Probability Theory The Logic Of Science Et Jaynes

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misapplications of accepted principles. This book discusses seven paradoxes surrounding probability theory. Some remain the focus of controversy; others have allegedly been solved, however the accepted solutions are demonstrably incorrect. Each paradox is shown to rest on one or more fallacies. Instead of the esoteric, idiosyncratic, and untested methods that have been brought to bear on these problems, the book invokes uncontroversial probability principles, acceptable both to frequentists and subjectivists. The philosophical disputation inspired by these paradoxes is shown to be misguided and unnecessary; for instance, startling claims concerning human destiny and the nature of reality are directly related to fallacious reasoning in a betting paradox, and a problem analyzed in philosophy journals is resolved by means of a computer program.

An introductory 2001 textbook on probability and induction written by a foremost philosopher of science.

This clear exposition begins with basic concepts and moves on to combination of events, dependent events and random variables, Bernoulli trials and the De Moivre-Laplace theorem, and more. Includes 150 problems, many with answers.

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Essentials of Probability Theory for Statisticians provides graduate students with a rigorous treatment of probability theory, with an emphasis on results central to theoretical statistics. It presents classical probability theory motivated with illustrative examples in biostatistics, such as outlier tests, monitoring clinical trials, and using adaptive methods to make design changes based on accumulating data. The authors explain different methods of proofs and show how they are useful for establishing classic probability results. After building a foundation in probability, the text intersperses examples that make seemingly esoteric mathematical constructs more intuitive. These examples elucidate essential elements in definitions and conditions in theorems. In addition,
counterexamples further clarify nuances in meaning and expose common fallacies in logic. This text encourages students in statistics and biostatistics to think carefully about probability. It gives them the rigorous foundation necessary to provide valid proofs and avoid paradoxes and nonsensical conclusions.

An intelligent agent interacting with the real world will encounter individual people, courses, test results, drugs prescriptions, chairs, boxes, etc., and needs to reason about properties of these individuals and relations among them as well as cope with uncertainty. Uncertainty has been studied in probability theory and graphical models, and relations have been studied in logic, in particular in the predicate calculus and its extensions. This book examines the foundations of combining logic and probability into what are called relational probabilistic models. It introduces representations, inference, and learning techniques for probability, logic, and their combinations. The book focuses on two representations in detail: Markov logic networks, a relational extension of undirected graphical models and weighted first-order predicate calculus formula, and Problog, a probabilistic extension of logic programs that can also be viewed as a Turing-complete relational extension of Bayesian networks.

This book presents new research in probability theory using ideas from mathematical logic. It is a general study of stochastic processes on adapted probability spaces, employing the concept of similarity of stochastic processes based on the notion of adapted distribution. The authors use ideas from model theory and methods from nonstandard analysis

Features an introduction to probability theory using measure theory. This work provides proofs of the essential introductory results and presents the measure theory and mathematical details in terms of intuitive probabilistic concepts, rather than as separate, imposing subjects.

This multi-authored effort, Mathematics of the nineteenth century
(to be followed by Mathematics of the twentieth century), is a sequel to the History of mathematics from antiquity to the early nineteenth century, published in three volumes from 1970 to 1972. For reasons explained below, our discussion of twentieth-century mathematics ends with the 1930s. Our general objectives are identical with those stated in the preface to the three-volume edition, i.e., we consider the development of mathematics not simply as the process of perfecting concepts and techniques for studying real-world spatial forms and quantitative relationships but as a social process as well. Mathematical structures, once established, are capable of a certain degree of autonomous development. In the final analysis, however, such immanent mathematical evolution is conditioned by practical activity and is either self-directed or, as is most often the case, is determined by the needs of society. Proceeding from this premise, we intend, first, to unravel the forces that shape mathematical progress. We examine the interaction of mathematics with the social structure, technology, the natural sciences, and philosophy. Through an analysis of mathematical history proper, we hope to delineate the relationships among the various mathematical disciplines and to evaluate mathematical achievements in the light of the current state and future prospects of the science. The difficulties confronting us considerably exceeded those encountered in preparing the three-volume edition.

A basic system of inductive logic; An axiomatic foundation for the logic of inductive generalization; A survey of inductive systems; On the condition of partial exchangeability; Representation theorems of the de finetti type; De finetti’s generalizations of exchangeability; The structure of probabilities defined on first-order languages; A subjectivit’s guide to objective chance.

