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BARTLETT PHOENIX

Applied Matrix Algebra in the Statistical Sciences Springer Science & Business Media
Nonnegative matrices and positive operators are widely applied in science, engineering, and technology. This book provides the basic theory and several typical modern science and engineering applications of nonnegative matrices and positive operators, including the fundamental theory, methods, numerical analysis, and applications in the Google search engine, computational molecular dynamics, and wireless communications. Unique features of this book include the combination of the theories of nonnegative matrices and positive operators as well as the emphasis on applications of nonnegative matrices in the numerical analysis of positive operators, such as Markov operators and Frobenius-Perron operators both of which play key roles in the statistical and stochastic studies of dynamical systems. It can be used as a textbook for an upper level undergraduate or beginning graduate course in advanced matrix theory and/or positive operators as well as for an advanced topics course in operator theory or ergodic theory. In addition, it serves as a good reference for researchers in mathematical sciences, physical sciences, and engineering.

Random Walks and Diffusions on Graphs and Databases World Scientific

This book contains over 300 exercises and solutions covering a wide variety of topics in matrix algebra. They can be used for independent study or in creating a challenging and stimulating environment that encourages active engagement in the learning process. Thus, the book can be of value to both teachers and students. The requisite background is some previous exposure to matrix algebra of the kind obtained in a first course. The exercises are those from an earlier book by the same author entitled "Matrix Algebra From a Statistician's Perspective". They have been restated (as necessary) to stand alone, and the book includes extensive and detailed summaries of all relevant terminology and notation. The coverage includes topics of special interest and relevance in statistics and related disciplines, as well as standard topics. The overlap with exercises available from other sources is relatively small. David A. Harville is a research staff member in the Mathematical Sciences Department of the IBM T.J. Watson Research Center. Prior to joining the Research Center, he served ten years as a mathematical statistician in the Applied Mathematics Research Laboratory of the Aerospace Research Laboratories at Wright-Patterson Air Force Base, Ohio, followed by twenty years as a full professor in the Department of Statistics at Iowa State University. He has extensive experience in linear statistical models, which is an area of statistics that makes heavy use of matrix algebra, and has taught (on numerous occasions) graduate-level courses on that topic. He has authored over 70 research articles. His work has been recognized by his election as a Fellow of the American Statistical Association and the Institute of Mathematical Statistics.

Computing and Combinatorics Springer Science & Business Media

Concise treatment covers graph theory, unitary and Hermitian matrices, and positive definite matrices as well as stochastic, genetic, and economic models. Problems, with solutions, enhance the

text. 1987 edition.

Nonnegative Matrix and Tensor Factorizations Elsevier

This work applies the theory of nonnegative matrices to problems arising in positive differential and control systems. There is a concise review of requisite material in convex analysis and matrix theory, as well as a detailed review of linear differential and control systems. Exposition incorporates simple real-world dynamic models to better illustrate various aspects of the theory being developed. Contains exercises.

Common Problems And Ideas Of Modern Physics - Proceedings Of The 6th Winter School On Hadronic Physics Springer

This book collects new results, concepts and further developments of NMF. The open problems discussed include, e.g. in bioinformatics: NMF and its extensions applied to gene expression, sequence analysis, the functional characterization of genes, clustering and text mining etc. The research results previously scattered in different scientific journals and conference proceedings are methodically collected and presented in a unified form. While readers can read the book chapters sequentially, each chapter is also self-contained. This book can be a good reference work for researchers and engineers interested in NMF, and can also be used as a handbook for students and professionals seeking to gain a better understanding of the latest applications of NMF.

Totally Nonnegative Matrices Ellis Horwood Limited

Bayesian methods are increasingly being used in the social sciences, as the problems encountered lend themselves so naturally to the subjective qualities of Bayesian methodology. This book provides an accessible introduction to Bayesian methods, tailored specifically for social science students. It contains lots of real examples from political science, psychology, sociology, and economics, exercises in all chapters, and detailed descriptions of all the key concepts, without assuming any background in statistics beyond a first course. It features examples of how to implement the methods using WinBUGS - the most-widely used Bayesian analysis software in the world - and R - an open-source statistical software. The book is supported by a Website featuring WinBUGS and R code, and data sets.

