Convex Analysis And Optimization

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Convex Analysis Springer Science & Business Media
Convex optimization has an increasing impact on many areas of mathematics, applied sciences, and practical applications. It is now being taught at many universities and being used by researchers of different fields. As convex analysis is the mathematical f
Convex Optimization Springer Science & Business Media
A comprehensive introduction to convexity and optimization inRn This book presents the mathematics of finite dimensionalconstrained optimization problems. It provides a basis for thefurther mathematical study of convexity, of more generaloptimization problems, and of numerical algorithms for the solutionof finite dimensional optimization problems. For readers who do nothave the requisite background in real analysis, the author providesa chapter covering this material. The text features abundantexercises and problems designed to lead the reader to a fundamentalunderstanding of the material. Convexity and Optimization in Rn provides detailed discussionof: * Requisite topics in real analysis * Convex sets * Convex functions * Optimization problems * Convex programming and duality * The simplex method A detailed bibliography is included for further study and an indexoffers quick reference. Suitable as a text for both graduate andundergraduate students in mathematics and engineering, thisaccessible text is written from extensively class-tested notes.
Fundamentals of Convex Analysis Athena Scientific
In the last few years, Algorithms for Convex Optimization have revolutionized algorithm design, both for discrete and continuous optimization problems. For problems like maximum flow, maximum matching, and submodular function minimization, the fastest algorithms involve essential methods such as gradient descent, mirror descent, interior point methods, and ellipsoid methods. The goal of this self-contained book is to enable researchers and professionals in computer science, data science, and machine learning to gain an in-depth understanding of these algorithms. The text emphasizes how to derive key algorithms for convex optimization from first principles and how to establish precise running time bounds. This modern text explains the success of these algorithms in problems of discrete optimization, as well as how these methods have significantly pushed the state of the art of convex optimization itself.
Real and Convex Analysis Springer Science & Business Media
A uniquely pedagogical, insightful, and rigorous treatment of the analytical/geometrical foundations of optimization. The book provides a comprehensive development of convexity theory, and its rich applications in optimization, including duality, minimax/saddle point theory, Lagrange multipliers, and Lagrangian relaxation/nondifferentiable optimization. It is an excellent supplement to several of our books: Convex Optimization Theory (Athena Scientific, 2009), Convex Optimization Algorithms (Athena Scientific, 2015), Nonlinear Programming (Athena Scientific, 2016), Network Optimization (Athena Scientific, 1998), and Introduction to Linear Optimization (Athena Scientific, 1997). Aside from a thorough account of convex analysis and optimization, the book aims to restructure the theory of the subject, by introducing several novel unifying lines of analysis, including: 1) A unified development of minimax theory and constrained optimization duality as special cases of duality between two simple geometrical problems. 2) A unified development of conditions for existence of solutions of convex optimization problems, conditions for the minimax equality to hold, and conditions for the absence of a duality gap in constrained optimization. 3) A unification of the major constraint qualifications allowing the use of Lagrange multipliers for nonconvex constrained optimization, using the notion of constraint pseudonormality and an enhanced form of the Fritz John necessary optimality conditions. Among its features the book: a) Develops rigorously and comprehensively the theory of convex sets and functions, in the classical tradition of Fenchel and Rockafellar b) Provides a geometric, highly visual treatment of convex and nonconvex optimization problems, including existence of solutions, optimality conditions, Lagrange multipliers, and duality c) Includes an insightful and comprehensive presentation of minimax theory and zero sum games, and its connection with duality d) Describes dual optimization, the associated computational methods, including the novel incremental subgradient methods, and applications in linear, quadratic, and integer programming e) Contains many examples, illustrations, and exercises with complete solutions (about 200 pages) posted at the publisher's web site http://www.athenasc.com/convexity.html
Analysis II Springer Nature
This book contains different developments of infinite dimensional convex programming in the context of convex analysis, including duality, minmax and Lagrangians, and convexification of nonconvex optimization problems in the calculus of variations (infinite dimension). It also includes the theory of convex duality applied to partial differential equations; no other reference presents this in a systematic way. The minmax theorems contained in this book have many useful applications, in particular the robust control of partial differential equations in finite time horizon. First published in English in 1976, this SIAM Classics in Applied Mathematics edition contains the original text along with a new preface and some additional references.
Convex Analysis and Nonlinear Optimization Springer Science & Business Media
Convexity is an ancient idea going back to Archimedes. Used sporadically in the mathematical literature over the centuries, today it is a flourishing area of research and a mathematical subject in its own right. Convexity is used in optimization theory, functional analysis, complex analysis, and other parts of mathematics.Convex Analysis introduces
Convex Analysis and Monotone Operator Theory in Hilbert Spaces Walter de Gruyter GmbH & Co KG
Here is a book devoted to well-structured and thus efficiently solvable convex optimization problems, with emphasis on conic quadratic and semidefinite programming. The authors present the basic theory underlying these problems as well as their numerous applications in engineering, including synthesis of filters, Lyapunov stability analysis, and structural design. The authors also discuss the complexity issues and provide an overview of the basic theory of state-of-the-art polynomial time interior point methods for linear, conic quadratic, and semidefinite programming. The book's focus on well-structured convex problems in conic form allows for unified theoretical and algorithmical treatment of a wide spectrum of important optimization problems arising in applications.
Convex Analysis and Variational Problems Princeton University Press
This work is intended to serve as a guide for graduate students and researchers who wish to get acquainted with the main theoretical and practical tools for the numerical minimization of convex functions on Hilbert spaces. Therefore, it contains the main tools that are necessary to conduct independent research on the topic. It is also a concise, easy-to-follow and self-contained textbook, which may be useful for any researcher working on related fields, as well as teachers giving graduate-level courses on the topic. It will contain a thorough revision of the extant literature including both classical and state-of-the-art references.
Statistical Inference Via Convex Optimization Foundations and Trends (R) in Machine Learning
This book presents state-of-the-art results and methodologies in modern global optimization, and has been a staple reference for researchers, engineers, advanced students (also in applied mathematics), and practitioners in various fields of engineering. The second edition has been brought up to date and continues to develop a coherent and rigorous theory of deterministic global optimization, highlighting the essential role of convex analysis. The text has been revised and

