Kurt Marti

Stochastic Optimization Methods

Applications in Engineering and Operations Research

Fourth Edition

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Stochastic Optimization Methods

Jin-Ying Zhang

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Stochastic Optimization Methods Kurt Marti,2005-12-05 Optimization problems arising in practice involve random parameters For the computation of robust optimal solutions i e optimal solutions being insensitive with respect to random parameter variations deterministic substitute problems are needed Based on the distribution of the random data and using decision theoretical concepts optimization problems under stochastic uncertainty are converted into deterministic substitute problems Due to the occurring probabilities and expectations approximative solution techniques must be applied Deterministic and stochastic approximation methods and their analytical properties are provided Taylor expansion regression and response surface methods probability inequalities First Order Reliability Methods convex approximation deterministic descent directions efficient points stochastic approximation methods differentiation of probability and mean value functions Convergence results of the resulting iterative solution procedures are given **First-order and Stochastic Optimization Methods for Machine Learning** Guanghui Lan,2020-05-15 This book covers not only foundational materials but also the most recent progresses made during the past few years on the area of machine learning algorithms In spite of the intensive research and development in this area there does not exist a systematic treatment to introduce the fundamental concepts and recent progresses on machine learning algorithms especially on those based on stochastic optimization methods randomized algorithms nonconvex optimization distributed and online learning and projection free methods This book will benefit the broad audience in the area of machine learning artificial intelligence and mathematical programming community by presenting these recent developments in a tutorial style starting from the basic building blocks to the most carefully designed and complicated algorithms for machine learning Stochastic Optimization Methods Kurt Marti,2015 This book examines optimization problems that in practice involve random model parameters It details the computation of robust optimal solutions i e optimal solutions that are insensitive with respect to random parameter variations where appropriate deterministic substitute problems are needed Based on the probability distribution of the random data and using decision theoretical concepts optimization problems under stochastic uncertainty are converted into appropriate deterministic substitute problems Due to the probabilities and expectations involved the book also shows how to apply approximative solution techniques Several deterministic and stochastic approximation methods are provided Taylor expansion methods regression and response surface methods RSM probability inequalities multiple linearization of survival failure domains discretization methods convex approximation deterministic descent directions efficient points stochastic approximation and gradient procedures and differentiation formulas for probabilities and expectations In the third edition this book further develops stochastic optimization methods In particular it now shows how to apply stochastic optimization methods to the approximate solution of important concrete problems arising in engineering economics and operations research

Stochastic Optimization Kurt Marti,2012-12-06 This volume includes a selection of refereed papers presented at the

GAMM IFIP Workshop on Stochastic Optimization Numerical Methods and Technical Applications held at the Federal Armed Forces University Munich May 29 31 1990 The objective of this meeting was to bring together scientists from Stochastic Programming and from those Engineering areas where Mathematical Programming models are common tools as e g Optimal Structural Design Power Dispatch Acid Rain Management etc The first theoretical part includes the papers by S D Flam H Niederreiter E Poechinger and R Schultz The second part on methods and applications contains the articles by N Baba N Grwe and W Roemisch J Mayer E A Mc Bean and A Vasarhelyi   Stochastic Optimization Methods for Modern Machine Learning Problems Yuejiao Sun,2021 Optimization has been the workhorse of solving machine learning problems However the efficiency of these methods remains far from satisfaction to meet the ever growing demand that arises in modern applications In this context the present dissertation will focus on two fundamental classes of machine learning problems 1 stochastic nested problems where one subproblem builds upon the solution of others and 2 stochastic distributed problems where the subproblems are coupled through sharing the common variables One key difficulty of solving stochastic nested problems is that the hierarchically coupled structure makes the computation of stochastic gradients the basic element in first order optimization machinery prohibitively expensive or even impossible We will develop the first stochastic optimization method which runs in a single loop manner and achieves the same sample complexity as the stochastic gradient descent method for non nested problems One key difficulty of solving stochastic distributed problems is the resource intensity especially when algorithms are running atresource limited devices In this context we will introduce a class of communication adaptive stochastic gradient descent SGD methods which adaptively reuse the stale gradients thus saving communication We will show that the new algorithms have convergence rates comparable to original SGD and Adam algorithms but enjoy impressive empirical performance in terms of total communication round reduction   **Designing Engineering Structures using Stochastic Optimization Methods** Levent Aydin,H. Seçil Artem,Selda Oterkus,2020-04-27 Among all aspects of engineering design is the most important step in developing a new product A systematic approach to managing design issues can only be accomplished by applying mathematical optimization methods Furthermore due to the practical issues in engineering problems there are limitations in using traditional methods As such stochastic optimization methods such as differential evolution simulated annealing and genetic algorithms are preferable in finding solutions in design optimization problems This book reviews mechanical engineering design optimization using stochastic methods It introduces students and design engineers to practical aspects of complicated mathematical optimization procedures and outlines steps for wide range of selected engineering design problems It shows how engineering structures are systematically designed Many new engineering design applications based on stochastic optimization techniques in automotive energy military naval manufacturing process and fluids heat transfer are described in the book For each design optimization problem described background is provided for understanding the solutions There are very few books on optimization that include engineering

