Stochastic Approximation And Recursive Algorithms And Applications 2nd Edition

Stochastic Approximation and Recursive Algorithms and Applications
Stochastic Approximation
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Stochastic Approximation and Recursive Estimation
Approximation and Weak Convergence Methods for Random Processes, with Applications to Stochastic Systems Theory
Recursive Estimation and Time-Series Analysis
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Stochastic Approximation and Recursive Algorithms and Applications
Seminaire de Probabilites XXXI
Random Iterative Models
Approximate Dynamic Programming

Recursive Estimation and Time-Series Analysis
Recursive Identification and Parameter Estimation
Stochastic Approximation and Optimization of Random Systems

FAULKNER ZAYDEN

Stochastic Approximation and Recursive Algorithms and Applications John Wiley & Sons
Spectral methods refer to the use of eigenvalues, eigenvectors, singular values and singular vectors. They are widely used in Engineering, Applied Mathematics and Statistics. More recently, spectral methods have found numerous applications in Computer Science to "discrete" as well as "continuous" problems. Spectral Algorithms describes modern applications of spectral methods, and novel algorithms for estimating spectral parameters. The first part of the book presents applications of spectral methods to problems from a variety of topics including combinatorial optimization, learning and clustering. The second part of the book is motivated by efficiency considerations. A feature of many modern applications is the massive amount of input data. While sophisticated algorithms for matrix computations have been developed over a century, a more recent development is algorithms based on "sampling on the fly" from massive matrices. Good estimates of singular values and low rank approximations of the whole matrix can be provably derived from a sample. The main emphasis in the second part of the book is to present these sampling methods with rigorous error bounds. It also presents recent extensions of spectral methods from matrices to tensors and their applications to some combinatorial optimization problems.
Stochastic Approximation Springer Nature
This is a revised version of the 1984 book of the same name but considerably modified and enlarged to accommodate the developments in recursive estimation and time series analysis that have occurred over the last quarter century. Also over this time, the CAPTAIN Toolbox for recursive estimation and time series analysis has been developed at Lancaster, for use in the MatlabTM software environment (see Appendix G). Consequently, the present version of the book is able to exploit the many computational routines that are contained in this widely available Toolbox, as well as some of the other routines in MatlabTM and its other toolboxes. The book is an introductory one on the topic of recursive estimation and it demonstrates how this approach to estimation, in its various forms, can be an impressive aid to the modelling of stochastic, dynamic systems. It is intended for undergraduate or Masters students who wish to obtain a grounding in this subject; or for practitioners in industry who may have heard of topics dealt with in this book and, while they want to know more about them, may have been deterred by the rather esoteric nature of some books in this challenging area of study.

Stochastic Approximation Springer Science & Business Media A rigorous mathematical treatment of the technique for studying the properties of an experimental situation. Stochastic Approximation and Recursive Estimation Springer Science & Business Media REINFORCEMENT LEARNING AND STOCHASTIC OPTIMIZATION Clearing the jungle of stochastic optimization Sequential decision problems, which consist of “decision, information, decision, information,” are ubiquitous, spanning virtually every human activity ranging from business applications, health (personal and public health, and medical decision making), energy, the sciences, all fields of engineering, finance, and e-commerce. The diversity of applications attracted the attention of at least 15 distinct fields of research, using eight distinct notational systems which produced a vast array of analytical tools. A byproduct is that powerful tools developed in one community may be unknown to other communities. Reinforcement Learning and Stochastic Optimization offers a single canonical framework that can model any sequential decision problem using five core components: state variables, decision variables, exogenous information variables, transition function, and objective function. This book highlights twelve types of uncertainty that might enter any model and pulls together the diverse set of methods for making decisions, known as policies, into four fundamental classes that span every method suggested in the academic literature or used in practice. Reinforcement Learning and Stochastic Optimization is the first book to provide a balanced treatment of the different methods for modeling and solving sequential decision problems, following the style used by most books on machine learning, optimization, and simulation. The presentation is designed for readers with a course in probability and statistics, and an interest in modeling and applications. Linear programming is occasionally used for specific problem classes. The book is designed for readers who are new to the field, as well as those with some background in optimization under uncertainty. Throughout this book, readers will find references to over 100 different applications, spanning pure learning problems, dynamic resource allocation problems, general state-dependent problems, and hybrid learning/resource allocation problems such as those that arose in the COVID pandemic. There are 370 exercises, organized into seven groups, ranging from review questions, modeling, computation, problem solving, theory, programming exercises and a “diary problem” that a reader chooses at the beginning of the book, and which is used as a basis for questions throughout the rest of the book.

