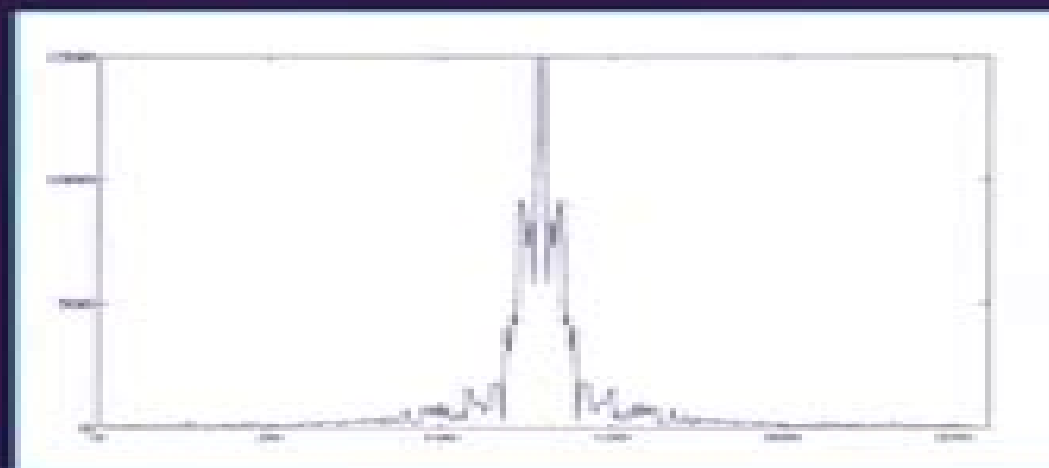


Multidimensional Discrete Unitary Transforms

Representation, Partitioning,
and Algorithms



ARTYOM M. GRIGORYAN
SOS S. AGAIAN

Multidimensional Discrete Unitary Transforms

**Artyom M. Grigoryan, Merughan M.
Grigoryan**



Multidimensional Discrete Unitary Transforms:

Multidimensional Discrete Unitary Transforms Artyom M. Grigoryan, Sos S. Agaian, 2003-07-31 This reference presents a more efficient flexible and manageable approach to unitary transform calculation and examines novel concepts in the design classification and management of fast algorithms for different transforms in one two and multidimensional cases Illustrating methods to construct new unitary transforms for best algorithm selection and development in real world applications the book contains a wide range of examples to compare the efficacy of different algorithms in a variety of one two and three dimensional cases Multidimensional Discrete Unitary Transforms builds progressively from simple representative cases to higher levels of generalization

Transforms and Applications Handbook Alexander D. Poularikas, 2018-09-03 Updating the original Transforms and Applications Handbook Third Edition solidifies its place as the complete resource on those mathematical transforms most frequently used by engineers scientists and mathematicians Highlighting the use of transforms and their properties this latest edition of the bestseller begins with a solid introduction to signals and systems including properties of the delta function and some classical orthogonal functions It then goes on to detail different transforms including lapped Mellin wavelet and Hartley varieties Written by top experts each chapter provides numerous examples and applications that clearly demonstrate the unique purpose and properties of each type The material is presented in a way that makes it easy for readers from different backgrounds to familiarize themselves with the wide range of transform applications Revisiting transforms previously covered this book adds information on other important ones including Finite Hankel Legendre Jacobi Gegenbauer Laguerre and Hermite Fraction Fourier Zak Continuous and discrete Chirp Fourier Multidimensional discrete unitary Hilbert Huang Most comparable books cover only a few of the transforms addressed here making this text by far the most useful for anyone involved in signal processing including electrical and communication engineers mathematicians and any other scientist working in this field

Medical Image Processing, Reconstruction and Restoration Jiri Jan, 2005-11-02 It is essential that differently oriented specialists and students involved in image processing have a firm grasp of the necessary concepts and principles A single source reference that can provide this foundation as well as a thorough explanation of the techniques involved particularly those found in medical image processing would be an

