Convex Optimization Stephen Boyd

Convex Optimization Convex Optimization South Asia Edition Proximal Algorithms Convex Optimization Euclidean Distance Geometry 2e Distributed Optimization and Statistical Learning Via the Alternating Direction Method of Multipliers Introduction to Applied Linear Algebra Multi-Period Trading Via Convex Optimization Convex Optimization & Euclidean Distance Geometry Large-Scale Convex Optimization Linear Matrix Inequalities in System and Control Theory Optimization for Machine Learning Risk Modeling LMIs in Control Systems Apache Spark 2.x Machine Learning Cookbook Robust Equity Portfolio Management Machine Learning and Security Communications, Computation, Control, and Signal Processing Lectures on the Fourier Transform and Its Applications Handbook on Blockchain Analytical Skills for AI and Data Science High-Dimensional Data Analysis with Low-Dimensional Models Algebraic and Geometric Methods in Discrete Mathematics Sum of Squares: Theory and Applications On Informative Path Planning for Tracking and Surveillance ECAI 2016 Applied and Computational Control, Signals, and Circuits Data Science for Engineers On Motion Planning Using Numerical Optimal Control Equity Valuation and Portfolio Management Risk Analysis and Portfolio Modelling Model-Based Reinforcement Learning Financial Modeling of the Equity Market Machine Learning Refined Positive Polynomials in Control Machine Learning Fundamentals Quantitative Equity Investing Self-Stabilizing Systems Energy Minimization Methods in Computer Vision and Pattern Recognition Analog Design Centering and Sizing Maximum-Entropy Sampling

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Algebraic and Geometric Methods in Discrete Mathematics Jan 08 2021 This volume contains the proceedings of the AMS Special Session on Algebraic and Geometric Methods in Applied Discrete Mathematics, held on January 11, 2015, in San Antonio, Texas. The papers present connections between techniques from “pure” mathematics and various applications amenable to the analysis of discrete models, encompassing applications of combinatorics, topology, algebra, geometry, optimization, and representation theory. Papers not only present novel results, but also survey the current state of knowledge of important topics in applied discrete mathematics. Particular highlights include: a new computational framework, based on geometric combinatorics, for structure prediction from RNA sequences; a new method for approximating the optimal solution of a sum of squares problem; a survey of recent Helly-type geometric theorems; applications of representation theory to voting theory and game theory; a study of fixed points of tensors; and exponential random graph models from the perspective of algebraic statistics with applications to networks. This volume was written for those trained in areas such as

algebra, topology, geometry, and combinatorics who are interested in tackling problems in fields such as biology, the social sciences, data analysis, and optimization. It may be useful not only for experts, but also for students who wish to gain an applied or interdisciplinary perspective.

LMIs in Control Systems Oct 17 2021 Although LMI has emerged as a powerful tool with applications across the major domains of systems and control, there has been a need for a textbook that provides an accessible introduction to LMIs in control systems analysis and design. Filling this need, LMIs in Control Systems: Analysis, Design and Applications focuses on the basic analysis and d

Convex Optimization Oct 29 2022 A comprehensive introduction to the tools, techniques and applications of convex optimization.

Positive Polynomials in Control Dec 27 2019 Positive Polynomials in Control originates from an invited session presented at the IEEE CDC 2003 and gives a comprehensive overview of existing results in this quickly emerging area. This carefully edited book collects important contributions from several fields of control, optimization, and mathematics, in order to show different views and approaches of polynomial positivity. The book is organized in three parts, reflecting the current trends in the area: 1. applications of positive polynomials and LMI optimization to solve various control problems, 2. a mathematical overview of different algebraic techniques used to cope with polynomial positivity, 3. numerical aspects of positivity of polynomials, and recently developed software tools which can be employed to solve the problems discussed in the book.

Self-Stabilizing Systems Sep 23 2019 This book constitutes the refereed proceedings of the 7th International Symposium on Self-Stabilizing Systems, SSS 2005, held in Barcelona, Spain, in October 2005. The 15 revised full papers presented were carefully reviewed and selected from 33 submissions. The papers address classical topics of self-stabilization, prevailing extensions to the field, such as snap-stabilization, code stabilization, self-stabilization with either dynamic, faulty or Byzantine components, or deal with applications of self-stabilization, either related to operating systems, security, or mobile and ad hoc networks.

Distributed Optimization and Statistical Learning Via the Alternating Direction Method of Multipliers Jun 25 2022 Surveys the theory and history of the alternating direction method of multipliers, and discusses its applications to a wide variety of statistical and machine learning problems of recent interest, including the lasso, sparse logistic regression, basis pursuit, covariance selection, support vector machines, and many others.

Multi-Period Trading Via Convex Optimization Apr 23 2022 This monograph collects in one place the basic definitions, a careful description of the model, and discussion of how convex optimization can be used in multi-period trading, all in a common notation and framework.

