Intensity Estimation For Poisson Processes

Lectures on the Poisson ProcessCambridge University Press
Through this text, the author aims to make recent developments in the title subject (a modern strategy for the creation of statistical models to solve 'real world' problems) accessible to graduate students and researchers in the field of statistics.
Understand How to Analyze and Interpret Information in Ecological Point PatternsAlthough numerous statistical methods for analyzing spatial point patterns have been available for several decades, they haven't been extensively applied in an ecological context. Addressing this gap, Handbook of Spatial Point-Pattern Analysis in Ecology shows how the t
A modern introduction to the Poisson process, with general point processes and random measures, and applications to stochastic geometry.
This work is devoted to several problems of parametric (mainly) and nonparametric estimation through the observation of Poisson processes defined on general spaces. Poisson processes are quite popular in applied research and therefore they attract the attention of many statisticians. There are a lot of good books on point processes and many of them contain chapters devoted to statistical inference for general and partic ular models of processes. There are even chapters on statistical estimation problems for inhomogeneous Poisson processes in asymptotic statements. Nevertheless it seems that the asymptotic theory of estimation for nonlinear models of Poisson processes needs some development. Here nonlinear means the models of inhomogeneous Pois son processes with intensity function nonlinearly depending on unknown parameters. In such situations the estimators usually cannot be written in exact form and are given as solutions of some equations. However the models can be quite fruitful in en gineering problems and the existing computing algorithms are sufficiently powerful to calculate these estimators. Therefore the properties of estimators can be interesting too.
A far-reaching course in practical advanced statistics for biologists using R/Bioconductor, data exploration, and simulation.
This volume describes how to develop Bayesian thinking, modelling and computation both from philosophical, methodological and application point of view. It further describes parametric and nonparametric Bayesian methods for modelling and how to use modern computational methods to summarize inferences using simulation. The book covers wide range of topics including objective and subjective Bayesian inferences with a variety of applications in modelling categorical, survival, spatial, spatiotemporal, Epidemiological, software reliability, small area and micro array data. The book concludes with a chapter on how to teach Bayesian thoughts to nonstatisticians. Critical thinking on causal effects

Objective Bayesian philosophy Nonparametric Bayesian methodology Simulation based computing techniques Bioinformatics and Biostatistics

The goal of this book is to publish the latest mathematical techniques, research, and developments in engineering. This book includes a comprehensive range of mathematics applied in engineering areas for different tasks. Various mathematical tools, techniques, strategies, and methods in engineering applications are covered in each chapter. Mathematical techniques are the strength of engineering sciences and form the common foundation of all novel disciplines within the field. Advanced Mathematical Techniques in Engineering Sciences provides an ample range of mathematical tools and techniques applied across various fields of engineering sciences. Using this book, engineers will gain a greater understanding of the practical applications of mathematics in engineering sciences. Features Covers the mathematical techniques applied in engineering sciences Focuses on the latest research in the field of engineering applications Provides insights on an international and transnational scale Offers new studies and research in modeling and simulation

The theory of marked point processes on the real line is of great and increasing importance in areas such as insurance mathematics, queuing theory and financial economics. However, the theory is often viewed as technically and conceptually difficult and has proved to be a block for PhD students looking to enter the area. This book gives an intuitive picture of the central concepts as well as the deeper results, while presenting the mathematical theory in a rigorous fashion and discussing applications in filtering theory and financial economics. Consequently, readers will get a deep understanding of the theory and how to use it. A number of exercises of differing levels of difficulty are included, providing opportunities to put new ideas into practice. Graduate students in mathematics, finance and economics will gain a good working knowledge of point-process theory, allowing them to progress to independent research.