Broadband Last Mile Nikil Jayant, 2018-10-03 Broadband Last Mile Access Technologies for Multimedia Communications provides in depth treatments of access technologies and the applications that rely upon them or support them It examines innovations and enhancements along multiple dimensions in access with the overarching goal of ensuring that the last mile is not the weak link in the broadband chain Written by experts from the academic and commercial segments of the field the book s self contained sections address topics related to the disciplines of communications networking computing and signal processing The core of this treatment contains contemporary reviews of broadband pipes in the classes of copper cable fiber wireless and satellite It emphasizes the coexistence of these classes

within a network the importance of optical communications for unprecedented bandwidth and the flexibility and mobility provided by wireless The book also includes perspective on the increasingly important topic of network management providing insights that are true regardless of the nature of the pipe The text concludes with a discussion of newly emerging applications and broadband services This book offers an all in one treatment of the physical pipes and network architectures that make rich and increasingly personalized applications possible It serves as a valuable resource for researchers and practitioners working in the increasingly pervasive field of broadband

Biosignal and Medical Image Processing John L. Semmlow, 2004-01-14 Relying heavily on MATLAB problems and examples as well as simulated data this text reference surveys a vast array of signal and image processing tools for biomedical applications providing a working knowledge of the technologies addressed while showcasing valuable implementation procedures common pitfalls and essential application concepts The first and only textbook to supply a hands on tutorial in biomedical signal and image processing it offers a unique and proven approach to signal processing instruction unlike any other competing source on the topic The text is accompanied by a CD with support data files and software including all MATLAB examples and figures found in the text

Digital Video Image Quality and Perceptual Coding H.R. Wu, K.R. Rao, 2017-12-19 The hand is quicker than the eye In many cases so is digital video Maintaining image quality in bandwidth and memory restricted environments is quickly becoming a reality as thriving research delves ever deeper into perceptual coding techniques which discard superfluous data that humans cannot process or detect Surveying the topic from a Human Visual System HVS based approach Digital Video Image Quality and Perceptual Coding outlines the principles metrics and standards associated with perceptual coding as well as the latest techniques and applications This book is divided broadly into three parts First it introduces the fundamental theory concepts principles and techniques underlying the field such as the basics of compression HVS modeling and coding artifacts associated with current well known techniques The next section focuses on picture quality assessment criteria subjective and objective methods and metrics including vision model based digital video impairment metrics testing procedures and international standards regarding image quality Finally practical applications come into focus including digital image and video coder designs based on the HVS as well as post filtering restoration error correction and concealment techniques The permeation of digital images and video throughout the world cannot be understated Nor can the importance of preserving quality while using minimal storage space and Digital Video Image Quality and Perceptual Coding provides the tools necessary to accomplish this goal Instructors and lecturers wishing to make use of this work as a textbook can download a presentation of 786 slides in PDF format organized to augment the text accompany our book H R Wu and K R Rao Digital Video Image Quality and Perceptual Coding CRC Press ISBN 0 8247 2777 0 Nov 2005 for lecturers or instructor to use for their classes if they use the book

Quantum Image Processing in Practice Artyom M. Grigoryan, Sos S. Agaian, 2025-02-21 Comprehensive resource addressing the need for a quantum image processing machine learning model

that can outperform classical neural networks Quantum Image Processing in Practice explores the transformative potential of quantum color image processing across various domains including biomedicine entertainment economics and industry The rapid growth of image data especially in facial recognition and autonomous vehicles demands more efficient processing techniques Quantum computing promises to accelerate digital image processing DIP to meet this demand This book covers the role of quantum image processing QIP in quantum information processing including mathematical foundations quantum operations image processing using quantum filters quantum image representation and quantum neural networks It aims to inspire practical applications and foster innovation in this promising field Topics include Qubits and Quantum Logic Gates Introduces qubits the fundamental data unit in quantum computing and their manipulation using quantum logic gates like Pauli matrices rotations the CNOT gate and Hadamard matrices The concept of entanglement where qubits become interconnected is also explored highlighting its importance for applications like quantum teleportation and cryptography Two and Multiple Qubit Systems Demonstrates the importance of using two qubits to process color images enabling image enhancement noise reduction edge detection and feature extraction Covers the tensor product Kronecker sum SWAP gate and local and controlled gates Extends to multi qubit superpositions exploring local and control gates for three qubits such as the Toffoli and Fredkin gates and describes the measurement of superpositions using projection operators Transforms and Quantum Image Representations Covers the Hadamard Fourier and Heap transforms and their circuits in quantum computation highlighting their applications in signal and image processing Introduces the quantum signal induced heap transform for image enhancement classification compression and filtration Explores quantum representations and operations for images using the RGB XYZ CMY HSI and HSV color models providing numerous examples Fourier Transform Qubit Representation Introduces a new model of quantum image representation the Fourier transform qubit representation Describes the algorithm and circuit for calculating the 2 D quantum Fourier transform enabling advancements in quantum imaging techniques New Operations and Hypercomplex Algebra Presents new operations on qubits and quantum representations including multiplication division and inverse operations Explores hypercomplex algebra specifically quaternion algebra for its potential in color image processing Quantum Neural Networks QNNs Discusses QNNs and their circuit implementation as advancements in machine learning driven by quantum mechanics Summarizes various applications of QNNs and current trends and future developments in this rapidly evolving field The book also addresses challenges and opportunities in QIP research aiming to inspire practical applications and innovation It is a valuable resource for researchers students and professionals interested in the intersection of quantum computing and color image processing applications as well as those in visual communications multimedia systems computer vision entertainment and biomedical applications

