Cholesky Decomposition And Linear Programming On A Gpu

Basic MatricesExploring Interior-point Linear ProgrammingLinear Programming: An Introduction to Finite Improvement AlgorithmsNumerical AlgorithmsLinear ProgrammingLinear Programming ComputationMastering Python for FinanceSIAM Journal on Matrix Analysis and ApplicationsAlgorithms for Linear Programming Via Weighted CentersDirect Methods for Sparse Linear SystemsLinear Programming and its ApplicationsSolving Linear Programming Problem with Fuzzy Resources by Lu Decomposition MethodProduct Form of the Cholesky Factorization for Large-scale Linear ProgrammingMatrix ComputationsPotential Function Methods for Approximately Solving Linear Programming Problems: Theory and PracticeLarge Sparse Numerical OptimizationA Parallel Block Cholesky Factorization for Staircase Linear Programming ProblemsLinear Programming Using MATLAB®Mathematical ReviewsA Parallelisable Block Cholesky Factorization for Staircase Linear Programming ProblemsNumerical Recipes 3rd EditionSolution of Sparse Linear Equations Using Cholesky Factors of Augmented SystemsLinear Programming with MATLABScientific Data AnalysisMilestones in Matrix Computation : The selected works of Gene H. Golub with commentariesParallel Processing of Discrete Optimization ProblemsAn Advanced Implementation of Cholesky Factorization for Computing Projections in Interior Point Methods of Large Scale Linear ProgrammingLarge Scale Linear and Integer Optimization: A Unified ApproachPrimal-dual Interior-Point MethodsMatrix partitioning Methods for Interior Point AlgorithmsA Matrix Factorization and Its Application to Large-scale Linear ProgrammingPrimal Barrier Methods for Linear ProgrammingLarge-scale Linear Programming Using the Cholesky FactorizationC++ Scientific ProgrammingStochastic Linear ProgrammingLinear Programming23 European Symposium on Computer Aided Process EngineeringIntegral Methods for Quadratic ProgrammingHigh Performance OptimizationRounding Errors in Algebraic Processes

Basic Matrices

Exploring Interior-point Linear Programming

The essential text and reference for modern scientific computing now also covers computational geometry, classification and inference, and much more.

Linear Programming: An Introduction to Finite Improvement Algorithms

Numerical Algorithms

Linear Programming

This PhD thesis was written at ETH Zurich, in Prof. Dr. Emo Welzl's research group, under the supervision of Dr. Bernd Garnter. It shows two theoretical results that are both related to quadratic programming. The first one concerns the abstract optimization framework of violator spaces and the randomized procedure called Clarkson's algorithm. In a nutshell, the algorithm randomly samples from a set of constraints, computes an optimal solution subject to these constraints, and then checks whether the ignored constraints violate the solution. If not, some form of re-sampling occurs. We present the algorithm in the easiest version that can still be analyzed successfully. The second contribution concerns quadratic programming more directly. It is well-known that a simplex-like procedure can be applied to quadratic programming. The main computational effort in this algorithm comes from solving a series of linear equation systems that change gradually. We develop the integral LU decomposition of matrices, which allows us to solve the equation systems efficiently and to exploit sparse inputs. Last but not least, a considerable portion of the work included in this thesis was devoted to implementing the integral LU decomposition in the framework of the existing quadratic programming solver in the Computational Geometry Algorithms Library (CGAL). In the last two chapters we describe our implementation and the experimental results we obtained.

Linear Programming Computation

Peter Kall and János Mayer are distinguished scholars and professors of Operations Research and their research interest is particularly devoted to the area of stochastic optimization. Stochastic Linear Programming is a definitive presentation and discussion of the theoretical properties of the models, the conceptual algorithmic approaches, and the computational issues relating to the implementation of these methods to solve problems that are stochastic in nature.

Mastering Python for Finance

SIAM Journal on Matrix Analysis and Applications

Algorithms for Linear Programming Via Weighted Centers

Elementary introduction to problem of cumulative effect of rounding errors in a very large number of arithmetical calculations—particularly applicable to computer operations. Simple representative analyses illustrate techniques. Topics include fundamental arithmetic operations, computations involving polynomials and matrix computations. Results deal exclusively with digital computers but are equally applicable to desk calculators. Bibliography.