Approximation and Weak Convergence Methods for Random Processes, with Applications to Stochastic Systems Theory Springer Science & Business Media This book constitutes the refereed proceedings of the 4th International Symposium on Stochastic Algorithms: Foundations and Applications, SAGA 2007. The nine revised full

papers and five invited papers presented were carefully selected for inclusion in the book. The contributed papers included in this volume cover both theoretical as well as applied aspects of stochastic computations with a special focus on investigating the power of randomization in algorithmics.

Recursive Estimation and Time-Series Analysis Birkhäuser

The book deals with a powerful and convenient approach to a great variety of types of problems of the recursive monte-carlo or stochastic approximation type. Such recu- sive algorithms occur frequently in stochastic and adaptive control and optimization theory and in statistical esti- tion theory. Typically, a sequence {X } of estimates of a n parameter is obtained by means of some recursive statistical th st procedure. The n estimate is some function of the n_l estimate and of some new observational data, and the aim is to study the convergence, rate of convergence, and the pa- metric dependence and other qualitative properties of the - gorithms. In this sense, the theory is a statistical version of recursive numerical analysis. The approach taken involves the use of relatively simple compactness methods. Most standard results for Kiefer-Wolfowitz and Robbins-Monro like methods are extended considerably. Constrained and unconstrained problems are treated, as is the rate of convergence problem. While the basic method is rather simple, it can be elaborated to allow a broad and deep coverage of stochastic approximation like problems. The approach, relating algorithm behavior to qualitative properties of deterministic or stochastic differ ential equations, has advantages in algorithm conceptualiza tion and design. It is often possible to obtain an intuitive understanding of algorithm behavior or qualitative dependence upon parameters, etc., without getting involved in a great deal of deta~l.

On-Line Learning in Neural Networks World Scientific

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. Information and Randomness Springer Science & Business Media Multistage stochastic optimization problems appear in many ways in finance, insurance, energy production and trading, logistics and transportation, among other areas. They describe decision situations under uncertainty and with a longer planning horizon. This book contains a comprehensive treatment of today’s state of the art in multistage stochastic optimization. It covers the mathematical backgrounds of approximation theory as well as numerous practical algorithms and examples for the generation and handling of scenario trees. A special emphasis is put on estimation and bounding of the modeling error using novel distance concepts, on time consistency and the role of model ambiguity in the decision process. An extensive treatment of examples from electricity production, asset liability management and inventory control concludes the book. *Stochastic Approximation Algorithms and Applications* Springer Science & Business Media A complete and accessible introduction to the real-world applications of approximate dynamic programming With the growing levels of sophistication in modern-day operations, it is vital for practitioners to understand how to approach, model, and solve complex industrial problems. Approximate Dynamic Programming is a result of the author's decades of experience working in large industrial settings to develop practical and high-quality solutions to problems that involve making decisions in the presence of uncertainty. This groundbreaking book uniquely integrates four distinct disciplines—Markov design processes, mathematical programming, simulation, and statistics—to demonstrate how to successfully model and solve a wide range of real-life problems using the techniques of approximate dynamic programming (ADP). The reader is introduced to the three curses of dimensionality that impact complex problems and is also shown how the post-decision state variable allows for the use of classical algorithmic strategies from operations research to treat complex stochastic optimization problems. Designed as an introduction and assuming no prior training in dynamic programming of any form, Approximate Dynamic Programming contains dozens of algorithms that are intended to serve as a starting point in the

