Poisson Point Processes And Their Application To Markov Processes Springerbriefs In Probability And Mathematical Statistics

This text on stochastic processes and their applications is based on a set of lectures given during the past several years at the University of California, Santa Barbara (UCSB). It is an introductory graduate course designed for classroom purposes. Its objective is to provide graduate students of statistics with an overview of some basic methods and techniques in the

theory of stochastic processes. The only prerequisites are some rudiments of measure and integration theory and an intermediate course in probability theory. There are more than 50 examples and applications and 243 problems and complements which appear at the end of each chapter. The book consists of 10 chapters. Basic concepts and definitions are pro vided in Chapter 1. This chapter also contains a number of motivating ex amples and applications illustrating the practical use of the concepts. The last five sections are devoted to topics such as separability, continuity, and measurability of random processes, which are discussed in some detail. The concept of a simple point

process on R+ is introduced in Chapter 2. Using the coupling inequality and Le Cam's lemma, it is shown that if its counting function is stochastically continuous and has independent increments, the point process is Poisson. When the counting function is Markovian, the sequence of arrival times is also a Markov process. Some related topics such as independent thinning and marked point processes are also discussed. In the final section, an application of these results to flood modeling is presented. Mathematically rigorous exposition of the basic theory of marked point processes and piecewise deterministic stochastic processes Point processes are constructed

from scratch with detailed proofs Includes applications with examples and exercises in survival analysis, branching processes, ruin probabilities, sports (soccer), finance and risk management, and queueing theory Accessible to a wider cross-disciplinary audience

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 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.

An Introduction with Applications

A Comprehensive Course

An Introduction to the Theory of Point Processes

Zeros of Gaussian Analytic Functions and Determinantal Point Processes

Foundations and Applications to Vehicular Networks

Stochastic geometry is the branch of mathematics that studies geometric structures associated with random configurations, such as random graphs, tilings and mosaics. Due to its close ties with stereology and spatial statistics, the results in this area are relevant for a large number of

important applications, e.g. to the mathematical modeling and statistical analysis of telecommunication networks, geostatistics and image analysis. In recent years – due mainly to the impetus of the authors and their collaborators – a powerful connection has been established between stochastic geometry and the Malliavin calculus of variations, which is a collection of probabilistic techniques based on the properties of infinite-dimensional differential operators. This has led in particular to the discovery of a large number of new quantitative limit theorems for high-dimensional geometric objects. This unique book presents an organic collection of authoritative surveys written by the principal actors in this rapidly evolving field, offering a rigorous yet lively presentation of its many facets.

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Stochastic processes are mathematical models of random phenomena that evolve according to prescribed dynamics. Processes commonly used in applications are Markov chains in discrete and continuous time, renewal and regenerative processes, Poisson processes, and Brownian motion. This volume gives an in-depth description of the structure and basic properties of these stochastic processes. A main focus is on equilibrium distributions, strong laws of large numbers, and ordinary and functional central limit theorems for cost and performance parameters. Although these results differ for various processes, they have a common trait of being limit theorems for processes with regenerative

increments. Extensive examples and exercises show how to formulate stochastic models of systems as functions of a system's data and dynamics, and how to represent and analyze cost and performance measures. Topics include stochastic networks, spatial and space-time Poisson processes, queueing, reversible processes, simulation, Brownian approximations, and varied Markovian models. The technical level of the volume is between that of introductory texts that focus on highlights of applied stochastic processes, and advanced texts that focus on theoretical aspects of processes.

Stochastic Geometry is the mathematical discipline which studies mathematical models for random geometric structures. This book collects lectures presented at the CIME

summer school in Martina Franca in September 2004. The main lecturers covered Spatial Statistics, Random Points, Integral Geometry and Random Sets. These are complemented by two additional contributions on Random Mosaics and Crystallization Processes. The book presents a comprehensive and up-to-date description of important aspects of Stochastic Geometry.

Marked Point Processes on the Real Line

Spatial Point Patterns

Limit Order Books

Basics of Applied Stochastic Processes

Stochastic Geometry and Wireless Networks

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.

A modern introduction to the Poisson process,

with general point processes and random measures, and applications to stochastic geometry.

