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KEY=MARKOV - PRESTON LARSON

Approximating Countable Markov Chains

Springer Science & Business Media A long time ago I started writing a book about Markov chains, Brownian motion, and diffusion. I soon had two hundred pages of manuscript and my publisher was enthusiastic. Some years and several drafts later, I had a thousand pages of manuscript, and my publisher was less enthusiastic. So we made it a trilogy: Markov Chains Brownian Motion and Diffusion Approximating Countable Markov Chains familiarly - MC, B & D, and ACM. I wrote the first two books for beginning graduate students with some knowledge of probability; if you can follow Sections 10.4 to 10.9 of Markov Chains, you're in. The first two books are quite independent of one another, and completely independent of this one, which is a monograph explaining one way to think about chains with instantaneous states. The results here are supposed to be new, except when there are specific disclaimers. It's written in the framework of Markov chains; we wanted to reprint in this volume the MC chapters needed for reference. but this proved impossible. Most of the proofs in the trilogy are new, and I tried hard to make them explicit. The old ones were often elegant, but I seldom saw what made them go. With my own, I can sometimes show you why things work. And, as I will argue in a minute, my demonstrations are easier technically. If I wrote them down well enough, you may come to agree.

Approximating Countable Markov Chains

The book, part of a trilogy covering the field of Markov processes, explains one method of approximating countable Markov chains by finite ones. Intended for use in seminars with advanced graduate students, it is written in the framework of the first book in the trilogy, Markov Chains, although it is completely independent of the second, Brownian Motion and Diffusion. The idea is to skip over the times at which the chain is outside some large, finite set of states. The technique is especially useful for dealing with instantaneous states. Many of the results are original. (Author).

Markov Chains

Springer Science & Business Media A long time ago I started writing a book about Markov chains, Brownian motion, and diffusion. I soon had two hundred pages of manuscript and my publisher was enthusiastic. Some years and several drafts later, I had a thousand pages of manuscript, and my publisher was less enthusiastic. So we made it a trilogy: Markov Chains Brownian Motion and Diffusion Approximating Countable Markov Chains familiarly - MC, B & D, and ACM. I wrote the first two books for beginning graduate students with some knowledge of probability; if you can follow Sections 10.4 to 10.9 of Markov Chains you're in. The first two books are quite independent of one another, and completely independent of the third. This last book is a monograph which explains one way to think about chains with instantaneous states. The results in it are supposed to be new, except where there are specific disclaim ers; it's written in the framework of Markov Chains. Most of the proofs in the trilogy are new, and I tried hard to make them explicit. The old ones were often elegant, but I seldom saw what made them go. With my own, I can sometimes show you why things work. And, as I will VB1 PREFACE argue in a minute, my demonstrations are easier technically. If I wrote them down well enough, you may come to agree.

Brownian Motion and Diffusion

Springer Science & Business Media A long time ago I started writing a book about Markov chains, Brownian motion, and diffusion. I soon had two hundred pages of manuscript and my publisher was enthusiastic. Some years and several drafts later, I had a thot:sand pages of manuscript, and my publisher was less enthusiastic. So we made it a trilogy: Markov Chains Brownian Motion and Diffusion Approximating Countable Markov Chains familiarly - Me, B & D, and ACM. I wrote the first two books for beginning graduate students with some knowledge of probability; if you can follow Sections 3.4 to 3.9 of Brownian Motion and Diffusion you're in. The first two books are quite independent of one another, and completely independent of the third. This last book is a monograph, which explains one way to think about chains with instantaneous states. The results in it are supposed to be new, except where there are spe cific disclaimers; it's written in the framework of Markov Chains. Most of the proofs in the trilogy are new, and I tried hard to make them explicit. The old ones were often elegant, but I seldom saw what made them go. With my own, I can sometimes show you why things work. And, as I will argue in a minute, my demonstrations are easier technically. If I wrote them down well enough, you may come to agree.