Financial Modeling of the Equity Market Feb 27 2020 An inside look at modern approaches to modeling equity portfolios Financial Modeling of the Equity Market is the most comprehensive, up-to-date guide to modeling equity portfolios. The book is intended for a wide range of quantitative analysts, practitioners, and students of finance. Without sacrificing mathematical rigor, it presents arguments in a concise and clear style with a wealth of real-world examples and practical simulations. This book presents all the major approaches to single-period return analysis, including modeling, estimation, and optimization issues. It covers both static and dynamic factor analysis, regime shifts, long-run modeling, and cointegration. Estimation issues, including dimensionality reduction, Bayesian estimates, the Black-Litterman model, and random coefficient models, are also covered in depth. Important advances in transaction cost measurement and modeling,

robust optimization, and recent developments in optimization with higher moments are also discussed. Sergio M. Focardi (Paris, France) is a founding partner of the Paris-based consulting firm, The Intertek Group. He is a member of the editorial board of the Journal of Portfolio Management. He is also the author of numerous articles and books on financial modeling. Petter N. Kolm, PhD (New Haven, CT and New York, NY), is a graduate student in finance at the Yale School of Management and a financial consultant in New York City. Previously, he worked in the Quantitative Strategies Group of Goldman Sachs Asset Management, where he developed quantitative investment models and strategies.

Apache Spark 2.x Machine Learning Cookbook Sep 16 2021 Simplify machine learning model implementations with Spark About This Book Solve the day-to-day problems of data science with Spark This unique cookbook consists of exciting and intuitive numerical recipes Optimize your work by acquiring, cleaning, analyzing, predicting, and visualizing your data Who This Book Is For This book is for Scala developers with a fairly good exposure to and understanding of machine learning techniques, but lack practical implementations with Spark. A solid knowledge of machine learning algorithms is assumed, as well as hands-on experience of implementing ML algorithms with Scala. However, you do not need to be acquainted with the Spark ML libraries and ecosystem. What You Will Learn Get to know how Scala and Spark go hand-in-hand for developers when developing ML systems with Spark Build a recommendation engine that scales with Spark Find out how to build unsupervised clustering systems to classify data in Spark Build machine learning systems with the Decision Tree and Ensemble models in Spark Deal with the curse of high-dimensionality in big data using Spark Implement Text analytics for Search Engines in Spark Streaming Machine Learning System implementation using Spark In Detail Machine learning aims to extract knowledge from data, relying on fundamental concepts in computer science, statistics, probability, and optimization. Learning about algorithms enables a wide range of applications, from everyday tasks such as product recommendations and spam filtering to cutting edge applications such as self-driving cars and personalized medicine. You will gain hands-on experience of applying these principles using Apache Spark, a resilient cluster computing system well suited for large-scale machine learning tasks. This book begins with a quick overview of setting up the necessary IDEs to facilitate the execution of code examples that will be covered in various chapters. It also highlights some key issues developers face while working with machine learning algorithms on the Spark platform. We progress by uncovering the various Spark APIs and the implementation of ML algorithms with developing classification systems, recommendation engines, text analytics, clustering, and learning systems. Toward the final chapters, we'll focus on building high-end applications and explain various unsupervised methodologies and challenges to tackle when implementing with big data ML systems. Style and approach This book is packed with intuitive recipes supported with line-by-line explanations to help you understand how to optimize your work flow and resolve problems when working with complex data modeling tasks and predictive algorithms. This is a valuable resource for data scientists and those working on large scale data projects.

Robust Equity Portfolio Management Aug 15 2021 A comprehensive portfolio optimization guide, with provided MATLAB code Robust Equity Portfolio Management + Website offers the most comprehensive coverage available in this burgeoning field. Beginning with the fundamentals before moving into advanced techniques, this book provides useful coverage for both beginners and advanced readers. MATLAB code is provided to allow readers of all levels to begin implementing robust models immediately, with detailed explanations and applications in the equity market included to help you grasp the real-world use of each technique. The discussion includes the most up-to-date thinking and

cutting-edge methods, including a much-needed alternative to the traditional Markowitz mean-variance model. Unparalleled in depth and breadth, this book is an invaluable reference for all risk managers, portfolio managers, and analysts. Portfolio construction models originating from the standard Markowitz mean-variance model have a high input sensitivity that threatens optimization, spawning a flurry of research into new analytic techniques. This book covers the latest developments along with the basics, to give you a truly comprehensive understanding backed by a robust, practical skill set. Get up to speed on the latest developments in portfolio optimization Implement robust models using provided MATLAB code Learn advanced optimization methods with equity portfolio applications Understand the formulations, performances, and properties of robust portfolios The Markowitz mean-variance model remains the standard framework for portfolio optimization, but the interest in—and need for—an alternative is rapidly increasing. Resolving the sensitivity issue and dramatically reducing portfolio risk is a major focus of today's portfolio manager. Robust Equity Portfolio Management + Website provides a viable alternative framework, and the hard skills to implement any optimization method.

Introduction to Applied Linear Algebra May 24 2022 A groundbreaking introduction to vectors, matrices, and least squares for engineering applications, offering a wealth of practical examples.

Energy Minimization Methods in Computer Vision and Pattern Recognition Aug 23 2019 This volume constitutes the refereed proceedings of the 9th International Conference on Energy Minimization Methods in Computer Vision and Pattern Recognition, EMMCVPR 2013, held in Lund, Sweden, in August 2013. The 26 revised full papers were carefully reviewed and selected from 40 submissions. The papers are organized in topical sections on Medical Imaging; Image Editing; 3D Reconstruction; Shape Matching; Scene Understanding; Segmentation; Superpixels; Statistical Methods and Learning.