applications They cover limited applications and that too of well known design problems of advanced and niche nature Common problems are hardly addressed Thus the subject has remained fairly theoretical To overcome this each chapter in this book is contributed by at least one academic and one industrial expert researcher **Optimization Methods** Marco Cavazzuti,2012-09-14 This book is about optimization techniques and is subdivided into two parts In the first part a wide overview on optimization theory is presented Optimization is presented as being composed of five topics namely design of experiment response surface modeling deterministic optimization stochastic optimization and robust engineering design Each chapter after presenting the main techniques for each part draws application oriented conclusions including didactic examples In the second part some applications are presented to guide the reader through the process of setting up a few optimization exercises analyzing critically the choices which are made step by step and showing how the different topics that constitute the optimization theory can be used jointly in an optimization process The applications which are presented are mainly in the field of thermodynamics and fluid dynamics due to the author s background Stochastic Optimization Ioannis Dritsas,2011-02-28 Stochastic Optimization Algorithms have become essential tools in solving a wide range of difficult and critical optimization problems Such methods are able to find the optimum solution of a problem with uncertain elements or to algorithmically incorporate uncertainty to solve a deterministic problem They even succeed in fighting uncertainty with uncertainty This book discusses theoretical aspects of many such algorithms and covers their application in various scientific fields **Stochastic Optimization** Stanislav Uryasev,Panos M. Pardalos,2013-03-09 Stochastic programming is the study of procedures for decision making under the presence of uncertainties and risks Stochastic programming approaches have been successfully used in a number of areas such as energy and production planning telecommunications and transportation Recently the practical experience gained in stochastic programming has been expanded to a much larger spectrum of applications including financial modeling risk management and probabilistic risk analysis Major topics in this volume include 1 advances in theory and implementation of stochastic programming algorithms 2 sensitivity analysis of stochastic systems 3 stochastic programming applications and other related topics Audience Researchers and academies working in optimization computer modeling operations research and financial engineering The book is appropriate as supplementary reading in courses on optimization and financial engineering **Stochastic Optimization Methods in Finance and Energy** Marida Bertocchi,Giorgio Consigli,Michael A. H. Dempster,2011-09-15 This volume presents a collection of contributions dedicated to applied problems in the financial and energy sectors that have been formulated and solved in a stochastic optimization framework The invited authors represent a group of scientists and practitioners who cooperated in recent years to facilitate the growing penetration of stochastic programming techniques in real world applications inducing a significant advance over a large spectrum of complex decision problems After the recent widespread liberalization of the energy sector in Europe and the unprecedented growth of energy prices in international commodity markets we have witnessed a significant convergence

of strategic decision problems in the energy and financial sectors This has often resulted in common open issues and has induced a remarkable effort by the industrial and scientific communities to facilitate the adoption of advanced analytical and decision tools The main concerns of the financial community over the last decade have suddenly penetrated the energy sector inducing a remarkable scientific and practical effort to address previously unforeseeable management problems Stochastic Optimization Methods in Finance and Energy New Financial Products and Energy Markets Strategies aims to include in a unified framework for the first time an extensive set of contributions related to real world applied problems in finance and energy leading to a common methodological approach and in many cases having similar underlying economic and financial implications Part 1 of the book presents 6 chapters related to financial applications Part 2 presents 7 chapters on energy applications and Part 3 presents 5 chapters devoted to specific theoretical and computational issues   Stochastic Optimization Methods in Finance and Energy ,2011-09-11   **Stochastic Modeling and Optimization** ,2025 Most processes in life are prone to randomness which can be both a challenge and an aid in mathematical modeling and optimization In this dissertation this randomness is studied through various modeling methods and stochastic optimization algorithms It is shown how these can be developed for and applied to diverse problems in the domains of healthcare manufacturing and search engine optimization The key modeling methods are Markov chains and discrete event models and the key optimization algorithms are stochastic approximation algorithms and evolutionary algorithms The following is addressed A three step framework for capacity planning in nursing homes is developed that includes a shift scheduling algorithm and a genetic algorithm that assigns nurses to daily tasks A neural network metamodeler is developed that integrates biased analytical queuing features to estimate the throughput of a tandem line This metamodeler is applied to a variety of optimization problems such as the buffer allocation problem An algorithm based on pseudo gradient methods is developed to optimize a function over the stationary distribution of a Markov chain The emergency response process of electric ambulances is modeled to determine the influence of transitioning from a diesel to an electric fleet on the response times   **Adaptive Stochastic Optimization Techniques with Applications** James A. Momoh,2015-12-02 Adaptive Stochastic Optimization Techniques with Applications provides a single convenient source for state of the art information on optimization techniques used to solve problems with adaptive dynamic and stochastic features Presenting modern advances in static and dynamic optimization decision analysis intelligent systems evolutionary pro   Stochastic Process Optimization using Aspen Plus® Juan Gabriel Segovia-Hernández,Fernando Israel Gómez-Castro,2017-11-01 Stochastic Process Optimization using Aspen Plus Bookshop Category Chemical Engineering Optimization can be simply defined as choosing the best alternative among a set of feasible options In all the engineering areas optimization has a wide range of applications due to the high number of decisions involved in an engineering environment Chemical engineering and particularly process engineering is not an exception thus stochastic methods are a good option to solve optimization problems for the complex