This unique book delivers an encyclopedic treatment of classic as well as contemporary large sample theory, dealing with both statistical problems and probabilistic issues and tools. The book is unique in its detailed coverage of fundamental topics. It is written in an extremely lucid style, with an emphasis on the conceptual
discussion of the importance of a problem and the impact and relevance of the theorems. There is no other book in large sample theory that matches this book in coverage, exercises and examples, bibliography, and lucid conceptual discussion of issues and theorems.

A collection of papers on the pioneering work of Edwin T. Jaynes in statistical physics, quantum optics and probability theory.

This volume represents the proceedings of the Ninth Annual MaxEnt Workshop, held at Dartmouth College in Hanover, New Hampshire, on August 14-18, 1989. These annual meetings are devoted to the theory and practice of Bayesian Probability and the Maximum Entropy Formalism. The fields of application exemplified at MaxEnt '89 are as diverse as the foundations of probability theory and atmospheric carbon variations, the 1987 Supernova and fundamental quantum mechanics. Subjects include sea floor drug absorption in man, pressures, neutron scattering, plasma equilibrium, nuclear magnetic resonance, radar and astrophysical image reconstruction, mass spectrometry, generalized parameter estimation, delay estimation, pattern recognition, heave responses in underwater sound and many others. The first ten papers are on probability theory, and are grouped together beginning with the most abstract followed by those on applications. The tenth paper involves both Bayesian and MaxEnt methods and serves as a bridge to the remaining papers which are devoted to Maximum Entropy theory and practice. Once again, an attempt has been made to start with the more theoretical papers and to follow them with more and more practical applications. Papers number 29, 30 and 31, by Kesaven, Seth and Kapur, represent a somewhat different, perhaps even "unorthodox" viewpoint, and are included here even though the editor and, indeed many in the audience at Dartmouth, disagreed with their content. I feel that scientific disagreements are essential in any developing field, and often lead to a deeper understanding.
In this book the author charts the history and development of modern probability theory.

The founder of Hungary's Probability Theory School, A. Rényi made significant contributions to virtually every area of mathematics. This introductory text is the product of his extensive teaching experience and is geared toward readers who wish to learn the basics of probability theory, as well as those who wish to attain a thorough knowledge in the field. Based on the author's lectures at the University of Budapest, this text requires no preliminary knowledge of probability theory. Readers should, however, be familiar with other branches of mathematics, including a thorough understanding of the elements of the differential and integral calculus and the theory of real and complex functions. These well-chosen problems and exercises illustrate the algebras of events, discrete random variables, characteristic functions, and limit theorems. The text concludes with an extensive appendix that introduces information theory.

Authoritative account of the development of Boole's ideas in logic and probability theory ranges from The Mathematical Analysis of Logic to the end of his career. The Laws of Thought formed the most systematic statement of Boole's theories; this volume contains incomplete studies intended for a follow-up volume. 1952 edition.

Since the publication of the first edition in 1976, there has been a notable increase of interest in the development of logic. This is evidenced by the several conferences on the history of logic, by a journal devoted to the subject, and by an accumulation of new results. This increased activity and the new results - the chief one being that Boole's work in probability is best viewed as a probability logic - were influential circumstances conducive to a new edition. Chapter 1, presenting Boole's ideas on a mathematical treatment of logic, from their emergence in his early 1847 work on through to his immediate successors, has been considerably enlarged. Chapter 2 includes additional discussion of the "uninterpretable" notion, both
Chapter 3 now includes a revival of Boole's abandoned propositional logic and, also, a discussion of his hitherto unnoticed brush with ancient formal logic. Chapter 5 has an improved explanation of why Boole's probability method works. Chapter 6, Applications and Probability Logic, is a new addition. Changes from the first edition have brought about a three-fold increase in the bibliography.

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

This classic introduction to probability theory for beginning graduate students covers laws of large numbers, central limit theorems, random walks, martingales, Markov chains, ergodic theorems, and Brownian motion. It is a comprehensive treatment concentrating on the results that are the most useful for applications. Its philosophy is that the best way to learn probability is to see it in action, so there are 200 examples and 450 problems. The fourth edition begins with a short chapter on measure theory to orient readers new to the subject.