An extension problem (often called a boundary problem) of Markov processes has been studied, particularly in the case of one-dimensional diffusion processes, by W. Feller, K. Itô, and H. P. McKean, among others. In this book, Itô discussed a case of a general Markov process with state space S and a specified point a ∈ S called a boundary. The problem is to obtain all possible recurrent extensions of a given minimal process (i.e., the process on S \ {a} which is absorbed on

reaching the boundary a). The study in this lecture is restricted to a simpler case of the boundary a being a discontinuous entrance point, leaving a more general case of a continuous entrance point to future works. He established a one-to-one correspondence between a recurrent extension and a pair of a positive measure k(db) on S \ {a} (called the jumping-in measure and a non-negative number m

This volume bears on wireless network modeling and performance analysis. The aim is to show how stochastic geometry can be used in a more or less systematic way to analyze the phenomena

that arise in this context. It first focuses on medium access control mechanisms used in ad hoc networks and in cellular networks. It then discusses the use of stochastic geometry for the quantitative analysis of routing algorithms in mobile ad hoc networks. The appendix also contains a concise summary of wireless communication principles and of the network architectures considered in the two volumes. Lectures given at the C.I.M.E. Summer School held in Martina Franca, Italy, September 13-18, 2004

Point Processes

Statistical Inference and Simulation for Spatial Point Processes

Shocks and Repairable Systems

Point Processes and Their Statistical Inference

Focusing on the theory and applications of point processes, Point Processes for Reliability Analysis naturally combines classical results on the basic and advanced properties of point processes with recent theoretical findings of the authors. It also presents numerous examples that illustrate how general results and approaches are applied to stochastic description of repairable systems and systems operating in a random environment modelled by shock processes. The real life objects are operating in a changing, random environment. One of the ways to model an impact of this

environment is via the external shocks occurring in accordance with some stochastic point processes. The Poisson (homogeneous and nonhomogeneous) process, the renewal process and their generalizations are considered as models for external shocks affecting an operating system. At the same time these processes model the consecutive failure/repair times of repairable engineering systems. Perfect, minimal and intermediate (imperfect) repairs are discussed in this respect. Covering material previously available only in the journal literature, Point Processes for Reliability Analysis provides a survey of recent developments in this area which will be invaluable to researchers and advanced students in reliability engineering and applied mathematics.

This book provides an introduction to the theory and applications of point processes, both in time and in space. Presenting the two

components of point process calculus, the martingale calculus and the Palm calculus, it aims to develop the computational skills needed for the study of stochastic models involving point processes, providing enough of the general theory for the reader to reach a technical level sufficient for most applications. Classical and not-so-classical models are examined in detail, including Poisson–Cox, renewal, cluster and branching (Kerstan–Hawkes) point processes.The applications covered in this text (queueing, information theory, stochastic geometry and signal analysis) have been chosen not only for their intrinsic interest but also because they illustrate the theory. Written in a rigorous but not overly abstract style, the book will be accessible to earnest beginners with a basic training in probability but will also interest upper graduate students and experienced researchers.

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.
An integrated approach to fractals and point processes This publication provides a complete and integrated presentation ofthe fields of fractals and point processes, from definitions andmeasures to analysis and estimation. The authors skillfullydemonstrate how fractal-based point processes, established as theintersection of these two fields, are tremendously useful forrepresenting and describing a wide variety of diverse phenomena inthe physical and biological sciences. Topics range frominformation-packet arrivals on a computer network toaction-potential occurrences in a neural preparation. The authors begin with concrete and key examples of fractals andpoint processes, followed by an introduction to fractals

and chaos.Point processes are defined, and a collection of characterizingmeasures are presented. With the concepts of fractals and pointprocesses thoroughly explored, the authors move on to integrate thetwo fields of study. Mathematical formulations for severalimportant fractal-based point-process families are provided, aswell as an explanation of how various operations modify suchprocesses. The authors also examine analysis and estimationtechniques suitable for these processes. Finally, computer networktraffic, an important application used to illustrate the variousapproaches and models set forth in earlier chapters, isdiscussed. Throughout the presentation, readers are exposed to a number ofimportant applications that are examined with the aid of a set ofpoint processes drawn from biological signals and computer networktraffic. Problems are provided at the end of each chapter

allowingreaders to put their newfound knowledge into practice, and allsolutions are provided in an appendix. An accompanying Web sitefeatures links to supplementary materials and tools to assist withdata analysis and simulation. With its focus on applications and numerous solved problem sets,this is an excellent graduate-level text for courses in suchdiverse fields as statistics, physics, engineering, computerscience, psychology, and neuroscience.

Markov Point Processes and Their Applications

An Introduction to Stochastic Processes and Their Applications

Poisson Point Processes

Probability Theory

Malliavin Calculus, Wiener-Itô Chaos Expansions and Stochastic Geometry

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.