Totally Nonnegative Matrices Springer Science & Business Media

Nonnegative matrix factorization (NMF) in its modern form has become a standard tool in the analysis of high-dimensional data sets. This book provides a comprehensive and up-to-date account of the most important aspects of the NMF problem and is the first to detail its theoretical aspects, including geometric interpretation, nonnegative rank, complexity, and uniqueness. It explains why understanding these theoretical insights is key to using this computational tool effectively and meaningfully. Nonnegative Matrix Factorization is accessible to a wide audience and is ideal for anyone interested in the workings of NMF. It discusses some new results on the nonnegative rank and the identifiability of NMF and makes available MATLAB codes for readers to run the numerical examples presented in the book. Graduate students starting to work on NMF and researchers interested in better understanding the NMF problem and how they can use it will find this book

useful. It can be used in advanced undergraduate and graduate-level courses on numerical linear algebra and on advanced topics in numerical linear algebra and requires only a basic knowledge of linear algebra and optimization.

Statistical Data Mining and Knowledge Discovery Wiley-Interscience

The book is an introduction, for both graduate students and newcomers to the field of the modern theory of mesoscopic complex systems, time series, hypergraphs and graphs, scaled random walks, and modern information theory. As these are applied for the exploration and characterization of complex systems. Our self-consistent review provides the necessary basis for consistency. We discuss a number of applications such diverse as urban structures and musical compositions.

Nonnegative Matrix Factorization Princeton University Press

Nonnegative matrices is an increasingly important subject in economics, control theory, numerical analysis, Markov chains, and other areas. This concise treatment is directed toward undergraduates who lack specialized knowledge at the postgraduate level of mathematics and related fields, such as mathematical economics and operations research. An Introductory Survey encompasses some aspects of matrix theory and its applications and other relevant topics in linear algebra, including certain facets of graph theory. Subsequent chapters cover various points of the theory of normal matrices, comprising unitary and Hermitian matrices, and the properties of positive definite matrices. An exploration of the main topic, nonnegative matrices, is followed by a discussion of M-matrices. The final chapter examines stochastic, genetic, and economic models. The important concepts are illustrated by simple worked examples. Problems appear at the conclusion of most chapters, with solutions at the end of the book.

Topics in Non-negative Matrices World Scientific

Computational intelligence (CI) lies at the interface between engineering and computer science; control engineering, where problems are solved using computer-assisted methods. Thus, it can be regarded as an indispensable basis for all artificial intelligence (AI) activities. This book collects surveys of most recent theoretical approaches focusing on fuzzy systems, neurocomputing, and nature inspired algorithms. It also presents surveys of up-to-date research and application with special focus on fuzzy systems as well as on applications in life sciences and neuronal computing.

New Technical Books World Scientific

Geographical Information Systems, Three Volume Set is a computer system used to capture, store, analyze and display information related to positions on the Earth's surface. It has the ability to show multiple types of information on multiple geographical locations in a single map, enabling users to assess patterns and relationships between different information points, a crucial component for multiple aspects of modern life and industry. This 3-volumes reference provides an up-to date account of this growing discipline through in-depth reviews authored by leading experts in the field. VOLUME EDITORS Thomas J. Cova The University of Utah, Salt Lake City, UT, United States Ming-Hsiang Tsou San Diego State University, San Diego, CA, United States Georg Bareth University of Cologne, Cologne, Germany Chunqiao Song University of California, Los Angeles, CA, United States Yan Song University of North Carolina at Chapel Hill, Chapel Hill, NC, United States Kai Cao National University of Singapore, Singapore Elisabete A. Silva University of Cambridge, Cambridge, United Kingdom Covers a rapidly expanding discipline, providing readers with a detailed overview of all

aspects of geographic information systems, principles and applications Emphasizes the practical, socioeconomic applications of GIS Provides readers with a reliable, one-stop comprehensive guide, saving them time in searching for the information they need from different sources