Image Processing Technologies Kiyoharu Aizawa,Katsuhiko Sakaue,Yasuhito Suenaga,2004-04-07 Showcasing the most influential developments experiments and architectures impacting the digital surveillance automotive industrial and medical

sciences Image Processing Technologies tracks the evolution and advancement of computer vision and image processing CVIP technologies examining methods and algorithms for image analysis optimization segmentation and restoration It focuses on recent approaches and techniques in CVIP applications development and explores various coding methods for individual types of 3 D images This text reference brings researchers and specialists up to date on the latest innovations affecting multiple image processing environments

Domain-Specific Processors Shuvra S. Bhattacharyya, Ed F. Deprettere, Jörgen Teich, 2003-11-11 Ranging from low level application and architecture optimizations to high level modeling and exploration concerns this authoritative reference compiles essential research on various levels of abstraction appearing in embedded systems and software design It promotes platform based design for improved system implementation and modeling and enhanced

Watermarking Systems Engineering Mauro Barni, Franco Bartolini, 2004-02-03 The rapid growth of the Internet has fueled the demand for enhanced watermarking and data hiding technologies and has stimulated research into new ways to implement watermarking systems in the real world This book presents the fundamental principles of watermarking system design and discusses state of the art technologies in information concealment and recovery It highlights the requirements and challenges of applications in security image video indexing hidden communications image captioning and transmission error recovery and concealment It explains the foundations of digital watermarking technologies and offers an understanding of new approaches and applications and lays the groundwork for future developments in the field

Speech Processing Li Deng, Douglas O'Shaughnessy, 2018-10-03 Based on years of instruction and field expertise this volume offers the necessary tools to understand all scientific computational and technological aspects of speech processing The book emphasizes mathematical abstraction the dynamics of the speech process and the engineering optimization practices that promote effective problem solving in this area of research and covers many years of the authors personal research on speech processing Speech Processing helps build valuable analytical skills to help meet future challenges in scientific and technological advances in the field and considers the complex transition from human speech processing to computer speech processing

High-Resolution and Robust Signal Processing Yingbo Hua, Alex Gershman, Qi Cheng, 2017-12-19 High Resolution and Robust Signal Processing describes key methodological and theoretical advances achieved in this domain over the last twenty years placing emphasis on modern developments and recent research pursuits Applications grounded this sophisticated resource links theoretical background with high resolution methods used in wireless communications brain signal analysis and space time radar signal processing Chapter extras include theorem proofs derivations and computational shortcuts as well as open problems numerical measurement and performance examples and simulation results Sixteen illustrious field leaders invest High Resolution and Robust Signal Processing with in depth reviews of parametric high resolution estimation and detection techniques robust array processing solutions for adaptive beam forming and high resolution direction finding Parafac techniques for high resolution array processing and specific areas of

application high resolution nonparametric methods and implementation tactics for spectral analysis multidimensional high resolution data models and discussion of R D unitary ESPRIT with colored noise multidimensional high resolution parameter estimation techniques applicable to channel sounding estimation procedures for high resolution space time radar signal processing using 2 D or 1 D 1 D models and models and methods for EEG MEG space time dipole source estimation and sensory array design