Linear Matrix Inequalities in System and Control Theory Jan 20 2022 In this book the authors reduce a wide variety of problems arising in system and control theory to a handful of convex and quasiconvex optimization problems that involve linear matrix inequalities. These optimization problems can be solved using recently developed numerical algorithms that not only are polynomial-time but also work very well in practice; the reduction therefore can be considered a solution to the original problems. This book opens up an important new research area in which convex optimization is combined with system and control theory, resulting in the solution of a large number of previously unsolved problems.

Large-Scale Convex Optimization Feb 21 2022 Starting from where a first course in convex optimization leaves off, this text presents a unified analysis of first-order optimization methods – including parallel-distributed algorithms – through the abstraction of monotone operators. With the increased computational power and availability of big data over the past decade, applied disciplines have demanded that larger and larger optimization problems be solved. This text covers the first-order convex optimization methods that are uniquely effective at solving these large-scale optimization problems. Readers will have the opportunity to construct and analyze many well-known classical and modern algorithms using monotone operators, and walk away with a solid understanding of the diverse optimization algorithms. Graduate students and researchers in mathematical optimization, operations research, electrical engineering, statistics, and computer science will appreciate this concise introduction to the theory of convex optimization algorithms.

Maximum-Entropy Sampling Jun 20 2019 This monograph presents a comprehensive treatment of the maximum-entropy sampling problem (MESP), which is a fascinating topic

at the intersection of mathematical optimization and data science. The text situates MESP in information theory, as the algorithmic problem of calculating a sub-vector of pre-specificed size from a multivariate Gaussian random vector, so as to maximize Shannon's differential entropy. The text collects and expands on state-of-the-art algorithms for MESP, and addresses its application in the field of environmental monitoring. While MESP is a central optimization problem in the theory of statistical designs (particularly in the area of spatial monitoring), this book largely focuses on the unique challenges of its algorithmic side. From the perspective of mathematical-optimization methodology, MESP is rather unique (a 0/1 nonlinear program having a nonseparable objective function), and the algorithmic techniques employed are highly non-standard. In particular, successful techniques come from several disparate areas within the field of mathematical optimization; for example: convex optimization and duality, semidefinite programming, Lagrangian relaxation, dynamic programming, approximation algorithms, 0/1 optimization (e.g., branch-and-bound), extended formulation, and many aspects of matrix theory. The book is mainly aimed at graduate students and researchers in mathematical optimization and data analytics.

Risk Analysis and Portfolio Modelling Apr 30 2020 Financial Risk Measurement is a challenging task, because both the types of risk and the techniques evolve very quickly. This book collects a number of novel contributions to the measurement of financial risk, which address either non-fully explored risks or risk takers, and does so in a wide variety of empirical contexts.

Risk Modeling Nov 18 2021 A wide-ranging overview of the use of machine learning and AI techniques in financial risk management, including practical advice for implementation Risk Modeling: Practical Applications of Artificial Intelligence, Machine Learning, and Deep Learning introduces readers to the use of innovative AI technologies for forecasting and evaluating financial risks. Providing up-to-date coverage of the practical application of current modelling techniques in risk management, this real-world guide also explores new opportunities and challenges associated with implementing machine learning and artificial intelligence (AI) into the risk management process. Authors Terisa Roberts and Stephen Tonna provide readers with a clear understanding about the strengths and weaknesses of machine learning and AI while explaining how they can be applied to both everyday risk management problems and to evaluate the financial impact of extreme events such as global pandemics and changes in climate. Throughout the text, the authors clarify misconceptions about the use of machine learning and AI techniques using clear explanations while offering step-by-step advice for implementing the technologies into an organization's risk management model governance framework. This authoritative volume: Highlights the use of machine learning and AI in identifying procedures for avoiding or minimizing financial risk Discusses practical tools for assessing bias and interpretability of resultant models developed with machine learning algorithms and techniques Covers the basic principles and nuances of feature engineering and common machine learning algorithms Illustrates how risk modeling is incorporating machine learning and AI techniques to rapidly consume complex data and address current gaps in the end-to-end modelling lifecycle Explains how proprietary software and open-source languages can be combined to deliver the best of both worlds: for risk models and risk practitioners Risk Modeling: Practical Applications of Artificial Intelligence, Machine Learning, and Deep Learning is an invaluable guide for CEOs, CROs, CFOs, risk managers, business managers, and other professionals working in risk management.