Research has generated a number of advances in methods for spatial cluster modelling in recent years, particularly in the area of Bayesian cluster modelling. Along with these advances has come an explosion of interest in the potential applications of this work, especially in epidemiology and genome research. In one integrated volume, this book reviews the state-of-the-art in spatial clustering and spatial cluster modelling, bringing together research and applications previously scattered throughout the literature. It begins with an overview of the field, then presents a series of chapters that illuminate the nature and purpose of cluster modelling within different application areas, including astrophysics, epidemiology, ecology, and imaging. The focus then shifts to methods, with discussions on point and object process modelling, perfect sampling of cluster processes, partitioning in space and space-time, spatial and spatio-temporal process modelling, nonparametric methods for clustering, and spatio-temporal cluster modelling. Many figures, some in full color, complement the text, and a single section of references cited makes it easy to locate source material. Leading specialists in the field of cluster modelling authored each chapter, and an introduction by the editors to each chapter provides a cohesion not typically found in contributed works. Spatial Cluster Modelling thus offers a singular opportunity to explore this exciting new field, understand its techniques, and apply them in your own research.

Stochastic processes are found in probabilistic systems that evolve with time. Discrete stochastic processes change by only integer time steps (for some time scale), or are characterized by discrete occurrences at arbitrary times. Discrete Stochastic Processes helps the reader develop the understanding and intuition necessary to apply stochastic process theory in engineering, science and operations research. The book approaches the subject via many simple examples which build insight into the structure of stochastic processes and the general effect of these phenomena in real systems. The book presents mathematical ideas without recourse to measure theory, using only minimal mathematical analysis. In the proofs and explanations, clarity is favored over formal rigor, and simplicity over generality. Numerous examples are given to show how results fail to hold when all the conditions are not satisfied. Audience: An excellent textbook for a graduate level course in engineering and operations research. Also an invaluable reference for all those requiring a deeper understanding of the subject.

A limit order book is essentially a file on a computer that contains all orders sent to the market, along with their characteristics such as the sign of the order, price, quantity and a timestamp. The majority of organized electronic markets rely on limit order books to store the list of interests of market participants on their central computer. A limit order book contains all the information available on a specific market and it reflects the way the market moves under the influence of its participants. This book discusses several models of limit order books. It begins by discussing the data to assess their empirical properties, and then moves on to mathematical models in order to reproduce the observed properties. Finally, the book presents a framework for numerical simulations. It also covers important modelling techniques including agent-based modelling, and advanced modelling of limit order books based on Hawkes processes. The book also provides in-depth coverage of simulation techniques and introduces general, flexible, open source library concepts useful to readers studying trading strategies in order-driven markets.

Este libro de proceedings se edita para ponerlo a disposición de los asistentes a la Internacional Conference on Spatial Pont Process Modelling and its Applications (SPPA), realizada en Benicàssim en abril de 2004.

Stochastic processes are indispensable tools for development and research in signal and image processing, automatic control, oceanography, structural reliability, environmetrics, climatology, econometrics, and many other areas of science and engineering. Suitable for a one-semester course, Stationary Stochastic Processes for Scientists and Engineers teaches students how to use these processes efficiently. Carefully balancing mathematical rigor and ease of exposition, the book provides students with a sufficient understanding of the theory and a practical appreciation of how it is used in real-life situations. Special emphasis is on the interpretation of various statistical models and concepts as well as the types of questions statistical analysis can answer. The text first introduces numerous examples from signal processing, economics, and general natural sciences and technology. It then covers the estimation of mean value and covariance functions, properties of stationary Poisson processes, Fourier analysis of the covariance function (spectral analysis), and the Gaussian distribution. The book also focuses on input-output relations in linear filters, describes discrete-time auto-regressive and moving average processes, and explains how to solve linear stochastic differential equations. It concludes with frequency analysis and estimation of spectral densities. With a focus on model building and interpreting the statistical concepts, this classroom-tested book conveys a broad understanding of the mechanisms that generate stationary stochastic processes. By combining theory and applications, the text gives students a well-rounded introduction to these processes. To enable hands-on practice, MATLAB® code is available online.