Continuous-Time Markov Chains and Applications

A Singular Perturbation Approach

Springer Using a singular perturbation approach, this is a systematic treatment of those systems that naturally arise in queuing theory, control and optimisation, and manufacturing, gathering a number of ideas which were previously scattered throughout the literature. The book presents results on asymptotic expansions of the corresponding probability distributions, functional occupation measures, exponential upper bounds, and asymptotic normality. To bridge the gap between theory and applications, a large portion of the book is devoted to various applications, thus reducing the dimensionality for problems under Markovian disturbances and providing tools for dealing with large-scale and complex real-world situations. Much of this stems from the authors'recent research, presenting results which have not appeared elsewhere. An important reference for researchers in applied mathematics, probability and stochastic processes, operations research, control theory, and optimisation.

Continuous-Time Markov Chains

An Applications-Oriented Approach

Springer Science & Business Media Continuous time parameter Markov chains have been useful for modeling various random phenomena occurring in queueing theory, genetics, demography, epidemiology, and competing populations. This is the first book about those aspects of the theory of continuous time Markov chains which are useful in applications to such areas. It studies continuous time Markov chains through the transition function and corresponding q-matrix, rather than sample paths. An extensive discussion of birth and death processes, including the Stieltjes moment problem, and the Karlin-McGregor method of solution of the birth and death processes and multidimensional population processes is included, and there is an extensive bibliography. Virtually all of this material is appearing in book form for the first time.

Selected Works of A. N. Kolmogorov

Volume II Probability Theory and Mathematical Statistics

Springer Science & Business Media lEt moi •...• si j'avait so comment en revenir, One service mathematics has rendered the je n'y serais point alle:' human race. It has put common sense back Ju1e. Veme where it belongs, 01\ the topmost shelf next to the dUlty canister labelled 'discarded non- Tbe series is divergent; therefore we may be sense'. able to do something with it. Erie T. Bell O. Heaviside Mathematics is a tool for thought. A highly necessary tool in a world where both feedback and non linearities abound. Similarly, all kinds of parts of mathematics serve as tools for other parts and for other sciences. Applying a simple reweiting rule to the quote on the right above one finds such statements as: 'One service topology has rendered mathematical physics .. .'; 'One service logic has rendered com puter science .. .'; 'One service category theory has rendered mathematics .. .'. All arguably true. And all statements obtainable this way form part of the raison d'tftre of this series.

Technological Developments in Networking, Education and Automation

Springer Science & Business Media Technological Developments in Networking, Education and Automation includes a set of rigorously reviewed world-class manuscripts addressing and detailing state-of-the-art research projects in the following areas: Computer Networks: Access Technologies, Medium Access Control, Network architectures and Equipment, Optical Networks and Switching, Telecommunication Technology, and Ultra Wideband Communications. Engineering Education and Online Learning: including development of courses and systems for engineering, technical and liberal studies programs; online laboratories; intelligent testing using fuzzy logic; taxonomy of e-courses; and evaluation of online courses. Pedagogy: including benchmarking; group-learning; active learning; teaching of multiple subjects together; ontology; and knowledge management. Instruction Technology: including internet textbooks; virtual reality labs, instructional design, virtual models, pedagogy-oriented markup languages; graphic design possibilities; open source classroom management software; automatic email response systems; tablet-pcs; personalization using web mining technology; intelligent digital chalkboards; virtual room concepts for cooperative scientific work; and network technologies, management, and architecture. Coding and Modulation: Modeling and Simulation, OFDM technology , Space-time Coding, Spread Spectrum and CDMA Systems. Wireless technologies: Bluetooth , Cellular Wireless Networks, Cordless Systems and Wireless Local Loop, HIPERLAN, IEEE 802.11, Mobile Network Layer, Mobile Transport Layer, and Spread Spectrum. Network Security and applications: Authentication Applications, Block Ciphers Design Principles, Block Ciphers Modes of Operation, Electronic Mail Security, Encryption & Message Confidentiality, Firewalls, IP Security, Key Cryptography & Message Authentication, and Web Security. Robotics, Control Systems and Automation: Distributed Control Systems, Automation, Expert Systems, Robotics, Factory Automation, Intelligent Control Systems, Man Machine Interaction, Manufacturing Information System, Motion Control, and Process Automation. Vision Systems: for human action sensing, face recognition, and image processing algorithms for smoothing of high speed motion. Electronics and Power Systems: Actuators, Electro-Mechanical Systems, High Frequency Converters, Industrial Electronics, Motors and Drives, Power Converters, Power Devices and Components, and Power Electronics.