Direct Methods for Sparse Linear Systems

Numerical Algorithms: Methods for Computer Vision, Machine Learning, and Graphics presents a new approach to numerical analysis for modern computer scientists. Using examples from a broad base of computational tasks, including data processing, computational photography, and animation, the textbook introduces numerical modeling and algorithmic desig

Linear Programming and its Applications

Formulation of linear programming; the simplex method; geometry of the simplex method; duality in linear programming; revised (primal) simplex method; the dual simplex method; numerically stable forms of the simplex method; parametric linear programs; sensitivity analysis; degeneracy in linear programming; bounded-variable linear programs; the decomposition principle of linear programming; the transportation problem; computational complexity of the simplex algorithm; the ellipsoid method; iterative methods for linear inequalities and linear programs; vector minima.

Solving Linear Programming Problem with Fuzzy Resources by Lu Decomposition Method

Potential Function Methods For Approximately Solving Linear Programming Problems breaks new ground in linear programming theory. The book draws on the research developments in three broad areas: linear and integer programming, numerical analysis, and the computational architectures which enable speedy, high-level algorithm design. During the last ten years, a new body of research within the field of optimization research has emerged, which seeks to develop good approximation algorithms for classes of linear programming problems. This work both has roots in fundamental areas of mathematical programming and is also framed in the context of the modern theory of algorithms. The result of this work, in which Daniel Bienstock has been very much involved, has been a family of algorithms with solid theoretical foundations and with growing experimental success. This book will examine these algorithms, starting with some of the very earliest examples, and through the latest theoretical and computational developments.

Product Form of the Cholesky Factorization for Large-scale Linear Programming

Matrix Computations

This book contains papers presented at the Workshop on Parallel Processing of Discrete Optimization Problems held at DIMACS in April 1994. The contents cover a wide spectrum of the most recent algorithms and applications in parallel processing of discrete optimization and related problems. Topics include parallel branch and bound algorithms, scalability, load balancing, parallelism and irregular data structures and scheduling task graphs on parallel machines. Applications include parallel algorithms for solving satisfiability problems, location problems, linear programming, quadratic and linear assignment problems. This book would be suitable as a textbook in advanced courses on parallel algorithms and combinatorial optimization.

Potential Function Methods for Approximately Solving Linear Programming Problems: Theory and Practice

Teaches the design of programs for scientific computation in C++ Introduces unique C++ classes, defines the particular relationships among these classes, and demonstrates their use in a dozen of the most powerful current applications Presents a set of practices that allows programmers to embrace the attractive features of C++ without incurring undesired side effects and hidden costs Includes a collection of source code files downloadable from the Wiley ftp site Originally announced as Scientific Program Design: C++ for Native Fortran Writers

Large Sparse Numerical Optimization

This is a textbook about linear and integer linear optimization. There is a growing need in industries such as airline, trucking, and financial engineering to solve very large linear and integer linear optimization problems. Building these models requires uniquely trained individuals. Not only must they have a thorough understanding of the theory behind mathematical programming, they must have substantial knowledge of how to solve very large models in today's computing environment. The major goal of the book is to develop the theory of linear and integer linear optimization in a unified manner and then demonstrate how to use this theory in a modern computing environment to solve very large real world problems. After presenting introductory material in Part I, Part II of this book is de voted to the theory of linear and integer linear optimization. This theory is developed using two simple, but unifying ideas: projection and inverse projec tion. Through projection we take a system of linear inequalities and replace some of the variables with additional linear inequalities. Inverse projection, the dual of this process, involves replacing linear inequalities with additional variables. Fundamental results such as weak and strong duality, theorems of the alternative, complementary slackness, sensitivity analysis, finite basis the orems, etc. are all explained using projection or inverse projection. Indeed, a unique feature of this book is that these fundamental results are developed and explained before the simplex and interior point algorithms are presented.

