Convex Analysis And Optimization

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Convex Analysis And Optimization ***2022-01-18***

KAIYA GEORGE

Convex and Stochastic Optimization Addison-Wesley Longman Limited
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.

Lectures on Convex Optimization Athena Scientific

This book consists of two parts. Firstly, the main notions of abstract convexity and their applications in the study of some classes of functions and sets are presented. Secondly, both theoretical and numerical aspects of global optimization based on abstract convexity are examined. Most of the book does not require knowledge of advanced mathematics. Classical methods of nonconvex mathematical programming, being based on a local approximation, cannot be used to examine and solve many problems of global optimization, and so there is a clear need to develop special global tools for solving these problems. Some of these tools are based on abstract convexity, that is, on the representation of a function of a rather complicated nature as the upper envelope of a set of fairly simple functions. Audience: The book will be of interest to specialists

in global optimization, mathematical programming, and convex analysis, as well as engineers using mathematical tools and optimization techniques and specialists in mathematical modelling.

Convex Analysis and Nonlinear Optimization

Princeton University Press

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 Optimization for Signal Processing and Communications

Springer

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.

Optimality Conditions in Convex Optimization

Springer Nature

Optimality Conditions in Convex Optimization explores an important and central issue in the field of convex optimization: optimality conditions. It brings together the most important and recent results in this area that have been scattered in the literature—notably in the area of convex analysis—essential in developing many of the important results in this book, and not usually found in conventional texts. Unlike other books on convex optimization, which usually discuss algorithms along with some basic theory, the sole focus of this book is on fundamental and advanced convex optimization theory. Although many results presented in the book can also be proved in infinite dimensions, the authors focus on finite dimensions to allow for much deeper results and a better understanding of the structures involved in a convex optimization problem. They address semi-infinite optimization problems; approximate solution concepts of convex optimization problems; and some classes of non-convex problems which can be studied

using the tools of convex analysis. They include examples wherever needed, provide details of major results, and discuss proofs of the main results.

Convex Analysis

Princeton University Press

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) *Semidefinite Optimization and Convex Algebraic Geometry* CRC Press Intended for a wide range of readers, this book covers the main ideas of convex analysis and approximation theory. The author discusses the sources of these two trends in mathematical analysis, develops the main concepts and results, and mentions some beautiful theorems. The relationship of convex analysis to optimization problems, to the calculus of variations, to optimal

control and to geometry is considered, and the evolution of the ideas underlying approximation theory, from its origins to the present day, is discussed. The book is addressed both to students who want to acquaint themselves with these trends and to lecturers in mathematical analysis, optimization and numerical methods, as well as to researchers in these fields who would like to tackle the topic as a whole and seek inspiration for its further development.

Statistical Inference Via Convex 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 analytic tools for studying convexity and provides analytical applications of the concept. The book includes a general background on classical geometric theory which allows readers to obtain a glimpse of how modern mathematics is developed and how geometric ideas may be studied analytically. Featuring a user-friendly approach, the book contains copious examples and plenty of figures to illustrate the

ideas presented. It also includes an appendix with the technical tools needed to understand certain arguments in the book, a tale of notation, and a thorough glossary to help readers with unfamiliar terms. This book is a definitive introductory text to the concept of convexity in the context of mathematical analysis and a suitable resource for students and faculty alike.

Convex Analysis and Nonlinear Optimization

SIAM

Optimization is a rich and thriving mathematical discipline, and the underlying theory of current computational optimization techniques grows ever more sophisticated. This book aims to provide a concise, accessible account of convex analysis and its applications and extensions, for a broad audience. Each section concludes with an often extensive set of optional exercises. This new edition adds material on semismooth optimization, as well as several new proofs.