Approximate Iterative Algorithms

CRC Press Iterative algorithms often rely on approximate evaluation techniques, which may include statistical estimation, computer simulation or functional approximation. This volume presents methods for the study of approximate iterative algorithms, providing tools for the derivation of error bounds and convergence rates, and for the optimal design of such algorithms. Techniques of functional analysis are used to derive analytical relationships between approximation methods and convergence properties for general classes of algorithms. This work provides the necessary background in functional analysis and probability theory. Extensive applications to Markov decision processes are presented. This volume is intended for mathematicians, engineers and computer scientists, who work on learning processes in numerical analysis and are involved with optimization, optimal control, decision analysis and machine learning.

Chaotic Billiards

American Mathematical Soc. This book offers a complete and systematic presentation of chaotic billiards, with full proofs, exercises and illustrations. It is designed to give readers an understanding of crucial stochastic properties of chaotic billiards, including ergodicity, decay of correlations and the Central Limit Theorem. No other book offers a self-contained exposition of this new, dynamic and complex theory.

Stochastic Processes

Theory for Applications

Cambridge University Press This definitive textbook provides a solid introduction to discrete and continuous stochastic processes, tackling a complex field in a way that instils a deep understanding of the relevant mathematical principles, and develops an intuitive grasp of the way these principles can be applied to modelling real-world systems. It includes a careful review of elementary probability and detailed coverage of Poisson, Gaussian and Markov processes with richly varied queuing applications. The theory and applications of inference, hypothesis testing, estimation, random walks, large deviations, martingales and investments are developed. Written by one of the world's leading information theorists, evolving over twenty years of graduate classroom teaching and enriched by over 300 exercises, this is an exceptional resource for anyone looking to develop their understanding of stochastic processes.

Journal of Applied Probability

Labelled Markov Processes

Imperial College Press Labelled Markov processes are probabilistic versions of labelled transition systems with continuous state spaces. The book covers basic probability and measure theory on continuous state spaces and then develops the theory of LMPs.

Fluctuations in Markov Processes

Time Symmetry and Martingale Approximation

Springer Science & Business Media The present volume contains the most advanced theories on the martingale approach to central limit theorems. Using the time symmetry properties of the Markov processes, the book develops the techniques that allow us to deal with infinite dimensional models that appear in statistical mechanics and engineering (interacting particle systems, homogenization in random environments, and diffusion in turbulent flows, to mention just a few applications). The first part contains a detailed exposition of the method, and can be used as a text for graduate courses. The second concerns application to exclusion processes, in which the duality methods are fully exploited. The third part is about the homogenization of diffusions in random fields, including passive tracers in turbulent flows (including the superdiffusive behavior). There are no other books in the mathematical literature that deal with this kind of approach to the problem of the central limit theorem. Hence, this volume meets the demand for a monograph on this powerful approach, now widely used in many areas of probability and mathematical physics. The book also covers the connections with and application to hydrodynamic limits and homogenization theory, so besides probability researchers it will also be of interest also to mathematical physicists and analysts.

Automata, Languages and Programming

30th International Colloquium, ICALP 2003, Eindhoven, The Netherlands, June 30 - July 4, 2003. Proceedings

Springer The refereed proceedings of the 30th International Colloquium on Automata, Languages and Programming, ICALP 2003, held in Eindhoven, The Netherlands in June/July 2003. The 84 revised full papers presented together with six invited papers were carefully reviewed and selected from 212 submissions. The papers are organized in topical sections on algorithms, process algebra,

approximation algorithms, languages and programming, complexity, data structures, graph algorithms, automata, optimization and games, graphs and bisimulation, online problems, verification, the Internet, temporal logic and model checking, graph problems, logic and lambda-calculus, data structures and algorithms, types and categories, probabilistic systems, sampling and randomness, scheduling, and geometric problems.

Dependence in Probability and Statistics

Springer Science & Business Media This book gives an account of recent developments in the field of probability and statistics for dependent data. It covers a wide range of topics from Markov chain theory and weak dependence with an emphasis on some recent developments on dynamical systems, to strong dependence in times series and random fields. There is a section on statistical estimation problems and specific applications. The book is written as a succession of papers by field specialists, alternating general surveys, mostly at a level accessible to graduate students in probability and statistics, and more general research papers mainly suitable to researchers in the field.