The Twentieth Century has seen a dramatic rise in the use of probability and statistics in almost all fields of research. This has stimulated many new philosophical ideas on probability. Philosophical Theories of Probability is the first book to present a clear, comprehensive and systematic account of these various theories and to explain how they relate to one another. Gillies also offers a distinctive version of the propensity theory of probability, and the intersubjective interpretation, which develops the subjective theory.

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of controversy; others have allegedly been solved, however the accepted solutions are demonstrably incorrect. Each paradox is shown to rest on one or more fallacies. Instead of the esoteric, idiosyncratic, and untested methods that have been brought to bear on these problems, the book invokes uncontroversial probability principles, acceptable both to frequentists and subjectivists. The philosophical disputation inspired by these paradoxes is shown to be misguided and unnecessary; for instance, startling claims concerning human destiny and the nature of reality are directly related to fallacious reasoning in a betting paradox, and a problem analyzed in philosophy journals is resolved by means of a computer program.

Theories of Probability: An Examination of Foundations reviews the theoretical foundations of probability, with emphasis on concepts that are important for the modeling of random phenomena and the design of information processing systems. Topics covered range from axiomatic comparative and quantitative probability to the role of relative frequency in the measurement of probability. Computational complexity and random sequences are also discussed. Comprised of nine chapters, this book begins with an introduction to different types of probability theories, followed by a detailed account of axiomatic formalizations of comparative and quantitative probability and the relations between them. Subsequent chapters focus on the Kolmogorov formalization of quantitative probability; the common interpretation of probability as a limit of the relative frequency of the number of occurrences of an event in repeated, unlinked trials of a random experiment; an improved theory for repeated random experiments; and the classical theory of probability. The book also examines the origin of subjective probability as a by-product of the development of individual judgments into decisions. Finally, it suggests that none of the known theories of probability covers the whole domain of engineering and scientific practice. This monograph will appeal to students and practitioners in the fields of mathematics and statistics as well as engineering and the physical and social sciences.
This text is designed for an introductory probability course at the university level for sophomores, juniors, and seniors in mathematics, physical and social sciences, engineering, and computer science. It presents a thorough treatment of ideas and techniques necessary for a firm understanding of the subject. The text is also recommended for use in discrete probability courses. The material is organized so that the discrete and continuous probability discussions are presented in a separate, but parallel, manner. This organization does not emphasize an overly rigorous or formal view of probability and therefore offers some strong pedagogical value. Hence, the discrete discussions can sometimes serve to motivate the more abstract continuous probability discussions. Features: Key ideas are developed in a somewhat leisurely style, providing a variety of interesting applications to probability and showing some nonintuitive ideas. Over 600 exercises provide the opportunity for practicing skills and developing a sound understanding of ideas. Numerous historical comments deal with the development of discrete probability. The text includes many computer programs that illustrate the algorithms or the methods of computation for important problems. The book is a beautiful introduction to probability theory at the beginning level. The book contains a lot of examples and an easy development of theory without any sacrifice of rigor, keeping the abstraction to a minimal level. It is indeed a valuable addition to the study of probability theory. --Zentralblatt MATH

Standard probability theory has been an enormously successful contribution to modern science. However, from many perspectives it is too narrow as a general theory of uncertainty, particularly for issues involving subjective uncertainty. This first-of-its-kind book is primarily based on qualitative approaches to probabilistic-like uncertainty, and includes qualitative theories for the standard theory as well as several of its generalizations. One of these generalizations produces a belief function composed of two functions: a probability function that measures the probabilistic strength of an uncertain event, and another function that measures the amount of ambiguity or vagueness of the event. Another unique
approach of the book is to change the event space from a boolean algebra, which is closely linked to classical propositional logic, to a different event algebra that is closely linked to a well-studied generalization of classical propositional logic known as intuitionistic logic. Together, these new qualitative theories succeed where the standard probability theory fails by accounting for a number of puzzling empirical findings in the psychology of human probability judgments and decision making.

Early in his rise to enlightenment, man invented a concept that has since been variously viewed as a vice, a crime, a business, a pleasure, a type of magic, a disease, a folly, a weakness, a form of sexual substitution, an expression of the human instinct. He invented gambling. Recent advances in the field, particularly Parrondo's paradox, have triggered a surge of interest in the statistical and mathematical theory behind gambling. This interest was acknowledge in the motion picture, "21," inspired by the true story of the MIT students who mastered the art of card counting to reap millions from the Vegas casinos. Richard Epstein's classic book on gambling and its mathematical analysis covers the full range of games from penny matching to blackjack, from Tic-Tac-Toe to the stock market (including Edward Thorp's warrant-hedging analysis). He even considers whether statistical inference can shed light on the study of paranormal phenomena. Epstein is witty and insightful, a pleasure to dip into and read and rewarding to study. The book is written at a fairly sophisticated mathematical level; this is not "Gambling for Dummies" or "How To Beat The Odds Without Really Trying." A background in upper-level undergraduate mathematics is helpful for understanding this work.