Model-Based Reinforcement Learning Mar 30 2020 Model-Based Reinforcement Learning Explore a comprehensive and practical approach to reinforcement learning Reinforcement learning is an essential paradigm of machine learning, wherein an intelligent agent

performs actions that ensure optimal behavior from devices. While this paradigm of machine learning has gained tremendous success and popularity in recent years, previous scholarship has focused either on theory—optimal control and dynamic programming – or on algorithms—most of which are simulation-based. Model-Based Reinforcement Learning provides a model-based framework to bridge these two aspects, thereby creating a holistic treatment of the topic of model-based online learning control. In doing so, the authors seek to develop a model-based framework for data-driven control that bridges the topics of systems identification from data, model-based reinforcement learning, and optimal control, as well as the applications of each. This new technique for assessing classical results will allow for a more efficient reinforcement learning system. At its heart, this book is focused on providing an end-to-end framework—from design to application—of a more tractable model-based reinforcement learning technique. Model-Based Reinforcement Learning readers will also find: A useful textbook to use in graduate courses on data-driven and learning-based control that emphasizes modeling and control of dynamical systems from data Detailed comparisons of the impact of different techniques, such as basic linear quadratic controller, learning-based model predictive control, model-free reinforcement learning, and structured online learning Applications and case studies on ground vehicles with nonholonomic dynamics and another on quadrator helicopters An online, Python-based toolbox that accompanies the contents covered in the book, as well as the necessary code and data Model-Based Reinforcement Learning is a useful reference for senior undergraduate students, graduate students, research assistants, professors, process control engineers, and roboticists.

Convex Optimization Euclidean Distance Geometry 2e Jul 26 2022 Convex Analysis is an emerging calculus of inequalities while Convex Optimization is its application. Analysis is the domain of the mathematician while Optimization belongs to the engineer. In layman's terms, the mathematical science of Optimization is a study of how to make good choices when confronted with conflicting requirements and demands. The qualifier Convex means: when an optimal solution is found, then it is guaranteed to be a best solution; there is no better choice. As any convex optimization problem has geometric interpretation, this book is about convex geometry (with particular attention to distance geometry) and nonconvex, combinatorial, and geometrical problems that can be relaxed or transformed into convexity. A virtual flood of new applications follows by epiphany that many problems, presumed nonconvex, can be so transformed. This is a BLACK & WHITE paperback. A hardcover with full color interior, as originally conceived, is available at lulu.com/spotlight/dattorro

High-Dimensional Data Analysis with Low-Dimensional Models Feb 09 2021 Connects fundamental mathematical theory with real-world problems, through efficient and scalable optimization algorithms.

Quantitative Equity Investing Oct 25 2019 A comprehensive look at the tools and techniques used in quantitative equity management Some books attempt to extend portfolio theory, but the real issue today relates to the practical implementation of the theory introduced by Harry Markowitz and others who followed. The purpose of this book is to close the implementation gap by presenting state-of-the art quantitative techniques and strategies for managing equity portfolios. Throughout these pages, Frank Fabozzi, Sergio Focardi, and Petter Kolm address the essential elements of this discipline, including financial model building, financial engineering, static and dynamic factor models, asset allocation, portfolio models, transaction costs, trading strategies, and much more. They also provide ample illustrations and thorough discussions of implementation issues facing those in the investment management business and include the necessary background material in probability, statistics, and econometrics to make the book self-contained.

Written by a solid author team who has extensive financial experience in this area Presents state-of-the art quantitative strategies for managing equity portfolios Focuses on the implementation of quantitative equity asset management Outlines effective analysis, optimization methods, and risk models In today's financial environment, you have to have the skills to analyze, optimize and manage the risk of your quantitative equity investments. This guide offers you the best information available to achieve this goal.

Handbook on Blockchain Apr 11 2021 This handbook aims to serve as a one-stop, reliable source of reference, with curations of survey and expository contributions on the state-of-the-art in Blockchain technology. It covers a comprehensive range of topics, providing the technical and non-technical reader with fundamentals, applications, and deep details on a variety of topics. The readership is expected to span broadly from technologically-minded business professionals and entrepreneurs, to students, instructors, novices and seasoned researchers, in computer science, engineering, software engineering, finance, and data science. Though Blockchain technology is relatively young, its evolution as a field and a practice is booming in growth and its importance to society had never been more important than it is today. Blockchain solutions enable a decentralization of a digital society where people can contribute, collaborate, and transact without having to second-guess the trust and transparency factors with many geographical, financial, and political barriers removed. It is the distributed ledger technology behind the success of Bitcoin, Ethereum, and many emerging applications. The resource is divided into 5 parts. Part 1 (Foundation) walks the reader through a comprehensive set of essential concepts, protocols, and algorithms that lay the foundation for Blockchain. Part 2 (Scalability) focuses on the most pressing challenges of today's blockchain networks in how to keep pace with real-world expectations. Part 3 (Trust and Security) provides detailed coverage on the issues of trust, reputation, and security in Blockchain. Part 4 (Decentralized Finance) is devoted to a high-impact application of Blockchain to finance, the sector that has most benefitted from this technology. Part 5 (Application and Policy) includes several cases where Blockchain applies to the real world.