process engineering models In this book the combined use of the modular simulator Aspen Plus and stochastic optimization methods codified in MATLAB is presented Some basic concepts of optimization are first presented then strategies to use the simulator linked with the optimization algorithm are shown Finally examples of application for process engineering are discussed The reader will learn how to link the process simulator Aspen Plus and stochastic optimization algorithms to solve process design problems They will gain ability to perform multi objective optimization in several case studies Key Features The book links simulation and optimization through numerical analyses and stochastic optimization techniques Includes use of examples to illustrate the application of the concepts and specific guidance on the use of software Aspen Plus Excel MATLB to set up and solve models representing complex problems Illustrates several examples of applications for the linking of simulation and optimization software with other packages for optimization purposes Provides specific information on how to implement stochastic optimization with process simulators Enable readers to identify practical and economic solutions to problems of industrial relevance enhancing the safety operation environmental and economic performance of chemical processes   Numerical Techniques for Stochastic Optimization I︠U︡riĭ Mikhaĭlovich Ermolʹev,Roger J.-B. Wets,1988   Stochastic Optimization Techniques Kurt Marti,2002 Optimization problems arising in practice mostly contain several random parameters Hence in order to get robust optimal solutions with respect to random parameter variations the available statistical information about the random data should be considered already at the planning phase Thus the original problem with random coefficients must be replaced by an appropriate deterministic substitute problem This proceedings volume of the 4th GAMM IFIP Workshop on Stochastic Optimization Numerical Methods and Technical Applications held June 27 29 2000 at the Federal Armed Forces University Munich Neubiberg Munich contains new methods for the approximation and numerical solution of deterministic substitute problems especially the handling of mean value and probability functions as objective and or constraint functions Moreover many concrete applications from engineering and operations research can be found in this book   *Stochastic optimization methods and their value for experimenting with computing systems* Brigitte Baumeister,Heinz Beilner,1974   **Stochastic optimization methods for supply chains with perishable products** Michael A. Völkel,2020-07-03 This book deals with inventory systems in supply chains that face risks that could render products unsalable These risks include possible cooling system failures transportation risks packaging errors handling errors or natural quality deterioration over time like spoilage of food or blood products Classical supply chain inventory models do not regard these risks This thesis introduces novel cost models that consider these risks It also analyzes how real time tracking with RFID sensors and smart containers can contribute to decision making To solve these cost models this work presents new solution methods based on dynamic programming In extensive computational studies both with experimental as well as real life data from large players in the retailer industry the solution methods prove to lead to substantially lower costs than existing solution methods and heuristics   **Learning Automata and Stochastic Optimization** A.S. Poznyak,K.

Najim,1997-03-12 In the last decade there has been a steadily growing need for and interest in computational methods for solving stochastic optimization problems with or wihout constraints Optimization techniques have been gaining greater acceptance in many industrial applications and learning systems have made a significant impact on engineering problems in many areas including modelling control optimization pattern recognition signal processing and diagnosis Learning automata have an advantage over other methods in being applicable across a wide range of functions Featuring new and efficient learning techniques for stochastic optimization and with examples illustrating the practical application of these techniques this volume will be of benefit to practicing control engineers and to graduate students taking courses in optimization control theory or statistics   Optimization Methods Marco Cavazzuti,2012-09-11 This book is about optimization techniques and is subdivided into two parts In the first part a wide overview on optimization theory is presented Optimization is presented as being composed of five topics namely design of experiment response surface modeling deterministic optimization stochastic optimization and robust engineering design Each chapter after presenting the main techniques for each part draws application oriented conclusions including didactic examples In the second part some applications are presented to guide the reader through the process of setting up a few optimization exercises analyzing critically the choices which are made step by step and showing how the different topics that constitute the optimization theory can be used jointly in an optimization process The applications which are presented are mainly in the field of thermodynamics and fluid dynamics due to the author s background

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