This graduate-level textbook provides a straightforward 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 book is a revision of Random Point Processes written by D. L. Snyder and published by John Wiley and Sons in 1975. More emphasis is given to point processes on multidimensional spaces, especially to pro cesses in two dimensions. This reflects the tremendous increase that has taken place in the use of point-process models for the description of data from which images of objects of interest are formed in a wide variety of scientific and engineering

disciplines. A new chapter, Translated Poisson Processes, has been added, and several of the chapters of the fIrst edition have been modifled to accommodate this new material. Some parts of the fIrst edition have been deleted to make room. Chapter 7 of the fIrst edition, which was about general marked point-processes, has been eliminated, but much of the material appears elsewhere in the new text. With some re luctance, we concluded it necessary to eliminate the topic of hypothesis testing for point-process models. Much of the material of the fIrst edition was motivated by the

use of point-process models in applications at the Biomedical Computer Labo ratory of Washington University, as is evident from the following excerpt from the Preface to the first edition. "It was Jerome R. Cox, Jr. , founder and [1974] director of Washington University's Biomedical Computer Laboratory, who ftrst interested me [D. L. S.
In the theory of random processes there are two that are fundamental, and occur over and over again, often in surprising ways. There is a real sense in which the deepest results are concerned with their interplay. One, the Bachelier Wiener model of

Brownian motion, has been the subject of many books. The other, the Poisson process, seems at first sight humbler and less worthy of study in its own right. Nearly every book mentions it, but most hurry past to more general point processes or Markov chains. This comparative neglect is ill judged, and stems from a lack of perception of the real importance of the Poisson process. This distortion partly comes about from a restriction to one dimension, while the theory becomes more natural in more general context. This book attempts to redress the balance. It records Kingman's fascination with

the beauty and wide applicability of Poisson processes in one or more dimensions. The mathematical theory is powerful, and a few key results often produce surprising consequences.

Lectures on the Poisson Process

Stochastic Geometry

Mixed Poisson Processes

Case Studies in Spatial Point Process Modeling

Stochastic Analysis for Poisson Point Processes

Spatial point processes are mathematical models used to describe and analyse the geometrical structure

of patterns formed by objects that are irregularly or randomly distributed in one-, two- or three-dimensional space. Examples include locations of trees in a forest, blood particles on a glass plate, galaxies in the universe, and particle centres in samples of material. Numerous aspects of the nature of a specific spatial point pattern may be described using the appropriate statistical methods. Statistical Analysis and Modelling of

Spatial Point Patterns provides a practical guide to the use of these specialised methods. The application-oriented approach helps demonstrate the benefits of this increasingly popular branch of statistics to a broad audience. The book: Provides an introduction to spatial point patterns for researchers across numerous areas of application Adopts an extremely accessible style, allowing the non-statistician complete understanding

Describes the process of extracting knowledge from the data, emphasising the marked point process Demonstrates the analysis of complex datasets, using applied examples from areas including biology, forestry, and materials science Features a supplementary website containing example datasets. Statistical Analysis and Modelling of Spatial Point Patterns is ideally suited for researchers in the many areas of application, including

environmental statistics, ecology, physics, materials science, geostatistics, and biology. It is also suitable for students of statistics, mathematics, computer science, biology and geoinformatics.

"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.

This book gives a self-contained introduction to the dynamic martingale approach to marked point processes

(MPP). Based on the notion of a compensator, this approach gives a versatile tool for analyzing and describing the stochastic properties of an MPP. In particular, the authors discuss the relationship of an MPP to its compensator and particular classes of MPP are studied in great detail. The theory is applied to study properties of dependent marking and thinning, to prove results on absolute continuity of point process distributions, to

establish sufficient conditions for stochastic ordering between point and jump processes, and to solve the filtering problem for certain classes of MPPs.

This book provides a comprehensive treatment of the Poisson line Cox process (PLCP) and its applications to vehicular networks. The PLCP is constructed by placing points on each line of a Poisson line process (PLP) as per an independent Poisson point

process (PPP). For vehicular applications, one can imagine the layout of the road network as a PLP and the vehicles on the roads as the points of the PLCP. First, a brief historical account of the evolution of the theory of PLP is provided to familiarize readers with the seminal contributions in this area. In order to provide a self-contained treatment of this topic, the construction and key fundamental properties of both PLP and PLCP are