Machine Learning and Security Jul 14 2021 Can machine learning techniques solve our computer security problems and finally put an end to the cat-and-mouse game between attackers and defenders? Or is this hope merely hype? Now you can dive into the science and answer this question for yourself! With this practical guide, you'll explore ways to apply machine learning to security issues such as intrusion detection, malware classification, and network analysis. Machine learning and security specialists Clarence Chio and David Freeman provide a framework for discussing the marriage of these two fields, as well as a toolkit of machine-learning algorithms that you can apply to an array of security problems. This book is ideal for security engineers and data scientists alike. Learn how machine learning has contributed to the success of modern spam filters Quickly detect anomalies, including breaches, fraud, and impending system failure Conduct malware analysis by extracting useful information from computer binaries Uncover attackers within the network by finding patterns inside datasets Examine how attackers exploit consumer-facing websites and app functionality Translate your machine learning algorithms from the lab to production Understand the threat attackers pose to machine learning solutions

Data Science for Engineers Aug 03 2020 With tremendous improvement in computational power and availability of rich data, almost all engineering disciplines use data science at some level. This textbook presents material on data science comprehensively, and in a structured manner. It provides conceptual understanding of the fields of data science, machine learning, and artificial intelligence, with enough level of mathematical details necessary for the readers. This will help readers understand major thematic ideas in data

science, machine learning and artificial intelligence, and implement first-level data science solutions to practical engineering problems. The book- Provides a systematic approach for understanding data science techniques Explain why machine learning techniques are able to cross-cut several disciplines. Covers topics including statistics, linear algebra and optimization from a data science perspective. Provides multiple examples to explain the underlying ideas in machine learning algorithms Describes several contemporary machine learning algorithms The textbook is primarily written for undergraduate and senior undergraduate students in different engineering disciplines including chemical engineering, mechanical engineering, electrical engineering, electronics and communications engineering for courses on data science, machine learning and artificial intelligence.

On Informative Path Planning for Tracking and Surveillance Nov 06 2020 This thesis studies a class of sensor management problems called informative path planning (IPP). Sensor management refers to the problem of optimizing control inputs for sensor systems in dynamic environments in order to achieve operational objectives. The problems are commonly formulated as stochastic optimal control problems, where to objective is to maximize the information gained from future measurements. In IPP, the control inputs affect the movement of the sensor platforms, and the goal is to compute trajectories from where the sensors can obtain measurements that maximize the estimation performance. The core challenge lies in making decisions based on the predicted utility of future measurements. In linear Gaussian settings, the estimation performance is independent of the actual measurements. This means that IPP becomes a deterministic optimal control problem, for which standard numerical optimization techniques can be applied. This is exploited in the first part of this thesis. A surveillance application is considered, where a mobile sensor is gathering information about features of interest while avoiding being tracked by an adversarial observer. The problem is formulated as an optimization problem that allows for a trade-off between informativeness and stealth. We formulate a theorem that makes it possible to reformulate a class of nonconvex optimization problems with matrix-valued variables as convex optimization problems. This theorem is then used to prove that the seemingly intractable IPP problem can be solved to global optimality using off-the-shelf optimization tools. The second part of this thesis considers tracking of a maneuvering target using a mobile sensor with limited field of view. The problem is formulated as an IPP problem, where the goal is to generate a sensor trajectory that maximizes the expected tracking performance, captured by a measure of the covariance matrix of the target state estimate. When the measurements are nonlinear functions of the target state, the tracking performance depends on the actual measurements, which depend on the target's trajectory. Since these are unavailable in the planning stage, the problem becomes a stochastic optimal control problem. An approximation of the problem based on deterministic sampling of the distribution of the predicted target trajectory is proposed. It is demonstrated in a simulation study that the proposed method significantly increases the tracking performance compared to a conventional approach that neglects the uncertainty in the future target trajectory.

Optimization for Machine Learning Dec 19 2021 Optimization happens everywhere. Machine learning is one example of such and gradient descent is probably the most famous algorithm for performing optimization. Optimization means to find the best value of some function or model. That can be the maximum or the minimum according to some metric. Using clear explanations, standard Python libraries, and step-by-step tutorial lessons, you will learn how to find the optimum point to numerical functions confidently using modern optimization algorithms.

Sum of Squares: Theory and Applications Dec 07 2020 This volume is based on lectures

delivered at the 2019 AMS Short Course "Sum of Squares: Theory and Applications", held January 14–15, 2019, in Baltimore, Maryland. This book provides a concise state-of-the-art overview of the theory and applications of polynomials that are sums of squares. This is an exciting and timely topic, with rich connections to many areas of mathematics, including polynomial and semidefinite optimization, real and convex algebraic geometry, and theoretical computer science. The six chapters introduce and survey recent developments in this area; specific topics include the algebraic and geometric aspects of sums of squares and spectrahedra, lifted representations of convex sets, and the algorithmic and computational implications of viewing sums of squares as a meta algorithm. The book also showcases practical applications of the techniques across a variety of areas, including control theory, statistics, finance and machine learning.

Applied and Computational Control, Signals, and Circuits Sep 04 2020 The purpose of this annual series, Applied and Computational Control, Signals, and Circuits, is to keep abreast of the fast-paced developments in computational mathematics and scientific computing and their increasing use by researchers and engineers in control, signals, and circuits. The series is dedicated to fostering effective communication between mathematicians, computer scientists, computational scientists, software engineers, theorists, and practicing engineers. This interdisciplinary scope is meant to blend areas of mathematics (such as linear algebra, operator theory, and certain branches of analysis) and computational mathematics (numerical linear algebra, numerical differential equations, large scale and parallel matrix computations, numerical optimization) with control and systems theory, signal and image processing, and circuit analysis and design. The disciplines mentioned above have long enjoyed a natural synergy. There are distinguished journals in the fields of control and systems the ory, as well as signal processing and circuit theory, which publish high quality papers on mathematical and engineering aspects of these areas; however, articles on their computational and applications aspects appear only sporadically. At the same time, there has been tremendous recent growth and development of computational mathematics, scientific comput ing, and mathematical software, and the resulting sophisticated techniques are being gradually adapted by engineers, software designers, and other scientists to the needs of those applied disciplines.

