis; and Part 9 -Decision Theoretic Estimation. Part 1 contains the proceedings of a Workshop on Conditioning, which was held during the symposium. Most of the articles in Volume I involve either conditioning or Bayesian ideas, resulting in a volume of considerable

interest to conditionalists and Bayesians as well as to decision-theorists. Volume II has four parts: Part 1 -Selection, Ranking, and Multiple Com parisons; fart f! -Asymptotic and Sequential Analysis; Part 9 -Estimation and Testing; and Part -4 -Design and Comparison of Experiments and Distributions. These articles encompass the leading edge of much current research in math ematical statistics, with decision theory, of course, receiving special emphasis. It should be noted that the papers in these two volumes are by no means all theoretical; many are applied in nature or are creative review papers.

Theory of Games and Statistical Decisions

When making decisions, people naturally face uncertainty about the potential consequences of their actions due in part to limits in their capacity to represent, evaluate or deliberate. Nonetheless, they aim to make the best decisions possible. In Decision Theory with a Human Face, Richard Bradley develops new theories of agency and rational decision-making, offering guidance on how 'real' agents who are aware of their bounds should represent the uncertainty they face, how they should revise their opinions as a result of experience and how they should make decisions when lacking full awareness of, or precise opinions on relevant contingencies. He engages with the strengths and flaws of Bayesian reasoning, and presents clear and comprehensive explorations of key issues in decision theory, from belief and desire to semantics and learning. His book draws on philosophy, economics, decision science and psychology, and will appeal to readers in all of these disciplines.

Applications in Bayesian Decision Processes

Provides an introduction to decision analysis. This book is based upon a number of papers and articles taken from the Operational Research Society's journal and other publications. However, the book is not simply a 'collection of reprints': Professor French has provided extensive notes and commentary to weave the extracts into a coherent whole. Although techniques are presented, the main thrust is to convey the purpose of decision analysis and the interpretation that should be placed upon its output: vital topics, but ones seldom discussed in introductory texts. The writing is aimed at the non-technical reader.

Bayesian Decision Analysis

This is an introduction to Bayesian statistics and decision theory, including advanced topics such as Monte Carlo methods. This new edition contains several revised chapters and a new chapter on model choice.

Decision Theory with a Human Face

CD-ROM contains: Beta Distribution Generator (Excel file) ; Binomial Distribution Generator (Excel file) ; book exercises (MS Word files) ; book figures (Powerpoint files) ; TreeAge Data decision trees for some of the examples in the book ; Demonstration versions of TreeAge Data and Lumina Analytica.

Statistical Decision Theory and Related Topics IV

Robust Bayesian analysis aims at overcoming the traditional objection to Bayesian analysis of its dependence on subjective inputs, mainly the prior and the loss. Its purpose is the determination of the impact of the inputs to a Bayesian analysis (the prior, the loss and the model) on its output when the inputs range in certain classes. If the impact is considerable, there is sensitivity and we should attempt to further refine the information the incumbent classes available, perhaps through additional constraints on and/ or obtaining additional data; if the impact is not important, robustness holds and no further analysis and refinement would be required. Robust Bayesian analysis has been widely accepted by Bayesian statisticians; for a while it was even a main research topic in the field. However, to a great extent, their impact is yet to be seen in applied settings. This volume, therefore, presents an overview of the current state of robust Bayesian methods and their applications and identifies topics of further in terest in the area. The papers in the volume are divided into nine parts covering the main aspects of the field. The first one provides an overview of Bayesian robustness at a non-technical level. The paper in Part II con cerns foundational aspects and describes decision-theoretical axiomatisa tions leading to the robust Bayesian paradigm, motivating reasons for which robust analysis is practically unavoidable within Bayesian analysis.

Decision Theory with a Human Face

This book is based on lectures given at Yale in 1971-1981 to students prepared with a course in measure-theoretic probability. It contains one technical innovation-probability distributions in which the total probability is infinite. Such improper distributions arise embarras singly frequently in Bayes theory, especially in establishing correspondences between Bayesian and Fisherian techniques. Infinite probabilities create interesting complications in defining conditional probability and limit concepts. The main results are theoretical, probabilistic conclusions derived from probabilistic assumptions. A useful theory requires rules for constructing and interpreting probabilities. Probabilities are computed from similarities, using a formalization of the idea that the future will probably be like the past. Probabilities are objectively derived from similarities, but similarities are sUbjective judgments of individuals. Of course the theorems remain true in any interpretation of probability that satisfies the formal axioms. My colleague David Potlard helped a lot, especially with Chapter 13. Dan Barry read proof. vii Contents CHAPTER 1 Theories of Probability 1. 0. Introduction 1 1. 1. Logical Theories: Laplace 1 1. 2. Logical Theories: Keynes and Jeffreys 2 1. 3. Empirical Theories: Von Mises 3 1. 4. Empirical Theories: Kolmogorov 5 1. 5. Empirical Theories: Falsifiable Models 5 1. 6. Subjective Theories: De Finetti 6 7 1. 7. Subjective Theories: Good 8 1. 8. All the Probabilities 10 1. 9. Infinite Axioms 11 1. 10. Probability and Similarity 1. 11. References 13 CHAPTER 2 Axioms 14 2. 0. Notation 14 2. 1. Probability Axioms 14 2. 2.

Readings in Decision Analysis

Decision Theory and Decision Analysis: Trends and Challenges is divided into three parts. The first part, overviews, provides state-of-the-art surveys of various aspects of decision analysis and utility theory. The second part, theory and foundations, includes theoretical contributions on decision-making under uncertainty, partial beliefs and preferences. The third section, applications, reflects the real possibilities of recent theoretical developments such as non-expected utility theories, multicriteria decision techniques, and how these improve our understanding of other areas including artificial intelligence, economics, and environmental studies.

The Bayesian Choice

An Introduction to Bayesian Inference and Decision