design of practical solutions for real problems. The book provides detailed coverage of implementation challenges including: modeling complex sequential decision processes under uncertainty, identifying robust policies, designing and estimating value function approximations, choosing effective stepsize rules, and resolving convergence issues. With a focus on modeling and algorithms in conjunction with the language of mainstream operations research, artificial intelligence, and control theory, Approximate Dynamic Programming: Models complex, high-dimensional problems in a natural and practical way, which draws on years of industrial projects Introduces and emphasizes the power of estimating a value function around the post-decision state, allowing solution algorithms to be broken down into three fundamental steps: classical simulation, classical optimization, and classical statistics Presents a thorough discussion of recursive estimation, including fundamental theory and a number of issues that arise in the development of practical algorithms Offers a variety of methods for approximating dynamic programs that have appeared in previous literature, but that have never been presented in the coherent format of a book Motivated by examples from modern-day operations research, Approximate Dynamic Programming is an accessible introduction to dynamic modeling and is also a valuable guide for the development of high-quality solutions to problems that exist in operations research and engineering. The clear and precise presentation of the material makes this an appropriate text for advanced undergraduate and beginning graduate courses, while also serving as a reference for researchers and practitioners. A companion Web site is available for readers, which includes additional exercises, solutions to exercises, and data sets to reinforce the book's main concepts.

Stochastic Approximation Methods for Constrained and Unconstrained Systems John Wiley & Sons

With this hands-on introduction readers will learn what SDEs are all about and how they should use them in practice.

Stochastic Approximation and Recursive Estimation Cambridge University Press

A how-to guide and scientific tutorial covering the universe of reinforcement learning and control theory for online decision making.

Stochastic Recursive Algorithms for Optimization John Wiley & Sons

The DMV seminar "Stochastische Approximation und Optimierung zufalliger Systeme" was held at Blaubeuren, 28. 5. -4. 6. 1989. The goal was to give an approach to theory and application of stochas tic approximation in view of optimization problems, especially in engineering systems. These notes are based on the seminar lectures. They consist of three parts: I. Foundations of stochastic approximation (H. Walk); n. Applicational aspects of stochastic approximation (G. PHug); In. Applications to adaptation :ugorithms (L. Ljung). The prerequisites for reading this book are basic knowledge in probability, mathematical

statistics, optimization. We would like to thank Prof. M. Barner and Prof. G. Fischer for the or ganization of the seminar. We also thank the participants for their cooperation and our assistants and secretaries for typing the manuscript. November 1991 L. Ljung, G. PHug, H. Walk Table of contents I Foundations of stochastic approximation (H. Walk) §1 Almost sure convergence of stochastic approximation procedures 2 §2 Recursive methods for linear problems 17 §3 Stochastic optimization under stochastic constraints 22 §4 A learning model; recursive density estimation 27 §5 Invariance principles in stochastic approximation 30 §6 On the theory of large deviations 43 References for Part I 45 11 Applicational aspects of stochastic approximation (G. PHug) §7 Markovian stochastic optimization and stochastic approximation procedures 53 §8 Asymptotic distributions 71 §9 Stopping times 79 §1O Applications of stochastic approximation methods 80 References for Part II 90 III Applications to adaptation algorithms (L.

Theory and Practice of Recursive Identification Springer Science & Business Media

The DMV seminar "Stochastische Approximation und Optimierung zufalliger Systeme" was held at Blaubeuren, 28. 5. -4. 6. 1989. The goal was to give an approach to theory and application of stochas tic approximation in view of optimization problems, especially in engineering systems. These notes are based on the seminar lectures. They consist of three parts: I. Foundations of stochastic approximation (H. Walk); n. Applicational aspects of stochastic approximation (G. PHug); In. Applications to adaptation :ugorithms (L. Ljung). The prerequisites for reading this book are basic knowledge in probability, mathematical statistics, optimization. We would like to thank Prof. M. Barner and Prof. G. Fischer for the or ganization of the seminar. We also thank the participants for their cooperation and our assistants and secretaries for typing the manuscript. November 1991 L. Ljung, G. PHug, H. Walk Table of contents I Foundations of stochastic approximation (H. Walk) §1 Almost sure convergence of stochastic approximation procedures 2 §2 Recursive methods for linear problems 17 §3 Stochastic optimization under stochastic constraints 22 §4 A learning model; recursive density estimation 27 §5 Invariance principles in stochastic approximation 30 §6 On the theory of large deviations 43 References for Part I 45 11 Applicational aspects of stochastic approximation (G. PHug) §7 Markovian stochastic optimization and stochastic approximation procedures 53 §8 Asymptotic distributions 71 §9 Stopping times 79 §1O Applications of stochastic approximation methods 80 References for Part II 90 III Applications to adaptation algorithms (L.