Digital Image Processing Bernd Jähne, 2013-03-09 Intended as a practical guide the book takes the reader from basic concepts to up to date research topics in digital image processing Only little special knowledge in computer sciences is required since many principles and mathematical tools widely used in natural sciences are also applied in digital image processing thus the reader with a general background in natural science gets an easy access to the material presented The book discusses the following topics image acquisition and digitization linear and nonlinear filter operations edge detection local orientation and texture fast algorithms on pyramidal and multigrid data structures morphological operations to detect the shape of objects segmentation and classification Further chapters deal with the reconstruction of three dimensional objects from projections and the analysis of stereo images and image sequences with differential correlation and filter algorithms Many examples from different areas show how the reader can use digital image processing as an experimental tool for image data acquisition and evaluation in his or her research area

Applications of Digital Image Processing, 2001

Image Processing Artyom M. Grigoryan, Merughan M. Grigoryan, 2018-09-03 Focusing on mathematical methods in computer tomography Image Processing Tensor Transform and Discrete Tomography with MATLAB introduces novel approaches to help in solving the problem of image reconstruction on the Cartesian lattice Specifically it discusses methods of image processing along parallel rays to more quickly and accurately reconstruct images from a finite number of projections thereby avoiding overradiation of the body during a computed tomography CT scan The book presents several new ideas concepts and methods many of which have not been published elsewhere New concepts include methods of transferring the geometry of rays from the plane to the Cartesian lattice the point map of projections the particle and its field function and the statistical model of averaging The authors supply numerous examples MATLAB based programs end of chapter problems and experimental results of implementation The main approach for image reconstruction proposed by the authors differs from existing methods of back projection iterative reconstruction and Fourier and Radon filtering In this book the authors explain how to process each projection by a system of linear equations or linear convolutions to calculate the corresponding part of the 2 D tensor or paired transform of the discrete image They then describe how to calculate the inverse transform to obtain the reconstruction The proposed models for image reconstruction from projections are simple and result in more accurate reconstructions Introducing a new theory and methods of image reconstruction this book provides a solid grounding for those interested in further research and in obtaining new results It encourages readers to develop effective applications of these methods in CT

Brief Notes in Advanced DSP Artyom M. Grigoryan, Merughan

Grigoryan,2018-10-03 Based on the authors research in Fourier analysis Brief Notes in Advanced DSP Fourier Analysis with MATLAB addresses many concepts and applications of digital signal processing DSP The included MATLAB codes illustrate how to apply the ideas in practice The book begins with the basic concept of the discrete Fourier transformation and its properties It then describes lifting schemes integer transformations the discrete cosine transform and the paired transform method for calculating the discrete Hadamard transform The text also examines the decomposition of the 1D signal by so called section basis signals as well as new forms of 2D signal image representation and decomposition by direction signals images Focusing on Fourier transform wavelets and Givens Haar transforms the last chapter discusses the problem of signal multiresolution This book presents numerous interesting problems and concepts of unitary transformations such as the Fourier Hadamard Hartley Haar paired cosine and new signal induced transformations It aids readers in using new forms and methods of signals and images in the frequency and frequency and time domains **Tensor Computation for Data**

Analysis Yipeng Liu,Jiani Liu,Zhen Long,Ce Zhu,2021-08-31 Tensor is a natural representation for multi dimensional data and tensor computation can avoid possible multi linear data structure loss in classical matrix computation based data analysis This book is intended to provide non specialists an overall understanding of tensor computation and its applications in data analysis and benefits researchers engineers and students with theoretical computational technical and experimental details It presents a systematic and up to date overview of tensor decompositions from the engineer s point of view and comprehensive coverage of tensor computation based data analysis techniques In addition some practical examples in machine learning signal processing data mining computer vision remote sensing and biomedical engineering are also presented for easy understanding and implementation These data analysis techniques may be further applied in other applications on neuroscience communication psychometrics chemometrics biometrics quantum physics quantum chemistry etc The discussion begins with basic coverage of notations preliminary operations in tensor computations main tensor decompositions and their properties Based on them a series of tensor based data analysis techniques are presented as the tensor extensions of their classical matrix counterparts including tensor dictionary learning low rank tensor recovery tensor completion coupled tensor analysis robust principal tensor component analysis tensor regression logistical tensor regression support tensor machine multilinear discriminate analysis tensor subspace clustering tensor based deep learning tensor graphical model and tensor sketch The discussion also includes a number of typical applications with experimental results such as image reconstruction image enhancement data fusion signal recovery recommendation system knowledge graph acquisition traffic flow prediction link prediction environmental prediction weather forecasting background extraction human pose estimation cognitive state classification from fMRI infrared small target detection heterogeneous information networks clustering multi view image clustering and deep neural network compression *Numerical Grid Methods and Their Application to Schrödinger's Equation* C. Cerjan,2013-06-29 The use of numerical grid methods to solve the Schrodinger