Comprehensive and exciting analysis of all major casino games and variants. Covers a wide range of interesting topics not covered in other books on the subject. Depth and breadth of its material is unique compared to other books of this nature. Richard Epstein's website: www.gamblingtheory.net

Another title in the reissued Oxford Classic Texts in the Physical Sciences series, Jeffrey's Theory of Probability, first published in
1939, was the first to develop a fundamental theory of scientific inference based on the ideas of Bayesian statistics. His ideas were way ahead of their time and it is only in the past ten years that the subject of Bayes' factors has been significantly developed and extended. Until recently the two schools of statistics (Bayesian and Frequentist) were distinctly different and set apart. Recent work (aided by increased computer power and availability) has changed all that and today's graduate students and researchers all require an understanding of Bayesian ideas. This book is their starting point.

These sparkling essays by a gifted thinker offer philosophical views on the roots of statistical interference. A pioneer in the early development of computing, Irving J. Good made fundamental contributions to the theory of Bayesian inference and was a key member of the team that broke the German Enigma code during World War II. Good maintains that a grasp of probability is essential to answering both practical and philosophical questions. This compilation of his most accessible works concentrates on philosophical rather than mathematical subjects, ranging from rational decisions, randomness, and the nature of probability to operational research, artificial intelligence, cognitive psychology, and chess. These twenty-three self-contained articles represent the author's work in a variety of fields but are unified by a consistently rational approach. Five closely related sections explore Bayesian rationality; probability; corroboration, hypothesis testing, and simplicity; information and surprise; and causality and explanation. A comprehensive index, abundant references, and a bibliography refer readers to classic and modern literature. Good's thought-provoking observations and memorable examples provide scientists, mathematicians, and historians of science with a coherent view of probability and its applications.

Understanding Probability is a unique and stimulating approach to a first course in probability. The first part of the book demystifies probability and uses many wonderful probability applications from everyday life to help the reader develop a feel for probabilities. The
second part, covering a wide range of topics, teaches clearly and simply the basics of probability. This fully revised third edition has been packed with even more exercises and examples and it includes new sections on Bayesian inference, Markov chain Monte-Carlo simulation, hitting probabilities in random walks and Brownian motion, and a new chapter on continuous-time Markov chains with applications. Here you will find all the material taught in an introductory probability course. The first part of the book, with its easy-going style, can be read by anybody with a reasonable background in high school mathematics. The second part of the book requires a basic course in calculus.

Aimed primarily at graduate students and researchers, this text is a comprehensive course in modern probability theory and its measure-theoretical foundations. It covers a wide variety of topics, many of which are not usually found in introductory textbooks. The theory is developed rigorously and in a self-contained way, with the chapters on measure theory interlaced with the probabilistic chapters in order to display the power of the abstract concepts in the world of probability theory. In addition, plenty of figures, computer simulations, biographic details of key mathematicians, and a wealth of examples support and enliven the presentation.

Probability theory is a key tool of the physical, mathematical, and social sciences. It has also been playing an increasingly significant role in philosophy: in epistemology, philosophy of science, ethics, social philosophy, philosophy of religion, and elsewhere. A case can be made that probability is as vital a part of the philosopher's toolkit as logic. Moreover, there is a fruitful two-way street between probability theory and philosophy: the theory informs much of the work of philosophers, and philosophical inquiry, in turn, has shed considerable light on the theory. This Handbook encapsulates and furthers the influence of philosophy on probability, and of probability on philosophy. Nearly forty articles summarise the state of play and present new insights in various areas of research at the intersection of these two fields. The articles will be of special interest to practitioners of probability who seek a greater
understanding of its mathematical and conceptual foundations, and to philosophers who want to get up to speed on the cutting edge of research in this area. There is plenty here to entice philosophical readers who don't work especially on probability but who want to learn more about it and its applications. Indeed, this volume should appeal to the intellectually curious generally; after all, there is much here to be curious about. We do not expect all of this volume's audience to have a thorough training in probability theory. And while probability is relevant to the work of many philosophers, they often do not have much of a background in its formalism. With this in mind, we begin with 'Probability for Everyone--Even Philosophers', a primer on those parts of probability theory that we believe are most important for philosophers to know. The rest of the volume is divided into seven main sections: History; Formalism; Alternatives to Standard Probability Theory; Interpretations and Interpretive Issues; Probabilistic Judgment and Its Applications; Applications of Probability: Science; and Applications of Probability: Philosophy.