A Parallel Block Cholesky Factorization for Staircase Linear Programming Problems

Linear Programming Using MATLAB®

Mathematical Reviews

For a long time the techniques of solving linear optimization (LP) problems improved only marginally. Fifteen years ago, however, a revolutionary discovery changed everything. A new `golden age' for optimization started, which is continuing up to the current time. What is the cause of the excitement? Techniques of linear programming formed previously an isolated body of knowledge. Then suddenly a tunnel was built linking it with a rich and promising land, part of which was already cultivated, part of which was completely unexplored. These revolutionary new techniques are now applied to solve conic linear problems. This makes it possible to model and solve large classes of essentially nonlinear optimization problems as efficiently as LP problems. This volume gives an overview of the latest developments of such `High Performance Optimization Techniques'. The first part is a thorough treatment of interior point methods for semidefinite programming problems. The second part reviews today's most exciting research topics and results in the area of convex optimization. Audience: This volume is for graduate students and researchers who are interested in modern optimization techniques.

A Parallelisable Block Cholesky Factorization for Staircase Linear Programming Problems

This text covers the basic theory and computation for a first course in linear programming, including substantial material on mathematical proof techniques and sophisticated computation methods. Includes Appendix on using Excel. 1984 edition.

Numerical Recipes 3rd Edition

With emphasis on computation, this book is a real breakthrough in the field of LP. In addition to conventional topics, such as the simplex method, duality, and interior-point methods, all deduced in a fresh and clear manner, it introduces the state of the art by highlighting brand-new and advanced results, including efficient pivot rules, Phase-I approaches, reduced simplex methods, deficient-basis methods, face methods, and pivotal interior-point methods. In particular, it covers the determination of the optimal solution set, feasible-point simplex method, decomposition principle for solving large-scale problems, controlled-branch method based on generalized reduced simplex framework for solving integer LP problems.

Solution of Sparse Linear Equations Using Cholesky Factors of Augmented Systems

The linear program min c sub t sub x subject to Ax=b, x> or = 0, is solved by the projected Newton barrier method. The method consists of solving a sequence of subproblems of the form min c sub t sub x - micron sigma Ln x; subject to Ax=b. Extentions for upper bounds, free and fixed variables are given. A linear modification is made to the logarithmic barrier function, which results in the solution being bounded in all cases. It also facilitates the provision of a good starting point. The solution of each subproblem involves repeatedly computing a search direction and taking a step along this direction. Ways to find an initial feasible solution, step sizes and convergence criteria are discussed. Like other interior-point method for linear programming, this method solves a system of the form AH 1/AH A sub t sub q = y, where H is diagonal. This system can be very ill-conditioned and special precautions must be taken for the Cholesky factorization. The matrix A is assumed to be large and sparse. Data structures and algorithms for the sparse factorization are explained. In particular, the consequences of relatively dense columns in A are investigated and a Schur-complement method is introduced to maintain the speed of the method in these cases. An implementation of the method was developed as part of the research. Results of extensive testing with medium to large problems are presented and the testing methodologies used are discussed.

Linear Programming with MATLAB

This monograph is concerned with overdetermined systems, inconsistent systems with more equations than unknowns, in scientific data reduction. It is not a text on statistics, numerical methods, or matrix cOmputations, although elements of all three, especially the latter, enter into the discussion. The reader I have in mind is a scientist or engineer who has gathered data that he or she wants to model by a mathematical system, perhaps linear, perhaps nonlinear, and solve to obtain the best estimates, in some sense of the term "best," of various parameters. Because the calculations will be performed on a digital computer, the first chapter discusses floating-point numbers and their effect on mathematical operations. The chapter ends with some methods for accurately summing floating-point numbers, an operation frequently required in numerical work and one often done by the worst possible method, recursive summation. Chapter 2 gives a brief review of linear algebra and includes vector and matrix norms and condition numbers of matrices and linear systems. ' Chapter 3 presents some ideas for manipulating sparse matrices. Frequently, time or memory can be saved by use of sparse matrix techniques. The subject is extensive and the chapter is only indicative of the many techniques available. Although Chapter 3 is somewhat extraneous to the rest of the book, Chapter 5, on linear least squares, makes use of the compressed storage mode for the symmetric matrices discussed in Chapter 3.