equation has rapidly evolved in the past decade The early attempts to demonstrate the computational viability of grid methods have been largely superseded by applications to specific problems and deeper research into more sophisticated quadrature schemes Underpinning this research of course is the belief that the generic nature of grid methods can enjoy a symbiotic development with advances in computer technology harnessing this technology in an effective manner The contributions to this proceedings demonstrate these points in full several applications displayed creative use and extension of existing grid methodology other research concentrated on the development of new quadrature schemes or mixed numerical methods The research represented ranges from highly specific spectral simulations of van der Waals complexes to general schemes for reactive scattering The novelty of grid methods in Density Functional Theory calculations should also be highlighted since it represents an alternative to standard basis set expansion techniques and might offer distinct advantages to the standard techniques A deliberate attempt was made to present research material with more motivational and background discussion than is typical of research publications It is hoped that these contributed proceedings will be useful to students and researchers outside the field to have a rapid and complete introduction to many of the exciting uses of grid methodology in atomic and molecular physics Special thanks are due to the NATO Science Committee for its generous support of the activities of this workshop Knowledge-Based Software Engineering Alla Kravets, Maxim

Shcherbakov, Marina Kultsova, Tadashi Iijima, 2014-08-26 This book constitutes the refereed proceedings of the 11th Joint Conference on Knowledge Based Software Engineering JCKBSE 2014 held in Volgograd Russia in September 2014 The 59 full and 3 short papers presented were carefully reviewed and selected from 197 submissions The papers are organized in topical sections on methodology and tools for knowledge discovery and data mining methods and tools for software engineering education knowledge technologies for semantic web and ontology engineering knowledge based methods and tools for testing verification and validation maintenance and evolution natural language processing image analysis and recognition knowledge based methods and applications in information security robotics and navigation decision support methods for software engineering architecture of knowledge based systems including intelligent agents and softbots automating software design and synthesis knowledge management for business processes workflows and enterprise modeling knowledge based methods and applications in bioscience medicine and justice knowledge based requirements engineering domain analysis and modeling intelligent user interfaces and human machine interaction lean software engineering program understanding programming knowledge modeling programs and programmers **Wavelets Made**

Easy Yves Nievergelt, 2013-11-27 This book explains the nature and computation of mathematical wavelets which provide a framework and methods for the analysis and the synthesis of signals images and other arrays of data The material presented here addresses the audience of engineers financiers scientists and students looking for explanations of wavelets at the undergraduate level It requires only a working knowledge or memories of a first course in linear algebra and calculus The

first part of the book answers the following two questions What are wavelets Wavelets extend Fourier analysis How are wavelets computed Fast transforms compute them To show the practical significance of wavelets the book also provides transitions into several applications analysis detection of crashes edges or other events compression reduction of storage smoothing attenuation of noise and synthesis reconstruction after compression or other modification Such applications include one dimensional signals sounds or other time series two dimensional arrays pictures or maps and three dimensional data spatial diffusion The applications demonstrated here do not constitute recipes for real implementations but aim only at clarifying and strengthening the understanding of the mathematics of wavelets

This book delves into Multidimensional Discrete Unitary Transforms. Multidimensional Discrete Unitary Transforms is an essential topic that must be grasped by everyone, from students and scholars to the general public. This book will furnish comprehensive and in-depth insights into Multidimensional Discrete Unitary Transforms, encompassing both the fundamentals and more intricate discussions.

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 6. In chapter 5, this book will draw a conclusion about Multidimensional Discrete Unitary Transforms. The final chapter will summarize the key points that have been discussed throughout the book.
- This book is crafted in an easy-to-understand language and is complemented by engaging illustrations. This book is highly recommended for anyone seeking to gain a comprehensive understanding of Multidimensional Discrete Unitary Transforms.

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Multidimensional Discrete Unitary Transforms Introduction

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