Handbook of Markov Decision Processes

Methods and Applications

Springer Science & Business Media Eugene A. Feinberg Adam Shwartz This volume deals with the theory of Markov Decision Processes (MDPs) and their applications. Each chapter was written by a leading expert in the re spective area. The papers cover major research areas and methodologies, and discuss open questions and future research directions. The papers can be read independently, with the basic notation and concepts ofSection 1.2. Most chap ters should be accessible by graduate or advanced undergraduate students in fields of operations research, electrical engineering, and computer science. 1.1 AN OVERVIEW OF MARKOV DECISION PROCESSES The theory of Markov Decision Processes-also known under several other names including sequential stochastic optimization, discrete-time stochastic control, and stochastic dynamic programming-studiessequential optimization ofdiscrete time stochastic systems. The basic object is a discrete-time stochas tic system whose transition mechanism can be controlled over time. Each control policy defines the stochastic process and values of objective functions associated with this process. The goal is to select a "good" control policy. In real life, decisions that humans and computers make on all levels usually have two types ofimpacts: (i) they cost orsavetime, money, or other resources, or they bring revenues, as well as (ii) they have an impact on the future, by influencing the dynamics. In many situations, decisions with the largest immediate profit may not be good in view offuture events. MDPs model this paradigm and provide results on the structure and existence of good policies and on methods for their calculation.

Dynamics: Models and Kinetic Methods for Non-equilibrium Many Body Systems

Springer Science & Business Media Recent years have witnessed a resurgence in the kinetic approach to dynamic many-body problems. Modern kinetic theory offers a unifying theoretical framework within which a great variety of seemingly unrelated systems can be explored in a coherent way. Kinetic methods are currently being applied in such areas as the dynamics of colloidal suspensions, granular material flow, electron transport in mesoscopic systems, the calculation of Lyapunov exponents and other properties of classical many-body systems characterised by chaotic behaviour. The present work focuses on Brownian motion, dynamical systems, granular flows, and quantum kinetic theory.

Randomized Algorithms: Approximation, Generation, and Counting

Springer Science & Business Media Randomized Algorithms discusses two problems of fine pedigree: counting and generation, both of which are of fundamental importance to discrete mathematics and probability. When asking questions like "How many are there?" and "What does it look like on average?" of families of combinatorial structures, answers are often difficult to find -- we can be blocked by seemingly intractable algorithms. Randomized Algorithms shows how to get around the problem of intractability with the Markov chain Monte Carlo method, as well as highlighting the method's natural limits. It uses the technique of coupling before introducing "path coupling" a new technique which radically simplifies and improves upon previous methods in the area.

Discrete Stochastic Processes

Springer Science & Business Media 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.

Random Number Generation and Monte Carlo Methods

Springer Science & Business Media Monte Carlo simulation has become one of the most important tools in all fields of science. Simulation methodology relies on a good source of numbers that appear to be random. These "pseudorandom" numbers must pass statistical tests just as random samples would. Methods for producing pseudorandom numbers and transforming those numbers to simulate samples from various distributions are among the most important topics in statistical computing. This book surveys techniques of random number generation and the use of random numbers in Monte Carlo simulation. The book covers basic principles, as well as newer methods such as parallel random number generation, nonlinear congruential generators, quasi Monte Carlo methods, and Markov chain Monte Carlo. The best methods for generating random variates from the standard distributions are presented, but also general techniques useful in more complicated models and in novel settings are described. The emphasis throughout the book is on practical methods that work well in current computing environments. The book includes exercises and can be used as a test or supplementary text for various courses in modern statistics. It could serve as the primary test for a specialized course in statistical computing, or as a supplementary text for a course in computational statistics and other areas of modern statistics that rely on simulation. The book, which covers recent developments in the field, could also serve as a useful reference for practitioners. Although some familiarity with probability and statistics is assumed, the book is accessible to a broad audience. The second edition is approximately 50% longer than the first edition. It includes advances in methods for parallel random number generation, universal methods for generation of nonuniform variates, perfect sampling, and software for random number generation.