As a survey of many technical results in probability theory and probability logic, this monograph by two widely respected scholars offers a valuable compendium of the principal aspects of the formal study of probability. Hugues Leblanc and Peter Roeper explore probability functions appropriate for propositional, quantificational, intuitionistic, and infinitary logic and investigate the connections among probability functions, semantics, and logical consequence. They offer a systematic justification of constraints for various types of probability functions, in particular, an exhaustive account of probability functions adequate for first-order quantificational logic. The relationship between absolute and relative probability functions is fully explored and the book offers a complete account of the representation of relative functions by absolute ones. The volume is designed to review familiar results, to place these results within a broad context, and to extend the discussions in new and interesting ways. Authoritative, articulate, and accessible, it will interest mathematicians and philosophers at both professional and postgraduate levels.
Scientists and engineers often have to deal with systems that exhibit random or unpredictable elements and must effectively evaluate probabilities in each situation. Computer simulations, while the traditional tool used to solve such problems, are limited in the scale and complexity of the problems they can solve. Formalized Probability Theory and Applications Using Theorem Proving discusses some of the limitations inherent in computer systems when applied to problems of probabilistic analysis, and presents a novel solution to these limitations, combining higher-order logic with computer-based theorem proving. Combining practical application with theoretical discussion, this book is an important reference tool for mathematicians, scientists, engineers, and researchers in all STEM fields.

This reissue of D. A. Gillies highly influential work, first published in 1973, is a philosophical theory of probability which seeks to develop von Mises’ views on the subject. In agreement with von Mises, the author regards probability theory as a mathematical science like mechanics or electrodynamics, and probability as an objective, measurable concept like force, mass or charge. On the other hand, Dr Gillies rejects von Mises’ definition of probability in terms of limiting frequency and claims that probability should be taken as a primitive or undefined term in accordance with modern axiomatic approaches. This of course raises the problem of how the abstract calculus of probability should be connected with the ‘actual world of experiments’. It is suggested that this link should be established, not by a definition of probability, but by an application of Popper’s concept of falsifiability. In addition to formulating his own interesting theory, Dr Gillies gives a detailed criticism of the generally accepted Neyman Pearson theory of testing, as well as of alternative philosophical approaches to probability theory. The reissue will be of interest both to philosophers with no previous knowledge of probability theory and to mathematicians interested in the foundations of probability theory and statistics.

Bayesian Statistics the Fun Way gets you understanding the theory
behind data analysis without making you slog through a load of dry concepts first - with no programming experience necessary. You'll learn about probability with LEGO, statistics through Star Wars, distributions with bomb fuses, estimation through precipitation, and come away with some strong mathematical reasoning skills. This is a super approachable book for people who need to do data science and probability work in their lives, but never got a good grip on the underlying theory.

In May of 1973 we organized an international research colloquium on foundations of probability, statistics, and statistical theories of science at the University of Western Ontario. During the past four decades there have been striking formal advances in our understanding of logic, semantics and algebraic structure in probabilistic and statistical theories. These advances, which include the development of the relations between semantics and metamathematics, between logics and algebras and the algebraic-geometrical foundations of statistical theories (especially in the sciences), have led to striking new insights into the formal and conceptual structure of probability and statistical theory and their scientific applications in the form of scientific theory. The foundations of statistics are in a state of profound conflict. Fisher's objections to some aspects of Neyman-Pearson statistics have long been well known. More recently the emergence of Baysian statistics as a radical alternative to standard views has made the conflict especially acute. In recent years the response of many practising statisticians to the conflict has been an eclectic approach to statistical inference. Many good statisticians have developed a kind of wisdom which enables them to know which problems are most appropriately handled by each of the methods available. The search for principles which would explain why each of the methods works where it does and fails where it does offers a fruitful approach to the controversy over foundations.