Machine Learning Refined Jan 28 2020 Providing a unique approach to machine learning, this text contains fresh and intuitive, yet rigorous, descriptions of all fundamental concepts necessary to conduct research, build products, tinker, and play. By prioritizing geometric intuition, algorithmic thinking, and practical real world applications in disciplines including computer vision, natural language processing, economics, neuroscience, recommender systems, physics, and biology, this text provides readers with both a lucid understanding of foundational material as well as the practical tools needed to solve real-world problems. With in-depth Python and MATLAB/OCTAVE-based computational exercises and a complete treatment of cutting edge numerical optimization techniques, this is an essential resource for students and an ideal reference for researchers and practitioners working in machine learning, computer science, electrical engineering, signal processing, and numerical optimization.

ECAI 2016 Oct 05 2020 Artificial Intelligence continues to be one of the most exciting and fast-developing fields of computer science. This book presents the 177 long papers and 123 short papers accepted for ECAI 2016, the latest edition of the biennial European Conference on Artificial Intelligence, Europe's premier venue for presenting scientific results in AI. The conference was held in The Hague, the Netherlands, from August 29 to September 2, 2016. ECAI 2016 also incorporated the conference on Prestigious Applications of Intelligent Systems (PAIS) 2016, and the Starting AI Researcher Symposium

(STAIRS). The papers from PAIS are included in this volume; the papers from STAIRS are published in a separate volume in the Frontiers in Artificial Intelligence and Applications (FAIA) series. Organized by the European Association for Artificial Intelligence (EurAI) and the Benelux Association for Artificial Intelligence (BNVKI), the ECAI conference provides an opportunity for researchers to present and hear about the very best research in contemporary AI. This proceedings will be of interest to all those seeking an overview of the very latest innovations and developments in this field.

Lectures on the Fourier Transform and Its Applications May 12 2021 This book is derived from lecture notes for a course on Fourier analysis for engineering and science students at the advanced undergraduate or beginning graduate level. Beyond teaching specific topics and techniques—all of which are important in many areas of engineering and science—the author's goal is to help engineering and science students cultivate more advanced mathematical know-how and increase confidence in learning and using mathematics, as well as appreciate the coherence of the subject. He promises the readers a little magic on every page. The section headings are all recognizable to mathematicians, but the arrangement and emphasis are directed toward students from other disciplines. The material also serves as a foundation for advanced courses in signal processing and imaging. There are over 200 problems, many of which are oriented to applications, and a number use standard software. An unusual feature for courses meant for engineers is a more detailed and accessible treatment of distributions and the generalized Fourier transform. There is also more coverage of higher-dimensional phenomena than is found in most books at this level.

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Analytical Skills for AI and Data Science Mar 10 2021 While several market-leading companies have successfully transformed their business models by following data- and AI-driven paths, the vast majority have yet to reap the benefits. How can your business and analytics units gain a competitive advantage by capturing the full potential of this predictive revolution? This practical guide presents a battle-tested end-to-end method to help you translate business decisions into tractable prescriptive solutions using data and AI as fundamental inputs. Author Daniel Vaughan shows data scientists, analytics practitioners, and others interested in using AI to transform their businesses not only how to ask the right questions but also how to generate value using modern AI technologies and decision-making principles. You'll explore several use cases common to many enterprises, complete with examples you can apply when working to solve your own issues. Break business decisions into stages that can be tackled using different skills from the analytical toolbox Identify and embrace uncertainty in decision making and protect against common human biases Customize optimal decisions to different customers using predictive and prescriptive methods and technologies Ask business questions that create high value through AI- and data-driven technologies

Analog Design Centering and Sizing Jul 22 2019 What you'll find here is a fascinating compendium of fundamental problem formulations of analog design centering and sizing. This essential work provides a differentiated knowledge about the tasks of analog design centering and sizing. In particular, worst-case scenarios are formulated and analyzed. This work is right at the crossing point between process and design technology, and is both reference work and textbook for understanding CAD methods in analog sizing.

Communications, Computation, Control, and Signal Processing Jun 13 2021 A. Paulraj, V. Roychowdhury**, and C. Schaper* * Dept. of Electrical Engineering, Stanford University ** Dept. of Electrical Engineering, UCLA Innumerable conferences are held around the world on the subjects of commu nications, computation, control and signal processing, and on their numerous subdisciplines. Therefore one might not envision a coherent conference*

encom passing all these areas. However, such an event did take place June 22-26, 1995, at an international symposium held at Stanford University to celebrate Professor Thomas Kailath's sixtieth birthday and to honor the notable con tributions made by him and his students and associates. The depth of these contributions was evident from the participation of so many leading figures in each of these fields. Over the five days of the meeting, there were about 200 at tendees, from eighteen countries, more than twenty government and industrial organizations, and various engineering, mathematics and statistics faculties at nearly 50 different academic institutions. They came not only to celebrate but also to learn and to ponder the threads and the connections that Professor Kailath has discovered and woven among so many apparently disparate areas. The organizers received many comments about the richness of the occasion. A distinguished academic wrote of the conference being "the single most rewarding professional event of my life. " The program is summarized in Table 1. 1; a letter of reflections by Dr. C. Rohrs appears a little later.