Markov Processes, Structure and Asymptotic Behavior

Structure and Asymptotic Behavior

Springer Science & Business Media This book is concerned with a set of related problems in probability theory that are considered in the context of Markov processes. Some of these are natural to consider, especially for Markov processes. Other problems have a broader range of validity but are convenient to pose for Markov processes. The book can be used as the basis for an interesting course on Markov processes or stationary processes. For the most part these questions are considered for discrete parameter processes, although they are also of obvious interest for continuous time parameter processes. This allows one to avoid the delicate measure theoretic questions that might arise in the continuous parameter case. There is an attempt to motivate the material in terms of applications. Many of the topics concern general questions of structure and representation of processes that have not previously been presented in book form. A set of notes comment on the many problems that are still left open and related material in the literature. It is also hoped that the book will be useful as a reference to the reader who would like an introduction to these topics as well as to the reader interested in extending and completing results of this type.

Markov Chains and Invariant Probabilities

Springer Science & Business Media This book is about discrete-time, time-homogeneous, Markov chains (Mes) and their ergodic behavior. To this end, most of the material is in fact about stable Mes, by which we mean Mes that admit an invariant probability measure. To state this more precisely and give an overview of the questions we shall be dealing with, we will first introduce some notation and terminology. Let (X,B) be a measurable space, and consider a X-valued Markov chain ~. = {~k' k = 0, 1, ... } with transition probability function (t.pJ.) P(x, B), i.e., P(x, B) := Prob (~k+1 E B I ~k = x) for each x E X, B E B, and k = 0,1, ... The Me ~. is said to be stable if there exists a probability measure (p.m.) /.l on B such that (*) VB EB. /.l(B) = Ix /.l(dx) P(x, B) If (*) holds then /.l is called an invariant p.m. for the Me ~. (or the t.p.f. P).

Markov Chains and Mixing Times

American Mathematical Soc. This book is an introduction to the modern approach to the theory of Markov chains. The main goal of this approach is to determine the rate of convergence of a Markov chain to the stationary distribution as a function of the size and geometry of the state space. The authors develop the key tools for estimating convergence times, including coupling, strong stationary times, and spectral methods. Whenever possible, probabilistic methods are emphasized. The book includes many examples and provides brief introductions to some central models of statistical mechanics. Also provided are accounts of random walks on networks, including hitting and cover times, and analyses of several methods of shuffling cards. As a prerequisite, the authors assume a modest understanding of probability theory and linear algebra at an undergraduate level. Markov Chains and Mixing Times is meant to bring the excitement of this active area of research to a wide audience.

A Countable Markov Chain with Reward Structure

Continuity of the Average Reward

Handbook of Approximation Algorithms and Metaheuristics

CRC Press Delineating the tremendous growth in this area, the Handbook of Approximation Algorithms and Metaheuristics covers fundamental, theoretical topics as well as advanced, practical applications. It is the first book to comprehensively study both approximation algorithms and metaheuristics. Starting with basic approaches, the handbook presents the methodologies to design and analyze efficient approximation algorithms for a large class of problems, and to establish inapproximability results for another class of problems. It also discusses local search, neural networks, and metaheuristics, as well as multiobjective problems, sensitivity analysis, and stability. After laying this foundation, the book applies the methodologies to classical problems in combinatorial optimization, computational geometry, and graph problems. In addition, it explores large-scale and emerging applications in networks, bioinformatics, VLSI, game theory, and data analysis. Undoubtedly sparking further developments in the field, this handbook provides the essential techniques to apply approximation algorithms and metaheuristics to a wide range of problems in computer science, operations research, computer engineering, and economics. Armed with this information, researchers can design and analyze efficient algorithms to generate near-optimal solutions for a wide range of computational intractable problems.

Approximation and Weak Convergence Methods for Random Processes, with Applications to Stochastic Systems Theory

MIT Press Control and communications engineers, physicists, and probability theorists, among others, will find this book unique. It contains a detailed development of approximation and limit theorems and methods for random processes and applies them to numerous problems of practical importance. In particular, it develops usable and broad conditions and techniques for showing that a sequence of processes converges to a Markov diffusion or jump process. This is useful when the natural physical model is quite complex, in which case a simpler approximation la diffusion process, for example) is usually made. The book simplifies and extends some important older methods and develops some powerful new ones applicable to a wide variety of limit and approximation problems. The theory of weak convergence of probability measures is introduced along with general and usable methods (for example, perturbed test function, martingale, and direct averaging) for proving tightness and weak convergence. Kushner's study begins with a systematic development of the method. It then treats dynamical system models that have state-dependent noise or nonsmooth dynamics. Perturbed Liapunov function methods are developed for stability studies of nonMarkovian problems and for the study of asymptotic distributions of non-Markovian systems. Three chapters are devoted to applications in control and communication theory (for example, phase-locked loops and adoptive filters). Smallnoise problems and an introduction to the theory of large deviations and applications conclude the book. Harold J. Kushner is Professor of Applied Mathematics and Engineering at Brown University and is one of the leading researchers in the area of stochastic processes concerned with analysis and synthesis in control and communications theory. This book is the sixth in The MIT Press Series in Signal Processing, Optimization, and Control, edited by Alan S. Willsky.