Special Issue: Proceedings of the Workshop Nonnegative Matrices, Applications and Generalizations and the Eight Haifa Matrix Theory Conference Springer

A real matrix is positive semidefinite if it can be decomposed as $A=BB'$. In some applications the matrix B has to be elementwise nonnegative. If such a matrix exists, A is called completely positive. The smallest number of columns of a nonnegative matrix B such that $A=BB'$ is known as the cp-rank of A. This invaluable book focuses on necessary conditions and sufficient conditions for complete positivity, as well as bounds for the cp-rank. The methods are combinatorial, geometric and algebraic. The required background on nonnegative matrices, cones, graphs and Schur complements is outlined.

Bayesian Analysis for the Social Sciences Springer Science & Business Media

"This volume deals with advanced topics in matrix theory using the notions and tools from algebra, analysis, geometry and numerical analysis. It consists of seven chapters that are loosely connected and interdependent. The choice of the topics is very personal and reflects the subjects that the author was actively working on in the last 40 years. Many results appear for the first time in the volume. Readers will encounter various properties of matrices with entries in integral domains, canonical forms for similarity, and notions of analytic, pointwise and rational similarity of matrices with entries which are locally analytic functions in one variable. This volume is also devoted to various properties of operators in inner product space, with tensor products and other concepts in multilinear algebra, and the theory of non-negative matrices. It will be of great use to graduate students and researchers working in pure and applied mathematics, bioinformatics, computer science, engineering, operations research, physics and statistics."--

Nonnegative Matrices Academic Press

Combinatorics and Matrix Theory have a symbiotic, or mutually beneficial, relationship. This relationship is discussed in my paper The symbiotic relationship of combinatorics and matrix theory where I attempted to justify this description. One could say that a more detailed justification was given in my book with H. J. Ryser entitled Combinatorial Matrix Theory where an attempt was made to give a broad picture of the use of combinatorial ideas in matrix theory and the use of matrix theory in proving theorems which, at least on the surface, are combinatorial in nature. In the book by Liu and Lai, this picture is enlarged and expanded to include recent developments and contributions of Chinese mathematicians, many of which have not been readily available to those of us who are unfamiliar with Chinese journals. Necessarily, there is some overlap with the book Combinatorial Matrix Theory. Some of the additional topics include: spectra of graphs, eulerian graph problems, Shannon capacity, generalized inverses of Boolean matrices, matrix rearrangements, and matrix completions. A topic to which many Chinese mathematicians have made substantial contributions is the combinatorial analysis of powers of nonnegative matrices, and a large chapter is devoted to this topic. This book should be a valuable resource for mathematicians working in the area of combinatorial matrix theory. Richard A. Brualdi University of Wisconsin - Madison 1 Linear Alg. Applies., vols. 162-4, 1992, 65-105 2Cambridge University Press, 1991.

Nonnegative Matrices, Positive Operators, And Applications Springer Science & Business Media

This textbook addresses itself to two groups of students who need mathematics in an applied context: undergraduates starting at the beginning, and postgraduates who need reference-material, but who, not being mathematics specialists, nevertheless are not best served by an ordinary mathematics textbook, which will generally be at a higher level of abstraction. It gives full proofs throughout, and is illustrated with a large number of numerical examples, reinforcing the student's grasp of the topics covered by exercises and corresponding answersheets, and by the corresponding tutorial program ILLUSTRATE. The program 'Illustrate' will run on any IBM compatible micro-computer. The relevant areas of application are economics, econometrics, mathematical programming and engineering.