While mapped data provide a common ground for discussions between the public, the media, regulatory agencies, and public health researchers, the analysis of spatially referenced data has experienced a phenomenal growth over the last two decades, thanks in part to the development of geographical information systems (GISs). This is the first thorough overview to integrate spatial statistics with data management and the display capabilities of GIS. It describes methods for assessing the likelihood of observed patterns and quantifying the link between exposures and outcomes in spatially correlated data. This introductory text is designed to serve as both an introduction for the novice and a reference for practitioners in the field Requires only minimal background in public health and only some knowledge of statistics through multiple regression Touches upon some advanced topics, such as random effects, hierarchical models and spatial point processes, but does not require prior exposure Includes lavish use of figures/illustrations throughout the volume as well as analyses of several data sets (in the form of "data breaks") Exercises based on data analyses reinforce concepts

This graduate-level textbook provides a straight-forward and mathematically rigorous introduction to the standard theory of point processes. The author's aim is to present an account which concentrates on the essentials and which places an emphasis on conveying an intuitive understanding of the subject. As a result, it provides a clear presentation of how statistical ideas can be viewed from this perspective and particular topics covered include the theory of extreme values and sampling from finite populations. Prerequisites are that the reader has a basic grounding in the mathematical theory of probability and statistics, but otherwise the book is self-contained. It arises from courses given by the author over a number of years and includes numerous exercises ranging from simple computations to more challenging explorations of ideas from the text.

This is the second volume of the reworked second edition of a key work on Point Process Theory. Fully revised and updated by the authors who have reworked their 1988 first edition, it brings together the basic theory of random measures and point processes in a unified setting and continues with the more theoretical topics of the first edition: limit theorems, ergodic theory, Palm theory, and evolutionary behaviour via martingales and conditional intensity. The very substantial new material in this second volume includes expanded discussions of marked point processes, convergence to equilibrium, and the structure of spatial point processes.

Estimates are found for the intensity function and other related parameters in a non-homogeneous Poisson process. Asymptotic results are also obtained.

New Bayesian approach helps you solve tough problems in signal processing with ease Signal processing is based on this fundamental concept—the extraction of critical information from noisy, uncertain data. Most techniques rely on underlying Gaussian assumptions for a solution, but what happens when these assumptions are erroneous? Bayesian techniques circumvent this limitation by offering a completely different approach that can easily incorporate non-Gaussian and nonlinear processes along with all of the usual methods currently available. This text enables readers to fully exploit the many advantages of the "Bayesian approach" to model-based signal processing. It clearly demonstrates the features of this powerful approach compared to the pure statistical methods found in other texts. Readers will discover how easily and effectively the Bayesian approach, coupled with the hierarchy of physics-based models developed throughout, can be applied to signal processing problems that previously seemed unsolvable. Bayesian Signal Processing features the latest generation of processors (particle filters) that have been enabled by the advent of high-speed/high-throughput computers. The Bayesian approach is uniformly developed in this book's algorithms, examples, applications, and case studies. Throughout this book, the emphasis is on nonlinear/non-Gaussian problems; however, some classical techniques (e.g. Kalman filters, unscented Kalman filters, Gaussian sums, grid-based filters, et al) are included to enable readers familiar with those methods to draw parallels between the two approaches. Special features include: Unified Bayesian treatment starting from the basics (Bayes's rule) to the more advanced (Monte Carlo sampling), evolving to the next-generation techniques (sequential Monte Carlo sampling) Incorporates "classical" Kalman filtering for linear, linearized, and nonlinear systems; "modern" unscented Kalman filters; and the "next-generation" Bayesian particle filters Examples illustrate how theory can be applied directly to a variety of processing problems Case studies demonstrate how the Bayesian approach solves real-world problems in practice MATLAB notes at the end of each chapter help readers solve complex problems using readily available software commands and point out software packages available Problem sets test readers' knowledge and help them put their new skills into practice The basic Bayesian approach is emphasized throughout this text in order to enable the processor to rethink the approach to formulating and solving signal processing problems from the Bayesian perspective. This text brings readers from the classical methods of model-based signal processing to the next generation of processors that will clearly dominate the future of signal processing for years to come. With its many illustrations demonstrating the applicability of the Bayesian approach to real-world problems in signal processing, this text is essential for all students, scientists, and engineers who investigate and apply signal processing to their everyday problems.