Scientific Data Analysis

In Linear Programming: A Modern Integrated Analysis, both boundary (simplex) and interior point methods are derived from the complementary slackness theorem and, unlike most books, the duality theorem is derived from Farkas's Lemma, which is proved as a convex separation theorem. The tedium of the simplex method is thus avoided. A new and inductive proof of Kantorovich's Theorem is offered, related to the convergence of Newton's method. Of the boundary methods, the book presents the (revised) primal and the dual simplex methods. An extensive discussion is given of the primal, dual and primal-dual affine scaling methods. In addition, the proof of the convergence under degeneracy, a bounded variable variant, and a super-linearly convergent variant of the primal affine scaling method are covered in one chapter. Polynomial barrier or path-following homotopy methods, and the projective transformation method are also covered in the interior point chapter. Besides the popular sparse Cholesky factorization and the conjugate gradient method, new methods are presented in a separate chapter on implementation. These methods use LQ factorization and iterative techniques.

Milestones in Matrix Computation : The selected works of Gene H. Golub with commentaries

Parallel Processing of Discrete Optimization Problems

This book provides practitioners as well as students of this general methodology withan easily accessible introduction to the new class of algorithms known as interior-point methods forlinear programming.

An Advanced Implementation of Cholesky Factorization for Computing Projections in Interior Point Methods of Large Scale Linear Programming

Large Scale Linear and Integer Optimization: A Unified Approach

If you are an undergraduate or graduate student, a beginner to algorithmic development and research, or a software developer in the financial industry who is interested in using Python for quantitative methods in finance, this is the book for you. It would be helpful to have a bit of familiarity with basic Python usage, but no prior experience is required.

Primal-dual Interior-Point Methods

Only a few solvers are currently available to solve eigenvalue optimization problems. In case of nonlinear objective and/or constraints, the capabilities of existing methods are still limited. This contribution addresses two classes of eigenvalue optimization problems: the maximization (minimization) of the smallest (largest) eigenvalue of a real symmetric matrix and optimization subject to inequalities constraining the real parts of all eigenvalues of a real square matrix. This contribution considers the reformulation of such problems into optimization problems subject to the positive definiteness of a suitable matrix to enable the use of efficient and robust off-the-shelf solvers. This contribution revisits the utilization of Sylvester's criterion suggested previously and proposes to alternatively employ Cholesky decomposition to compel the constraints on positive definiteness. The methodology is implemented in an integrated symbolic-numeric computational environment. A comparative computational study demonstrates that the latter performs better than the former, at least in the set of examples studied.

Matrix partitioning Methods for Interior Point Algorithms

This book offers a theoretical and computational presentation of a variety of linear programming algorithms and methods with an emphasis on the revised simplex method and its components. A theoretical background and mathematical formulation is included for each algorithm as well as comprehensive numerical examples and corresponding MATLAB® code. The MATLAB® implementations presented in this book are sophisticated and allow users to find solutions to large-scale benchmark linear programs. Each algorithm is followed by a computational study on benchmark problems that analyze the computational behavior of the presented algorithms. As a solid companion to existing algorithmic-specific literature, this book will be useful to researchers, scientists, mathematical programmers, and students with a basic knowledge of linear algebra and calculus. The clear presentation enables the reader to understand and utilize all components of simplex-type methods, such as presolve techniques, scaling techniques, pivoting rules, basis update methods, and sensitivity analysis.

A Matrix Factorization and Its Application to Large-scale Linear Programming

A self-contained introduction to linear programming using MATLAB® software to elucidate the development of algorithms and theory. Exercises are included in each chapter, and additional information is provided in two appendices and an accompanying Web site. Only a basic knowledge of linear algebra and calculus is required.