discussed in detail. The rest of the book is devoted to the applications of these models to a variety of wireless networks, including vehicular communication networks and localization networks. Specifically, modeling the locations of vehicular nodes and roadside units (RSUs) using PLCP, the signal-to-interference-plus-noise ratio (SINR)-based coverage analysis is presented for both ad hoc and cellular network models. For a similar setting,

the load on the cellular macro base stations (MBSs) and RSUs in a vehicular network is also characterized analytically. For the localization networks, PLP is used to model blockages, which is shown to facilitate the characterization of asymptotic blind spot probability in a localization application. Finally, the path distance characteristics for a special case of PLCP are analyzed, which can be leveraged to answer

critical questions in the areas of transportation networks and urban planning. The book is concluded with concrete suggestions on future directions of research. Based largely on the original research of the authors, this is the first book that specifically focuses on the self-contained mathematical treatment of the PLCP. The ideal audience of this book is graduate students as well as researchers in academia and industry

who are familiar with probability theory, have some exposure to point processes, and are interested in the field of stochastic geometry and vehicular networks. Given the diverse backgrounds of the potential readers, the focus has been on providing an accessible and pedagogical treatment of this topic by consciously avoiding the measure theoretic details without compromising mathematical rigor.

Stochastic Point Processes

Poisson Line Cox Process

Poisson Processes

Marked Point and Piecewise

Deterministic Processes

Random Point Processes in Time and

Space

"Offers a mathematical introduction to non-life insurance and, at the same time, to a multitude of applied stochastic processes. It gives detailed discussions of the fundamental models for claim sizes, claim arrivals, the total claim amount, and their probabilistic properties....The reader gets to know how

the underlying probabilistic structures allow one to determine premiums in a portfolio or in an individual policy." --Zentralblatt für Didaktik der Mathematik
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.

Stochastic Point Processes are interesting from many points of view. From and abstract point of view, point process is a simple version of random measure; these

processes have acquired importance mainly due their viability in modeling a variety of phenomena spanning physical, biological, economic and engineering sciences. This volume with contributions from leading probabilists contains, besides surveys on the state-of-art of the theory, papers dealing with problems of queues, inventory, reliability and population evolution. There are also papers dealing with practical aspects like statistical inference and nonlinear filtering. The book will be of interest to a wide spectrum of people including those working in the area of operations research, signal processing, electrical

communications & control and neural network.
There has been much recent research on the theory of point processes, i.e., on random systems consisting of point events occurring in space or time. Applications range from emissions from a radioactive source, occurrences of accidents or machine breakdowns, or of electrical impluses along nerve fibres, to repetitive point events in an individual's medical or social history. Sometimes the point events occur in space rather than time and the application here raneg from statistical physics to geography. The object of this book is to develop the applied mathemathics of point

processes at a level which will make the ideas accessible both to the research worker and the postgraduate student in probability and statistics and also to the mathemathically inclined individual in another field interested in using ideas and results. A thorough knowledge of the key notions of elementary probability theory is required to understand the book, but specialised "pure mathematical" coniderations have been avoided.

Single Molecule Biophysics and Poisson Process Approach to Statistical Mechanics

Methodology and Applications with R

Statistical Inference for Spatial Poisson Processes
An Introduction with Finance Applications
Extreme Values, Regular Variation and Point Processes

Spatial point processes play a fundamental role in spatial statistics and today they are an active area of research with many new applications. Although other published works address different aspects of spatial point processes, most of the classical literature deals only with nonparametric methods, and a thorough treatment of the theory and applications of simulation-based inference is difficult to find. Written by researchers at the top of the field, this book collects and unifies recent theoretical advances and examples of applications. The authors examine Markov chain Monte Carlo

algorithms and explore one of the most important recent developments in MCMC: perfect simulation procedures.

This book examines the fundamental mathematical and stochastic process techniques needed to study the behavior of extreme values of phenomena based on independent and identically distributed random variables and vectors. It emphasizes the core primacy of three topics necessary for understanding extremes: the analytical theory of regularly varying functions; the probabilistic theory of point processes and random measures; and the link to asymptotic distribution approximations provided by the theory of weak convergence of probability measures in metric spaces.

This is an overview of single molecule physics, the study of both equilibrium and non-equilibrium properties at the single molecule level. It begins with an introduction to this fascinating science and

includes a chapter on how to build the most popular instrument for single molecule biophysics, the total internal reflection fluorescence (TIRF) microscope. It concludes with the Poisson process approach to statistical mechanics, explaining how to relate the process to diverse areas and see how data analysis and error bars are integral parts of science.