Control Techniques for Complex Networks

Cambridge University Press From foundations to state-of-the-art; the tools and philosophy you need to build network models.

Stochastic Dynamic Programming and the Control of Queueing Systems

John Wiley & Sons A path-breaking account of Markov decision processes-theory and computation This book's clear presentation of theory, numerous chapter-end problems, and development of a unified method for the computation of optimal policies in both discrete and continuous time make it an excellent course text for graduate students and advanced undergraduates. Its comprehensive coverage of important recent advances in stochastic dynamic programming makes it a valuable working resource for operations research professionals, management scientists, engineers, and others. Stochastic Dynamic Programming and the Control of Queueing Systems presents the theory of optimization under the finite horizon, infinite horizon discounted, and average cost criteria. It then shows how optimal rules of operation (policies) for each criterion may be numerically determined. A great wealth of examples from the application area of the control of queueing systems is presented. Nine numerical programs for the computation of optimal policies are fully explicated. The Pascal source code for the programs is available for viewing and downloading on the Wiley Web site at www.wiley.com/products/subject/mathematics. The site contains a link to the author's own Web site and is also a place where readers may discuss developments on the programs or other aspects of the material. The source files are also available via ftp at ftp://ftp.wiley.com/public/sci_tech_med/stochastic Stochastic Dynamic Programming and the Control of Queueing Systems features: * Path-breaking advances in Markov decision process techniques, brought together for the first time in book form * A theorem/proof format (proofs may be omitted without loss of continuity) * Development of a unified method for the computation of optimal rules of system operation * Numerous examples drawn mainly from the control of queueing systems * Detailed discussions of nine numerical programs * Helpful chapter-end problems * Appendices with complete treatment of background material

Revue Roumaine de Mathématiques Pures Et Appliquées

Applied Mechanics Reviews

Exploring the Limits of Bootstrap

John Wiley & Sons Explores the application of bootstrap to problems that place unusual demands on the method. The bootstrap method, introduced by Bradley Efron in 1973, is a nonparametric technique for inferring the distribution of a statistic derived from a sample. Most of the papers were presented at a special meeting sponsored by the Institute of Mathematical Statistics and the Interface Foundation in May, 1990.

Stochastic Models, Statistics and Their Applications

Wrocław, Poland, February 2015

Springer This volume presents the latest advances and trends in stochastic models and related statistical procedures. Selected peer-reviewed contributions focus on statistical inference, quality control, change-point analysis and detection, empirical processes, time series analysis, survival analysis and reliability, statistics for stochastic processes, big data in technology and the sciences, statistical genetics, experiment design, and stochastic models in engineering. Stochastic models and related statistical procedures play an important part in furthering our understanding of the challenging problems currently arising in areas of application such as the natural sciences, information technology, engineering, image analysis, genetics, energy and finance, to name but a few. This collection arises from the 12th Workshop on Stochastic Models, Statistics and Their Applications, Wroclaw, Poland.

Computational Medicine in Data Mining and Modeling

Springer Science & Business Media This book presents an overview of a variety of contemporary statistical, mathematical and computer science techniques which are used to further the knowledge in the medical domain. The authors focus on applying data mining to the medical domain, including mining the sets of clinical data typically found in patient’s medical records, image mining, medical mining, data mining and machine learning applied to generic genomic data and more. This work also introduces modeling behavior of cancer cells, multi-scale computational models and simulations of blood flow through vessels by using patient-specific models. The authors cover different imaging techniques used to generate patient-specific models. This is used in computational fluid dynamics software to analyze fluid flow. Case studies are provided at the end of each chapter. Professionals and researchers with quantitative backgrounds will find Computational Medicine in Data Mining and Modeling useful as a reference. Advanced-level students studying computer science, mathematics, statistics and biomedicine will also find this book valuable as a reference or secondary text book.