Proximal Algorithms Aug 27 2022 Proximal Algorithms discusses proximal operators and proximal algorithms, and illustrates their applicability to standard and distributed convex optimization in general and many applications of recent interest in particular. Much like Newton's method is a standard tool for solving unconstrained smooth optimization problems of modest size, proximal algorithms can be viewed as an analogous tool for nonsmooth, constrained, large-scale, or distributed versions of these problems. They are very generally applicable, but are especially well-suited to problems of substantial recent interest involving large or high-dimensional datasets. Proximal methods sit at a higher level of abstraction than classical algorithms like Newton's method: the base operation is evaluating the proximal operator of a function, which itself involves solving a small convex optimization problem. These subproblems, which generalize the problem of projecting a point onto a convex set, often admit closed-form solutions or can be solved very quickly with standard or simple specialized methods. Proximal Algorithms discusses different interpretations of proximal operators and algorithms, looks at their connections to many other topics in optimization and applied mathematics, surveys some popular algorithms, and provides a large number of examples of proximal operators that commonly arise in practice.

Convex Optimization & Euclidean Distance Geometry Mar 22 2022 The study of Euclidean distance matrices (EDMs) fundamentally asks what can be known geometrically given onlydistance information between points in Euclidean space. Each point may represent simply locationor, abstractly, any entity expressible as a vector in finite-dimensional Euclidean space.The answer to the question posed is that very much can be known about the points;the mathematics of this combined study of geometry and optimization is rich and deep.Throughout we cite beacons of historical accomplishment.The application of EDMs has already proven invaluable in discerning biological molecular conformation.The emerging practice of localization in wireless sensor networks, the global positioning system (GPS), and distance-based pattern recognitionwill certainly simplify and benefit from this theory.We study the pervasive convex Euclidean bodies and their various representations.In particular, we make convex polyhedra, cones, and dual cones more visceral through illustration, andwe study the geometric relation of polyhedral cones to nonorthogonal bases biorthogonal expansion.We explain conversion between halfspace- and vertex-descriptions of convex cones,we provide formulae for determining dual cones,and we show how classic alternative systems of linear inequalities or linear matrix inequalities and optimality conditions can be explained by generalized inequalities in terms of convex cones and their duals.The conic analogue to linear independence, called conic independence, is introducedas a new tool in the study of classical cone theory; the

logical next step in the progression:linear, affine, conic.Any convex optimization problem has geometric interpretation.This is a powerful attraction: the ability to visualize geometry of an optimization problem.We provide tools to make visualization easier.The concept of faces, extreme points, and extreme directions of convex Euclidean bodiesis explained here, crucial to understanding convex optimization.The convex cone of positive semidefinite matrices, in particular, is studied in depth.We mathematically interpret, for example,its inverse image under affine transformation, and we explainhow higher-rank subsets of its boundary united with its interior are convex.The Chapter on "Geometry of convex functions",observes analogies between convex sets and functions:The set of all vector-valued convex functions is a closed convex cone.Included among the examples in this chapter, we show how the real affinefunction relates to convex functions as the hyperplane relates to convex sets.Here, also, pertinent results formultidimensional convex functions are presented that are largely ignored in the literature;tricks and tips for determining their convexityand discerning their geometry, particularly with regard to matrix calculus which remains largely unsystematizedwhen compared with the traditional practice of ordinary calculus.Consequently, we collect some results of matrix differentiation in the appendices.The Euclidean distance matrix (EDM) is studied,its properties and relationship to both positive semidefinite and Gram matrices.We relate the EDM to the four classical axioms of the Euclidean metric;thereby, observing the existence of an infinity of axioms of the Euclidean metric beyondthe triangle inequality. We proceed byderiving the fifth Euclidean axiom and then explain why furthering this endeavoris inefficient because the ensuing criteria (while describing polyhedra)grow linearly in complexity and number.Some geometrical problems solvable via EDMs,EDM problems posed as convex optimization, and methods of solution arepresented;\eg, we generate a recognizable isotonic map of the United States usingonly comparative distance information (no distance information, only distance inequalities).We offer a new proof of the classic Schoenberg criterion, that determines whether a candidate matrix is an EDM. Our proofrelies on fundamental geometry; assuming, any EDM must correspond to a list of points contained in some polyhedron(possibly at its vertices) and vice versa.It is not widely known that the Schoenberg criterion implies nonnegativity of the EDM entries; proved here.We characterize the eigenvalues of an EDM matrix and then devisea polyhedral cone required for determining membership of a candidate matrix(in Cayley-Menger form) to the convex cone of Euclidean distance matrices (EDM cone); \ie,a candidate is an EDM if and only if its eigenspectrum belongs to a spectral cone for EDM^N.We will see spectral cones are not unique.In the chapter "EDM cone", we explain the geometric relationship betweenthe EDM cone, two positive semidefinite cones, and the elliptope.We illustrate geometric requirements, in particular, for projection of a candidate matrixon a positive semidefinite cone that establish its membership to the EDM cone. The faces of the EDM cone are described,but still open is the question whether all its faces are exposed as they are for the positive semidefinite cone.The classic Schoenberg criterion, relating EDM and positive semidefinite cones, isrevealed to be a discretized membership relation (a generalized inequality, a new Farkas''''''''-like lemma)between the EDM cone and its ordinary dual. A matrix criterion for membership to the dual EDM cone is derived thatis simpler than the Schoenberg criterion.We derive a new concise expression for the EDM cone and its dual involvingtwo subspaces and a positive semidefinite cone."Semidefinite programming" is reviewedwith particular attention to optimality conditionsof prototypical primal and dual conic programs,their interplay, and the perturbation method of rank reduction of optimal solutions(extant but not well-known).We show how to solve a ubiquitous platonic combinatorial optimization problem from linear algebra(the optimal Boolean solution x to Ax=b)via semidefinite program relaxation.A three-dimensional