Point process statistics is successfully used in fields such as material science, human epidemiology, social sciences, animal epidemiology, biology, and seismology. Its further application depends greatly on good software and instructive case studies that show the way to successful work. This book satisfies this need by a presentation of the spatstat package and many statistical examples. Researchers, spatial statisticians and scientists from biology, geosciences, materials sciences and other fields will use this book as

a helpful guide to the application of point process statistics. No other book presents so many well-founded point process case studies. From the reviews: "For those interested in analyzing their spatial data, the wide variatey of examples and approaches here give a good idea of the possibilities and suggest reasonable paths to explore." Michael Sherman for the Journal of the American Statistical Association, December 2006

Discrete Stochastic Processes

Poisson Point Processes and Their Application to Markov Processes

The Dynamical Approach

Imaging, Tracking, and Sensing

Point Processes and Jump Diffusions

These days, an increasing amount of information can be

obtained in graphical forms, such as weather maps, soil samples, locations of nests in a breeding colony, microscopical slices, satellite images, radar or medical scans and X-ray techniques. “High level” image analysis is concerned with the global interpretation of images, attempting to reduce it to a compact description of the salient features of the scene. This book takes a stochastic approach. It studies Markov object processes, showing that they form a flexible class of models for a range of problems involving the interpretation of spatial data. Applications can be found in statistical physics (under the name of “Gibbs processes”), environmental mapping of

diseases, forestry, identification of ore structure in materials science, signal analysis, object recognition, robot vision, and interpretation of images from medical scans or confocal microscopy. Contents:Point Processes:Definitions and NotationSimple Point ProcessesFinite Point ProcessesMarkov Point Processes:Ripley–Kelly Markov Point ProcessesThe Hammersley–Clifford TheoremMarkov Marked Point ProcessesStatistics Inference:The Metropolis–Hastings AlgorithmConditional SimulationSpatial Birth-and-Death ProcessesApplications:Modelling Spatial PatternsPairwise Interaction ProcessesArea-Interaction Processesand other

papers Readership: Undergraduate and postgraduate students; a reference book for researchers in probability & statistics, or engineers interested in spatial data and image analysis. Keywords:Conditional Intensity;Gibbs Process;Interaction Modelling;Markov Point Process;Spatial Statistics;Spatial Inference;Stochastic Geometry;Marked Point Process;Markov Chain Monte CarloReviews:“The book is remarkable by the amount of the material covered and excellent readability … It is highly recommended as the first comprehensive text that covers various concepts related to Markov point processes and typically scattered in the journal

literature."Mathematical Reviews

Stochastic point processes are sets of randomly located points in time, on the plane or in some general space. This book provides a general introduction to the theory, starting with simple examples and an historical overview, and proceeding to the general theory. It thoroughly covers recent work in a broad historical perspective in an attempt to provide a wider audience with insights into recent theoretical developments. It contains numerous examples and exercises. This book aims to bridge the gap between informal treatments concerned with applications and highly abstract theoretical treatments.

Modern Statistical Methodology and Software for Analyzing Spatial Point PatternsSpatial Point Patterns: Methodology and Applications with R shows scientific researchers and applied statisticians from a wide range of fields how to analyze their spatial point pattern data. Making the techniques accessible to non-mathematicians, the authors draw on th

The book examines in some depth two important classes of point processes, determinantal processes and ``Gaussian zeros'', i.e., zeros of random analytic functions with Gaussian coefficients. These processes share a property of ``point-repulsion'', where distinct points are less likely to

fall close to each other than in processes, such as the Poisson process, that arise from independent sampling. Nevertheless, the treatment in the book emphasizes the use of independence: for random power series, the independence of coefficients is key; for determinantal processes, the number of points in a domain is a sum of independent indicators, and this yields a satisfying explanation of the central limit theorem (CLT) for this point count. Another unifying theme of the book is invariance of considered point processes under natural transformation groups. The book strives for balance between general theory and concrete examples. On the one

hand, it presents a primer on modern techniques on the interface of probability and analysis. On the other hand, a wealth of determinantal processes of intrinsic interest are analyzed; these arise from random spanning trees and eigenvalues of random matrices, as well as from special power series with determinantal zeros. The material in the book formed the basis of a graduate course given at the IAS-Park City Summer School in 2007; the only background knowledge assumed can be acquired in first-year graduate courses in analysis and probability.

Point Process Theory and Applications

Functionals of Poisson Point Processes

Random Point Processes

Statistical Analysis and Modelling of Spatial Point Patterns

An Introduction with the Poisson Process