Recursive Estimation and Control for Stochastic Systems Springer Science & Business Media

This book presents a thorough development of the modern theory of stochastic approximation or recursive stochastic algorithms for both constrained and unconstrained problems. This second edition is a thorough revision, although the main features and structure remain unchanged. It contains many additional applications and results

as well as more detailed discussion.
Stochastic Algorithms: Foundations and Applications Cambridge University Press
Performance optimization is vital in the design and operation of modern engineering systems, including communications, manufacturing, robotics, and logistics. Most engineering systems are too complicated to model, or the system parameters cannot be easily identified, so learning techniques have to be applied. This book provides a unified framework based on a sensitivity point of view. It also introduces new approaches and proposes new research topics within this sensitivity-based framework. This new perspective on a popular topic is presented by a well respected expert in the field.
Introduction to Stochastic Search and Optimization Springer
This book constitutes the refereed proceedings of the Second International Symposium on Stochastic Algorithms: Foundations and Applications, SAGA 2003, held in Hatfield, UK in September 2003. The 12 revised full papers presented together with three invited papers were carefully reviewed and selected for inclusion in the book. Among the topics addressed are ant colony optimization, randomized algorithms for the intersection problem, local search for constraint satisfaction problems, randomized local search and combinatorial optimization, simulated annealing, probabilistic global search, network communication complexity, open shop scheduling, aircraft routing, traffic control, randomized straight-line programs, and stochastic automata and probabilistic transformations.
Stochastic Learning and Optimization Springer Science & Business Media
Recursive Identification and Parameter Estimation describes a recursive approach to solving system identification and parameter estimation problems arising from diverse areas. Supplying a systematic description of recursive estimation methods, it provides rigorous theoretical analysis of recursive solutions to problems of stochastic systems. Presenting the material and proposed algorithms in a manner that makes it easy to understand, the book provides readers with the modeling and identification skills required for successful theoretical research and effective applications.
Stochastic Algorithms: Foundations and Applications Springer
This book is devoted to sequential methods of solving a class of problems to which belongs, for example, the problem of finding a maximum point of a function if each measured value of this function contains a random error. Some basic procedures of stochastic approximation are investigated from a single point of view, namely the theory of Markov processes and martingales. Examples are considered of applications of the theorems to some problems of estimation theory, educational theory and control theory, and also to some problems of information transmission in the presence of inverse feedback.
Control Systems and Reinforcement Learning CRC Press
There is a thorough treatment of rate of convergence, iterate averaging, high-dimensional problems, ergodic cost problems, stability methods for

correlated noise, and decentralized and asynchronous algorithms. Spectral Algorithms Now Publishers Inc Reinforcement learning is a learning paradigm concerned with learning to control a system so as to maximize a numerical performance measure that expresses a long-term objective. What distinguishes reinforcement learning from supervised learning is that only partial feedback is given to the learner about the learner's predictions. Further, the predictions may have long term effects through influencing the future state of the controlled system. Thus, time plays a special role. The goal in reinforcement learning is to develop efficient learning algorithms, as well as to understand the algorithms' merits and limitations. Reinforcement learning is of great interest because of the large number of practical applications that it can be used to address, ranging from problems in artificial intelligence to operations research or control engineering. In this book, we focus on those algorithms of reinforcement learning that build on the powerful theory of dynamic programming. We give a fairly comprehensive catalog of learning problems, describe the core ideas, note a large number of state of the art algorithms, followed by the discussion of their theoretical properties and limitations. Table of Contents: Markov Decision Processes / Value Prediction Problems / Control / For Further Exploration