expanded to meet the needs of research, education, and applications for many years to come. Updates for this new edition include: · Discussion of modern approaches to minimax, fixed point, and equilibrium theorems, and to nonconvex optimization; · Increased focus on dealing more efficiently with ill-posed problems of global optimization, particularly those with hard constraints; · Important discussions of decomposition methods for specially structured problems; · A complete revision of the chapter on nonconvex quadratic programming, in order to encompass the advances made in quadratic optimization since publication of the first edition. · Additionally, this new edition contains entirely new chapters devoted to monotonic optimization, polynomial optimization and optimization under equilibrium constraints, including bilevel programming, multiobjective programming, and optimization with variational inequality constraint. From the reviews of the first edition: The book gives a good review of the topic. ...The text is carefully constructed and well written, the exposition is clear. It leaves a remarkable impression of the concepts, tools and techniques in global optimization. It might also be used as a basis and guideline for lectures on this subject. Students as well as professionals will profitably read and use it.—Mathematical Methods of Operations Research, 49:3 (1999)

Finite Dimensional Convexity and Optimization Springer

This book is an abridged version of the two volumes "Convex Analysis and Minimization Algorithms I and II" (Grundlehren der mathematischen Wissenschaften Vol. 305 and 306). It presents an introduction to the basic concepts in convex analysis and a study of convex minimization problems (with an emphasis on numerical algorithms). The "backbone" of bot volumes was extracted, some material deleted which was deemed too advanced for an introduction, or too closely attached to numerical algorithms. Some exercises were included and finally the index has been considerably enriched, making it an excellent choice for the purpose of learning and teaching.