polyhedral analogue for the positive semidefinite cone of 3X3 symmetricmatrices is introduced; a tool for visualizing in 6 dimensions.In "EDM proximity"we explore methods of solution to a few fundamental and prevalentEuclidean distance matrix proximity problems; the problem of finding that Euclidean distance matrix closestto a given matrix in the Euclidean sense.We pay particular attention to the problem when compounded with rank minimization.We offer a new geometrical proof of a famous result discovered by Eckart \& Young in 1936 regarding Euclideanprojection of a point on a subset of the positive semidefinite cone comprising all positive semidefinite matriceshaving rank not exceeding a prescribed limit rho.We explain how this problem is transformed to a convex optimization for any rank rho.

Machine Learning Fundamentals Nov 25 2019 A coherent introduction to core concepts and deep learning techniques that are critical to academic research and real-world applications.

On Motion Planning Using Numerical Optimal Control Jul 02 2020 During the last decades, motion planning for autonomous systems has become an important area of research. The high interest is not the least due to the development of systems such as self-driving cars, unmanned aerial vehicles and robotic manipulators. In this thesis, the objective is not only to find feasible solutions to a motion planning problem, but solutions that also optimize some kind of performance measure. From a control perspective, the resulting problem is an instance of an optimal control problem. In this thesis, the focus is to further develop optimal control algorithms such that they be can used to obtain improved solutions to motion planning problems. This is achieved by combining ideas from automatic control, numerical optimization and robotics. First, a systematic approach for computing local solutions to motion planning problems in challenging environments is presented. The solutions are computed by combining homotopy methods and numerical optimal control techniques. The general principle is to define a homotopy that transforms, or preferably relaxes, the original problem to an easily solved problem. The approach is demonstrated in motion planning problems in 2D and 3D environments, where the presented method outperforms both a state-of-the-art numerical optimal control method based on standard initialization strategies and a state-of-the-art optimizing sampling-based planner based on random sampling. Second, a framework for automatically generating motion primitives for lattice-based motion planners is proposed. Given a family of systems, the user only needs to specify which principle types of motions that are relevant for the considered system family. Based on the selected principle motions and a selected system instance, the algorithm not only automatically optimizes the motions connecting pre-defined boundary conditions, but also simultaneously optimizes the terminal state constraints as well. In addition to handling static a priori known system parameters such as platform dimensions, the framework also allows for fast automatic re-optimization of motion primitives if the system parameters change while the system is in use. Furthermore, the proposed framework is extended to also allow for an optimization of discretization parameters, that are are used by the lattice-based motion planner to define a state-space discretization. This enables an optimized selection of these parameters for a specific system instance. Finally, a unified optimization-based path planning approach to efficiently compute locally optimal solutions to advanced path planning problems is presented. The main idea is to combine the strengths of sampling-based path planners and numerical optimal control. The lattice-based path planner is applied to the problem in a first step using a discretized search space, where system dynamics and objective function are chosen to coincide with those used in a second numerical optimal control step. This novel tight combination of a sampling-based path planner and numerical optimal control makes, in a structured way, benefit of the former method’s ability to solve combinatorial parts of the problem and the

latter method’s ability to obtain locally optimal solutions not constrained to a discretized search space. The proposed approach is shown in several practically relevant path planning problems to provide improvements in terms of computation time, numerical reliability, and objective function value.

Equity Valuation and Portfolio Management Jun 01 2020 A detailed look at equity valuation and portfolio management Equity valuation is a method of valuing stock prices using fundamental analysis to determine the worth of the business and discover investment opportunities. In Equity Valuation and Portfolio Management Frank J. Fabozzi and Harry M. Markowitz explain the process of equity valuation, provide the necessary mathematical background, and discuss classic and new portfolio strategies for investment managers. Divided into two comprehensive parts, this reliable resource focuses on valuation and portfolio strategies related to equities. Discusses both fundamental and new techniques for valuation and strategies Fabozzi and Markowitz are experts in the fields of investment management and economics Includes end of chapter bullet point summaries, key chapter take-aways, and study questions Filled with in-depth insights and practical advice, Equity Valuation and Portfolio Management will put you in a better position to excel at this challenging endeavor.