Stochastic Optimization Methods

Michael Rajnik

Stochastic Optimization Methods:

   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   Stochastic Optimization Methods Kurt Marti,2024 This book examines optimization problems that in practice involve random model parameters It outlines the computation of robust optimal solutions i e optimal solutions that are insensitive 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 corresponding deterministic 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 The fourth edition of this classic text has been carefully and thoroughly revised It includes new chapters on the solution of stochastic linear programs by discretization of the underlying probability distribution and on solving deterministic optimization problems by means of controlled random search methods and multiple random search procedures It also presents a new application of stochastic optimization methods to machine learning problems with different loss functions For the computation of optimal feedback controls under stochastic uncertainty besides the open loop feedback procedures a new method based on Taylor expansions with respect to the gain parameters is presented The book is intended for researchers and graduate students who are interested in stochastics stochastic optimization and control It will also benefit professionals and practitioners whose work involves technical economic and or operations research problems under stochastic uncertainty   *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** 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 **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** 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 **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 **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 **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   Numerical Techniques for Stochastic Optimization Yuri Ermoliev,Roger J-B. Wets,2011-10-04 Rapid changes in today s environment emphasize the need for models and meth ods capable of dealing with the uncertainty inherent in virtually all systems re lated to economics meteorology demography ecology etc Systems involving interactions between man nature and technology are subject to disturbances which may be unlike anything which has been experienced in the past In the technological revolution increases uncertainty as each new stage particular perturbs existing knowledge of structures limitations and constraints At the same time many systems are often too complex to allow for precise measure ment of the parameters or the state of the system Uncertainty nonstationarity disequilibrium are pervasivE characteristics of most modern systems In order to manage such situations or to survive in such an environment we must develop systems which can facilitate oar response to uncertainty and changing conditions In our individual behavior we often follow guidelines that are conditioned by the need to be prepared for all likely eventualities insur ance wearing seat belts savings versus investments annual medical check ups even keeping an umbrella at the office etc One can identify two major types of mechanisms the short term adaptive adjustments defensive driving mar keting inventory control etc that are made after making some observations of the system s parameters and the long term anticipative actions engineer ing design policy setting allocation of resources investment strategies etc   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 in Finance and Energy* ,2011-09-11   *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

Swarm Intelligence Methods for Statistical Regression Soumya Mohanty,2018-12-14 A core task in statistical analysis

especially in the era of Big Data is the fitting of flexible high dimensional and non linear models to noisy data in order to capture meaningful patterns This can often result in challenging non linear and non convex global optimization problems The large data volume that must be handled in Big Data applications further increases the difficulty of these problems Swarm Intelligence Methods for Statistical Regression describes methods from the field of computational swarm intelligence SI and how they can be used to overcome the optimization bottleneck encountered in statistical analysis Features Provides a short self contained overview of statistical data analysis and key results in stochastic optimization theory Focuses on methodology and results rather than formal proofs Reviews SI methods with a deeper focus on Particle Swarm Optimization PSO Uses concrete and realistic data analysis examples to guide the reader Includes practical tips and tricks for tuning PSO to extract good performance in real world data analysis challenges **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 **Stochastic Global Optimization** Anatoly Zhigljavsky,Antanasz Zilinskas,2007-11-20 This book aims to cover major methodological and theoretical developments in the eld of stochastic global optimization This eld includes global random search and methods based on probabilistic assumptions about the objective function We discuss the basic ideas lying behind the main algorithmic schemes formulate the most essential algorithms and outline the ways of their theor ical investigation We try to be mathematically precise and sound but at the same time we do not often delve deep into the mathematical detail referring instead to the corresponding literature We often do not consider the most g eral assumptions preferring instead simplicity of arguments For example we only consider continuous nite dimensional optimization despite the fact that some of the methods can easily be modi ed for discrete or in nite dimensional optimization problems The authors interests and the availability of good surveys on particular topics have in uenced the choice of material in the book For example there are excellent surveys on simulated annealing both on theoretical and plementation aspects of this method and evolutionary algorithms including genetic algorithms We thus devote much less attention to these topics than they merit concentrating instead on the issues which are not that well d umented in literature We also spend more time discussing the most recent ideas which have been proposed in the last few years *Optimization Methods and Applications* Sergiy Butenko,Panos M. Pardalos,Volodymyr Shylo,2018-02-20 Researchers and practitioners in

computer science optimization operations research and mathematics will find this book useful as it illustrates optimization models and solution methods in discrete non differentiable stochastic and nonlinear optimization Contributions from experts in optimization are showcased in this book showcase a broad range of applications and topics detailed in this volume including pattern and image recognition computer vision robust network design and process control in nonlinear distributed systems This book is dedicated to the 80th birthday of Ivan V Sergienko who is a member of the National Academy of Sciences NAS of Ukraine and the director of the V M Glushkov Institute of Cybernetics His work has had a significant impact on several theoretical and applied aspects of discrete optimization computational mathematics systems analysis and mathematical modeling

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