Nonparametric statistics has probably become the leading methodology for researchers performing data analysis. It is nevertheless true that, whereas these methods have already proved highly effective in other applied areas of knowledge such as biostatistics or social sciences, nonparametric analyses in reliability currently form an interesting area of study that has not yet been fully explored. Applied Nonparametric Statistics in Reliability is focused on the use of modern statistical methods for the estimation of dependability measures of reliability systems that operate under different conditions. The scope of the book includes: smooth estimation of the reliability function and hazard rate of nonrepairable systems; study of stochastic processes for modelling the time evolution of systems when imperfect repairs are performed; nonparametric analysis of discrete and continuous time semi-Markov processes; isotonic regression analysis of the structure function of a reliability system, and lifetime regression analysis. Besides the explanation of the mathematical background, several numerical computations or simulations are presented as illustrative examples. The corresponding computer-based methods have been implemented using R and MATLAB®. A concrete modelling scheme is chosen for each practical situation and, in consequence, a nonparametric inference procedure is conducted. Applied Nonparametric Statistics in Reliability will serve the practical needs of scientists (statisticians and engineers) working on applied reliability subjects.

Statistical Methods for Spatio-Temporal Systems presents current statistical research issues on spatio-temporal data modeling and will promote advances in research and a greater understanding between the mechanistic and the statistical modeling communities. Contributed by leading researchers in the field, each self-contained chapter starts with an introduction of the topic and progresses to recent research results. Presenting specific examples of epidemic data of bovine tuberculosis, gastroenteric disease, and the U.K. foot-and-mouth outbreak, the first chapter uses stochastic models, such as point process models, to provide the probabilistic backbone that facilitates statistical inference from data. The next chapter discusses the critical issue of modeling random growth objects in diverse biological systems, such as bacteria colonies, tumors, and plant populations. The subsequent chapter examines data transformation tools using examples from ecology and air quality data, followed by a chapter on space-time covariance functions. The contributors then describe stochastic and statistical models that are used to generate simulated rainfall sequences for hydrological use, such as flood risk assessment. The final chapter explores Gaussian Markov random field specifications and Bayesian computational inference via Gibbs sampling and Markov chain Monte Carlo, illustrating the methods with a variety of data examples, such as temperature surfaces, dioxin concentrations, ozone concentrations, and a well-established deterministic dynamical weather model.

In various scientific and industrial fields, stochastic simulations are taking on a new importance. This is due to the increasing power of computers and practitioners’ aim to simulate more and more complex systems, and thus use random parameters as well as random noises to model the parametric uncertainties and the lack of knowledge on the physics of these systems. The error analysis of these computations is a highly complex mathematical undertaking. Approaching these issues, the authors present stochastic numerical methods and prove accurate convergence rate estimates in terms of their numerical parameters (number of simulations, time discretization steps). As a result, the book is a self-contained and rigorous study of the numerical methods within a theoretical framework. After briefly reviewing the basics, the authors first introduce fundamental notions in stochastic calculus and continuous-time martingale theory, then develop the analysis of pure-jump Markov processes, Poisson processes, and stochastic differential equations. In particular, they review the essential properties of Itô integrals and prove fundamental results on the probabilistic analysis of parabolic partial differential equations. These results in turn provide the basis for developing stochastic numerical methods, both from an algorithmic and theoretical point of view. The book combines advanced mathematical tools, theoretical analysis of stochastic numerical methods, and practical issues at a high level, so as to provide optimal results on the accuracy of Monte Carlo simulations of stochastic processes. It is intended for master and Ph.D. students in the field of stochastic processes and their numerical applications, as well as for physicists, biologists, economists and other professionals working with stochastic simulations, who will benefit from the ability to reliably estimate and control the accuracy of their simulations.

This paper considers an estimation problem involving n independent Poisson processes such that the i-th process has intensity function lambda (intensity)(t) = delta (intensity) p(t; alpha). It is of interest to estimate p(t; alpha). Two estimation procedures are developed, one using the exact arrival times of observations, the second using categorical arrival times of observations. Two specific instances of p(t), an exponential and a bilinear form are investigated further. An example applying the methodology to the active life of a judicial opinion is described. (Author).