Convex and Stochastic Optimization Pitman Advanced Publishing Program

Convex Analysis may be considered as a refinement of standard calculus, with equalities and approximations replaced by inequalities. As such, it can easily be integrated into a graduate study curriculum. Minimization algorithms, more specifically those adapted to non-differentiable functions, provide an immediate application of convex analysis to various fields related to optimization and operations research. These two topics making up the title of the book, reflect the two origins of the authors, who belong respectively to the academic world and to that of applications. Part I can be used as an introductory textbook (as a basis for courses, or for self-study); Part II continues this at a higher technical level and is addressed more to specialists, collecting results that so far have not appeared in books.

Convex Optimization Theory Springer Nature

There has been much recent progress in global optimization algo rithms for nonconvex continuous and discrete problems from both a theoretical and a practical perspective. Convex analysis plays a fun damental role in the analysis and development of global optimization algorithms. This is due essentially to the fact that virtually all noncon vex optimization problems can be described using differences of convex functions and differences of convex sets. A conference on Convex Analysis and Global Optimization was held during June 5 -9, 2000 at Pythagorion, Samos, Greece. The conference was honoring the memory of C. Caratheodory (1873-1950) and was en dorsed by the Mathematical Programming Society (MPS) and by the Society for Industrial and Applied Mathematics (SIAM) Activity Group in Optimization. The conference was sponsored by the European Union (through the EPEAEK program), the Department of Mathematics of the Aegean University and the Center for Applied Optimization of the University of Florida, by the General Secretariat of Research and Tech nology of Greece, by the Ministry of Education of Greece, and several local Greek government agencies and companies. This volume contains a selective collection of refereed papers based on invited and contribut ing talks presented at this conference. The two themes of convexity and global optimization pervade this book. The conference provided a forum for researchers working on different aspects of convexity and global opti mization to present their recent discoveries, and to interact with people working on complementary aspects of mathematical programming.

Advances in Convex Analysis and Global Optimization Springer

This book aims at an innovative approach within the framework of convex analysis and optimization, based on an in-depth study of the behavior and properties of the supremum of families of convex functions. It presents an original and systematic treatment of convex analysis, covering standard results and improved calculus rules in subdifferential analysis. The tools supplied in the text allow a direct approach to the mathematical foundations of convex optimization, in particular to optimality and duality theory. Other applications in the book concern convexification processes in optimization, non-convex integration of the Fenchel subdifferential, variational characterizations of convexity, and the study of Chebychev sets. At the same time, the underlying geometrical meaning of all the involved concepts and operations is highlighted and duly emphasized. A notable feature of the book is its unifying methodology, as well as the novelty of providing an alternative or complementary view to the traditional one in which the discipline is presented to students and researchers. This textbook can be used for courses on optimization, convex and variational analysis, addressed to graduate and post-graduate students of mathematics, and also students of economics and engineering. It is also oriented to provide specific background for courses on optimal control, data science, operations research, economics (game theory), etc. The book represents a challenging and motivating development for those experts in functional analysis, convex geometry, and any kind of researchers who may be interested in applications of their work.

Convex Analysis and Optimization Cambridge University Press

This book examines the most fundamental parts of convex analysis and its applications to optimization and location problems. Accessible techniques of variational analysis are employed to clarify and simplify some basic proofs in convex analysis and to build a theory of generalized differentiation for convex functions and sets in finite dimensions. The book serves as a bridge for the readers who have just started using convex analysis to reach deeper topics in the field. Detailed proofs are presented for most of the results in the book and also included are many figures and exercises for better understanding the material. Applications provided include both the classical topics of convex optimization and important problems of modern convex optimization, convex geometry, and facility location.

Convex Analysis and Global Optimization Springer Science & Business Media

This book provides a comprehensive, modern introduction to convex optimization, a field that is becoming increasingly important in applied mathematics, economics and finance, engineering, and computer science, notably in data science and machine learning. Written by a leading expert in the field, this book includes recent advances in the algorithmic theory of convex optimization, naturally complementing the existing literature. It contains a unified and rigorous presentation of the acceleration techniques for minimization schemes of first- and second-order. It provides readers with a full treatment of the smoothing technique, which has tremendously extended the abilities of gradient-type methods. Several powerful approaches in structural optimization, including optimization in relative scale and polynomial-time interior-point methods, are also discussed in detail. Researchers in theoretical optimization as well as professionals working on optimization problems will find this book very useful. It presents many successful examples of how to develop very fast specialized minimization algorithms. Based on the author’s lectures, it can naturally serve as the basis for introductory and advanced courses in convex optimization for students in engineering, economics, computer science and mathematics.