Comprehensive Geographic Information Systems John Wiley & Sons

Linear algebra and matrix theory are essentially synonymous terms for an area of mathematics that has become one of the most useful and pervasive tools in a wide range of disciplines. It is also a subject of great mathematical beauty. In consequence of both of these facts, linear algebra has increasingly been brought into lower levels of the curriculum, either in conjunction with the calculus or separate from it but at the same level. A large and still growing number of textbooks has been written to satisfy this need, aimed at students at the junior, sophomore, or even freshman levels. Thus, most students now obtaining a bachelor's degree in the sciences or engineering have had some exposure to linear algebra. But rarely, even when solid courses are taken at the junior or senior levels, do these students have an adequate working knowledge of the subject to be useful in graduate work or in research and development activities in government and industry. In particular, most elementary courses stop at the point of canonical forms, so that while the student may have "seen" the Jordan and other canonical forms, there is usually little appreciation of their usefulness. And there is almost never time in the elementary courses to deal with more specialized topics like nonnegative matrices, inertia theorems, and so on. In consequence, many graduate courses in mathematics, applied mathematics, or applications develop certain parts of matrix theory as needed.

Computational Intelligence Arnaldo Rodriguez-Gonzalez

Linear algebra and matrix theory are fundamental tools for almost every area of mathematics, both pure and applied. This book combines coverage of core topics with an introduction to some areas in which linear algebra plays a key role, for example, block designs, directed graphs, error correcting codes, and linear dynamical systems. Notable features include a discussion of the Weyr characteristic and Weyr canonical forms, and their relationship to the better-known Jordan canonical form; the use of block cyclic matrices and directed graphs to prove Frobenius's theorem on the structure of the eigenvalues of a nonnegative, irreducible matrix; and the inclusion of such combinatorial topics as BIBDs, Hadamard matrices, and strongly regular graphs. Also included are McCoy's theorem about matrices with property P, the Bruck-Ryser-Chowla theorem on the existence of block designs, and an introduction to Markov chains. This book is intended for those who are familiar with the linear algebra covered in a typical first course and are interested in learning more

advanced results.

Computational Finance World Scientific

Since its inception by Perron and Frobenius, the theory of non-negative matrices has developed enormously and is now being used and extended in applied fields of study as diverse as probability theory, numerical analysis, demography, mathematical economics, and dynamic programming, while its development is still proceeding rapidly as a branch of pure mathematics in its own right. While there are books which cover this or that aspect of the theory, it is nevertheless not uncommon for workers in one or another branch of its development to be unaware of what is known in other branches, even though there is often formal overlap. One of the purposes of this book is to relate several aspects of the theory, insofar as this is possible. The author hopes that the book will be useful to mathematicians; but in particular to the workers in applied fields, so the mathematics has been kept as simple as could be managed. The mathematical requisites for reading it are: some knowledge of real-variable theory, and matrix theory; and a little knowledge of complex-variable; the emphasis is on real-variable methods. (There is only one part of the book, the second part of 55.5, which is of rather specialist interest, and requires deeper knowledge.) Appendices provide brief expositions of those areas of mathematics needed which may be less generally known to the average reader.

Matrix Theory: A Second Course Springer

Most networks and databases that humans have to deal with contain large, albeit finite number of units. Their structure, for maintaining functional consistency of the components, is essentially not random and calls for a precise quantitative description of relations between nodes (or data units) and all network components. This book is an introduction, for both graduate students and newcomers to the field, to the theory of graphs and random walks on such graphs. The methods based on random walks and diffusions for exploring the structure of finite connected graphs and databases are reviewed (Markov chain analysis). This provides the necessary basis for consistently discussing a number of applications such diverse as electric resistance networks, estimation of land prices, urban planning, linguistic databases, music, and gene expression regulatory networks.

Non-negative Matrices and Markov Chains American Mathematical Soc.

This comprehensive text covers both applied and theoretical branches of matrix algebra in the statistical sciences. It also provides a bridge between linear algebra and statistical models. Appropriate for advanced undergraduate and graduate students, the self-contained treatment also constitutes a handy reference for researchers. The only mathematical background necessary is a sound knowledge of high school mathematics and a first course in statistics. Consisting of two interrelated parts, this volume begins with the basic structure of vectors and vector spaces. The latter part emphasizes the diverse properties of matrices and their associated linear transformations--and how these, in turn, depend upon results derived from linear vector spaces. An overview of introductory concepts leads to more advanced topics such as latent roots and vectors, generalized inverses, and nonnegative matrices. Each chapter concludes with a section on real-world statistical applications, plus exercises that offer concrete examples of the applications of matrix algebra.