Nonparametric Statistics

3rd ISNPS, Avignon, France, June 2016

Springer This volume presents the latest advances and trends in nonparametric statistics, and gathers selected and peer-reviewed contributions from the 3rd Conference of the International Society for Nonparametric Statistics (ISNPS), held in Avignon, France on June 11-16, 2016. It covers a broad range of nonparametric statistical methods, from density estimation, survey sampling, resampling methods, kernel methods and extreme values, to statistical learning and classification, both in the standard i.i.d. case and for dependent data, including big data. The International Society for Nonparametric Statistics is uniquely global, and its international conferences are intended to foster the exchange of ideas and the latest advances among researchers from around the world, in cooperation with established statistical societies such as the Institute of Mathematical Statistics, the Bernoulli Society and the International Statistical Institute. The 3rd ISNPS conference in Avignon attracted more than 400 researchers from around the globe, and contributed to the further development and dissemination of nonparametric statistics knowledge.

Basics of Applied Stochastic Processes

Springer Science & Business Media 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.

Perturbed Semi-Markov Type Processes I

Limit Theorems for Rare-Event Times and Processes

Springer Nature This book is the first volume of a two-volume monograph devoted to the study of limit and ergodic theorems for regularly and singularly perturbed Markov chains, semi-Markov processes, and multi-alternating regenerative processes with semi-Markov modulation. The first volume presents necessary and sufficient conditions for weak convergence for first-rare-event times and convergence in the topology J for first-rare-event processes defined on regularly perturbed finite Markov chains and semi-Markov processes. The text introduces new asymptotic recurrent algorithms of phase space reduction. It also addresses both effective conditions of weak convergence for distributions of hitting times as well as convergence of expectations of hitting times for regularly and singularly perturbed finite Markov chains and semi-Markov processes. The book also contains a comprehensive bibliography of major works in the field. It provides an effective reference for both graduate students as well as theoretical and applied researchers studying stochastic processes and their applications.

Foundations of Computational Imaging

A Model-Based Approach

SIAM Collecting a set of classical and emerging methods previously unavailable in a single resource, Foundations of Computational Imaging: A Model-Based Approach is the first book to define a common foundation for the mathematical and statistical methods used in computational imaging. The book brings together a blend of research with applications in a variety of disciplines, including applied math, physics, chemistry, optics, and signal processing, to address a collection of problems that can benefit from a common set of methods. Readers will find basic techniques of model-based image processing, a comprehensive treatment of Bayesian and regularized image reconstruction methods, and an integrated treatment of advanced reconstruction techniques, such as majorization, constrained optimization, alternating direction method of multipliers (ADMM), and Plug-and-Play methods for model integration. Foundations of Computational Imaging can be used in courses on model-based or computational imaging, advanced numerical analysis, data science, numerical optimization, and approximation theory. It will also prove useful to researchers or practitioners in medical, scientific, commercial, and industrial imaging.

Foundations of Average-Cost Nonhomogeneous Controlled Markov Chains

Springer Nature This Springer brief addresses the challenges encountered in the study of the optimization of time-nonhomogeneous Markov chains. It develops new insights and new methodologies for systems in which concepts such as stationarity, ergodicity, periodicity and connectivity do not apply. This brief introduces the novel concept of confluencity and applies a relative optimization approach. It develops a comprehensive theory for optimization of the long-run average of time-nonhomogeneous Markov chains. The book shows that confluencity is the most fundamental concept in optimization, and that relative optimization is more suitable for treating the systems under consideration than standard ideas of dynamic programming. Using confluencity and relative optimization, the author classifies states as confluent or branching and shows how the under-selectivity issue of the long-run average can be easily addressed, multi-class optimization implemented, and Nth biases and Blackwell optimality conditions derived. These results are presented in a book for the first time and so may enhance the understanding of optimization and motivate new research ideas in the area.

Numerical Solution of Markov Chains

CRC Press Papers presented at a workshop held January 1990 (location unspecified) cover just about all aspects of solving Markov models numerically. There are papers on matrix generation techniques and generalized stochastic Petri nets; the computation of stationary distributions, including aggregation/disaggregation.