Convex Analysis for Optimization John Wiley & Sons

An updated and revised edition of the 1986 title Convexity and Optimization in Banach Spaces, this book provides a self-contained presentation of basic results of the theory of convex sets and functions in infinite-dimensional spaces. The main emphasis is on applications to convex optimization and convex optimal control problems in Banach spaces. A distinctive feature is a strong emphasis on the connection between theory and application. This edition has been updated to include new results pertaining to advanced concepts of subdifferential for convex functions and new duality results in convex programming. The last chapter, concerned with convex control problems, has been rewritten and completed with new research concerning boundary control systems, the dynamic programming equations in optimal control theory and periodic optimal control problems. Finally, the structure of the book has been modified to highlight the most recent progression in the field including fundamental results on the theory of infinite-dimensional convex analysis and includes helpful bibliographical notes at the end of each chapter.

Convex Analysis and Optimization in Hadamard Spaces Springer Science & Business Media

In the past two decades, convex analysis and optimization have been developed in Hadamard spaces. This book represents a first attempt to give a systematic account on the subject. Hadamard spaces are complete geodesic spaces of nonpositive curvature. They include Hilbert spaces, Hadamard manifolds, Euclidean buildings and many other important spaces. While the role of Hadamard spaces in geometry and geometric group theory has been studied for a long time, first analytical results appeared as late as in the 1990s. Remarkably, it turns out that Hadamard spaces are appropriate for the theory of convex sets and convex functions outside of linear spaces. Since convexity underpins a large number of results in the geometry of Hadamard spaces, we believe that its systematic study is of substantial interest. Optimization methods then address various computational issues and provide us with approximation algorithms which may be useful in sciences and engineering. We present a detailed description of such an application to computational phylogenetics. The book is primarily aimed at both graduate students and researchers in analysis and optimization, but it is accessible to advanced undergraduate students as well.

Convex Analysis and Nonlinear Optimization Princeton University Press

Available for the first time in paperback, R. Tyrrell Rockafellar's classic study presents readers with a coherent branch of nonlinear mathematical analysis that is especially suited to the study of optimization problems. Rockafellar's theory differs from classical analysis in that differentiability assumptions are replaced by convexity assumptions. The topics treated in this volume include: systems of inequalities, the minimum or maximum of a convex function over a convex set, Lagrange multipliers, minimax theorems and duality, as well as basic results about the structure of convex sets and the continuity and differentiability of convex functions and saddle- functions. This book has firmly established a new and vital area not only for pure mathematics but also for applications to economics and engineering. A sound knowledge of linear algebra and introductory real analysis should provide readers with sufficient background for this book. There is also a guide for the reader who may be using the book as an introduction, indicating which parts are essential and which may be skipped on a first reading.

Convex Analysis and Optimization in Hadamard Spaces Springer

This textbook provides an introduction to convex duality for optimization problems in Banach spaces, integration theory, and their application to stochastic programming problems in a static or dynamic setting. It introduces and analyses the main algorithms for stochastic programs, while the theoretical aspects are carefully dealt with. The reader is shown how these tools can be applied to various fields, including approximation theory, semidefinite and second-order cone programming and linear decision rules. This textbook is recommended for students, engineers and researchers who are willing to take a rigorous approach to the mathematics involved in the application of duality theory to optimization with uncertainty.

Convexity and Optimization in Rn SIAM

This book provides a concise, accessible account of convex analysis and its applications and extensions, for a broad audience. It can serve as a teaching text, at roughly the level of first year graduate students, since the main body of the text is self-contained, with each section rounded off by an often extensive set of optional exercises. The new edition adds material on semismooth optimization, as well as several new proofs that will make this book even more self-contained.