To date, Mixed Poisson processes have been studied by scientists primarily interested in either insurance mathematics or point processes. Work in one area has often been carried out without knowledge of the other area. Mixed Poisson Processes is the first book to combine and concentrate on these two themes, and to distinguish between the notions of distributions and processes. The first part of the text gives special emphasis to the estimation of the underlying intensity, thinning, infinite divisibility, and reliability properties. The second part is, to a greater extent, based on Lundberg's thesis.

This e-book is the product of Project Euclid and its mission to advance scholarly communication in the field of theoretical and applied mathematics and statistics. Project Euclid was developed and deployed by the Cornell University Library and is jointly managed by Cornell and the Duke University Press.

"Poisson Point Processes provides an overview of non-homogeneous and multidimensional Poisson point processes and their numerous applications. Readers will find constructive mathematical tools and applications ranging from emission and transmission computed tomography to multiple target tracking and distributed sensor detection, written from an engineering perspective. A valuable discussion of the basic properties of finite random sets is included. Maximum likelihood estimation techniques are discussed for several parametric forms of the intensity function, including Gaussian sums, together with their Cramer-Rao bounds. These methods are then used to investigate: -Several medical imaging techniques, including positron emission tomography (PET), single photon emission computed tomography (SPECT), and transmission tomography (CT scans) -Various multi-target and multi-sensor tracking applications, -Practical applications in areas like distributed sensing and detection, -Related finite point processes such as marked processes, hard core processes, cluster processes, and doubly stochastic processes, Perfect for researchers, engineers and graduate students working in electrical engineering and computer science, Poisson Point Processes will prove to be an extremely valuable volume for those seeking insight into the nature of these processes and their diverse applications.

An extensive update to a classic text Stochastic geometry and spatial statistics play a fundamental role in many modern branches of physics, materials sciences, engineering, biology and environmental sciences. They offer successful models for the description of random two- and three-dimensional micro and macro structures and statistical methods for their analysis. The previous edition of this book has served as the key reference in its field for over 18 years and is regarded as the best treatment of the subject of stochastic geometry, both as a subject with vital applications to spatial statistics and as a very interesting field of mathematics in its own right. This edition: Presents a wealth of models for spatial patterns and related statistical methods. Provides a great survey of the modern theory of random tessellations, including many new models that became tractable only in the last few years. Includes new sections on random networks and random graphs to review the recent ever growing interest in these areas. Provides an excellent introduction to theory and modelling of point processes, which covers some very latest developments. Illustrate the forefront theory of random sets, with many applications. Adds new results to the discussion of fibre and surface processes. Offers an updated collection of useful stereological methods. Includes 700 new references. Is written in an accessible style enabling non-mathematicians to benefit from this book. Provides a companion website hosting information on recent developments in the field www.wiley.com/go/cskm Stochastic Geometry and its Applications is ideally suited for researchers in physics, materials science, biology and ecological sciences as well as mathematicians and statisticians. It should also serve as a valuable introduction to the subject for students of mathematics and statistics.

Offering a rich diversity of models, Bayesian phylogenetics allows evolutionary biologists, systematists, ecologists, and epidemiologists to obtain answers to very detailed phylogenetic questions. Suitable for graduate-level researchers in statistics and biology, Bayesian Phylogenetics: Methods, Algorithms, and Applications presents a snapshot of current trends in Bayesian phylogenetic research. Encouraging interdisciplinary research, this book introduces state-of-the-art phylogenetics to the Bayesian statistical community and, likewise, presents state-of-the-art Bayesian statistics to the phylogenetics community. The book emphasizes model selection, reflecting recent interest in accurately estimating marginal likelihoods. It also discusses new approaches to improve mixing in Bayesian phylogenetic analyses in which the tree topology varies. In addition, the book covers divergence time estimation, biologically realistic models, and the burgeoning interface between phylogenetics and population genetics.