First-Order Methods in Optimization

Springer Science & Business Media

An insightful, concise, and rigorous treatment of the basic theory of convex sets and functions in finite dimensions, and the analytical/geometrical foundations of convex optimization and duality theory. Convexity theory is first developed in a simple accessible manner, using easily visualized proofs. Then

the focus shifts to a transparent geometrical line of analysis to develop the fundamental duality between descriptions of convex functions in terms of points, and in terms of hyperplanes. Finally, convexity theory and abstract duality are applied to problems of constrained optimization, Fenchel and conic duality, and game theory to develop the sharpest possible duality results within a highly visual geometric framework. This on-line version of the book, includes an extensive set of theoretical problems with detailed high-quality solutions, which significantly extend the range and value of the book. The book may be used as a text for a theoretical convex optimization course; the author has taught several variants of such a course at MIT and elsewhere over the last ten years. It may also be used as a supplementary source for nonlinear programming classes, and as a theoretical foundation for classes focused on convex optimization models (rather than theory). It is an excellent supplement to several of our books: Convex Optimization Algorithms (Athena Scientific, 2015), Nonlinear Programming (Athena Scientific, 2017), Network Optimization(Athena Scientific, 1998), Introduction to Linear Optimization (Athena Scientific, 1997), and Network Flows and Monotropic

Optimization (Athena Scientific, 1998).

Lectures on Modern Convex Optimization Springer

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.

Theory, Methods and Examples John Wiley & Sons

The primary goal of this book is to provide a self-contained, comprehensive study of the main ?rst-order methods that are frequently used in solving large-scale problems. First-order methods exploit

information on values and gradients/subgradients (but not Hessians) of the functions composing the model under consideration. With the increase in the number of applications that can be modeled as large or even huge-scale optimization problems, there has been a revived interest in using simple methods that require low iteration cost as well as low memory storage. The author has gathered, reorganized, and synthesized (in a unified manner) many results that are currently scattered throughout the literature, many of which cannot be typically found in optimization books. First-Order Methods in Optimization offers comprehensive study of first-order methods with the theoretical foundations; provides plentiful examples and illustrations; emphasizes rates of convergence and complexity analysis of the main first-order methods used to solve large-scale problems; and covers both variables and functional decomposition methods.

□□□□□□ Springer Science & Business Media

An accessible introduction to convex algebraic geometry and semidefinite optimization. For graduate students and researchers in mathematics and computer science.

Abstract Convexity and Global Optimization

Foundations and

Trends (R) in Machine Learning
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 Optimization
SIAM
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.

Real and Convex Analysis Walter de Gruyter

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.

Honoring the Memory of C. Caratheodory (1873–1950) Athena Scientific

Convex Optimization for Signal Processing and Communications: From Fundamentals to Applications provides fundamental background knowledge of convex optimization, while striking a balance between mathematical theory and applications in signal processing and communications. In addition to comprehensive proofs and perspective interpretations for core convex optimization theory, this book also provides many insightful figures, remarks, illustrative examples, and guided journeys from theory to cutting-edge research explorations, for efficient and in-depth learning, especially for engineering students and professionals. With the powerful convex optimization theory and tools, this book provides you with a new degree of freedom and the capability of solving challenging real-world scientific and engineering problems.

Foundations of Mathematical Optimization SIAM

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Convex Analysis and Optimization in Hadamard Spaces Cambridge University Press

This monograph presents the main complexity theorems in convex optimization and their corresponding algorithms. It begins with the fundamental theory of black-box optimization and proceeds to guide the reader through recent advances in structural optimization and stochastic optimization. The presentation of black-box optimization, strongly influenced by the seminal book by Nesterov, includes the analysis of cutting plane methods, as well as (accelerated) gradient descent schemes. Special attention is also given to non-Euclidean settings (relevant algorithms include Frank-Wolfe, mirror descent, and dual averaging), and discussing their relevance in machine learning. The text provides a gentle introduction to structural optimization with FISTA (to optimize a sum of a smooth and a simple non-smooth term), saddle-point mirror prox (Nemirovski's alternative to Nesterov's smoothing), and a concise description of interior point methods. In stochastic optimization it discusses stochastic gradient descent, mini-batches, random coordinate descent, and sublinear algorithms. It also briefly touches upon convex relaxation of combinatorial problems and the use of randomness to round solutions, as well as random walks based

methods.

A Finite-Dimensional View Springer Science & Business Media

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.