Primal Barrier Methods for Linear Programming

Large-scale Linear Programming Using the Cholesky Factorization

The sparse backslash book. Everything you wanted to know but never dared to ask about modern direct linear solvers. Chen Greif, Assistant Professor, Department of Computer Science, University of British Columbia.Overall, the book is magnificent. It fills a long-felt need for an accessible textbook on modern sparse direct methods. Its choice of scope is excellent John Gilbert, Professor, Department of Computer Science, University of California, Santa Barbara.Computational scientists often encounter problems requiring the solution of sparse systems of linear equations. Attacking these problems efficiently requires an in-depth knowledge of the underlying theory, algorithms, and data structures found in sparse matrix software libraries. Here, Davis presents the fundamentals of sparse matrix algorithms to provide the requisite background. The book includes CSparse, a concise downloadable sparse matrix package that illustrates the algorithms and theorems presented in the book and equips readers with the tools necessary to understand larger and more complex software packages.With a strong emphasis on MATLAB and the C programming language, Direct Methods for Sparse Linear Systems equips readers with the working knowledge required to use sparse solver packages and write code to interface applications to those packages. The book also explains how MATLAB performs its sparse matrix computations.Audience This invaluable book is essential to computational scientists and software developers who want to understand the theory and algorithms behind modern techniques used to solve large sparse linear systems. The book also serves as an excellent practical resource for students with an interest in combinatorial scientific computing.Preface; Chapter 1: Introduction; Chapter 2: Basic algorithms; Chapter 3: Solving triangular systems; Chapter 4: Cholesky factorization; Chapter 5: Orthogonal methods; Chapter 6: LU factorization; Chapter 7: Fill-reducing orderings; Chapter 8: Solving sparse linear systems; Chapter 9: CSparse; Chapter 10: Sparse matrices in MATLAB; Appendix: Basics of the C programming language; Bibliography; Index.

C++ Scientific Programming

The text presents and discusses some of the most influential papers in Matrix Computation authored by Gene H. Golub, one of the founding fathers of the field. The collection of 21 papers is divided into five main areas: iterative methods for linear systems, solution of least squares problems, matrix factorizations and applications, orthogonal polynomials and quadrature, and eigenvalue problems. Commentaries for each area are provided by leading experts: Anne Greenbaum, Ake Bjorck, Nicholas Higham, Walter Gautschi, and G. W. (Pete) Stewart. Comments on each paper are also included by the original authors, providing the reader with historical information on how the paper came to be written and under what circumstances the collaboration was undertaken. Including a brief biography and facsimiles of the original papers, this text will be of great interest to students and researchers in numerical analysis and scientific computation.

Stochastic Linear Programming

Linear Programming

In the past decade, primal-dual algorithms have emerged as the most important and useful algorithms from the interior-point class. This book presents the major primal-dual algorithms for linear programming in straightforward terms. A thorough description of the theoretical properties of these methods is given, as are a discussion of practical and computational aspects and a summary of current software. This is an excellent, timely, and well-written work. The major primal-dual algorithms covered in this book are path-following algorithms (short- and long-step, predictor-corrector), potential-reduction algorithms, and infeasible-interior-point algorithms. A unified treatment of superlinear convergence, finite termination, and detection of infeasible problems is presented. Issues relevant to practical implementation are also discussed, including sparse linear algebra and a complete specification of Mehrotra's predictor-corrector algorithm. Also treated are extensions of primal-dual algorithms to more general problems such as monotone complementarity, semidefinite programming, and general convex programming problems.

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In the pages of this text readers will find nothing less than a unified treatment of linear programming. Without sacrificing mathematical rigor, the main emphasis of the book is on models and applications. The most important classes of problems are surveyed and presented by means of mathematical formulations, followed by solution methods and a discussion of a variety of "what-if" scenarios. Non-simplex based solution methods and newer developments such as interior point methods are covered.

Integral Methods for Quadratic Programming

High Performance Optimization

Rounding Errors in Algebraic Processes

The fourth edition of Gene H. Golub and Charles F. Van Loan's classic is an essential reference for computational scientists and engineers in addition to researchers in the numerical linear algebra community. Anyone whose work requires the solution to a matrix problem and an appreciation of its mathematical properties will find this book to be an indispensible tool. This revision is a cover-to-cover expansion and renovation of the third edition. It now includes an introduction to tensor computations and brand new sections on • fast transforms • parallel LU • discrete Poisson solvers • pseudospectra • structured linear equation problems • structured eigenvalue problems • large-scale SVD methods • polynomial eigenvalue problems Matrix Computations is packed with challenging problems, insightful derivations, and pointers to the literatureâ€”everything needed to become a matrix-savvy developer of numerical methods and software. The second most cited math book of 2012 according to MathSciNet, the book has placed in the top 10 for since 2005.