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With the widespread availability of satellite and aircraft remote sensing image data in digital form, and the ready access most remote sensing practitioners have to computing systems for image interpretation, there is a need to draw together the range of digital image processing procedures and methodologies commonly used in this field into a

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single treatment. It is the intention of this book to provide such a function, at a level meaningful to the non-specialist digital image analyst, but in sufficient detail that algorithm limitations, alternative procedures and current trends can be appreciated. Often the applications specialist in remote sensing wishing to make use of digital processing procedures has had to depend upon either the mathematically detailed treatments of image processing found in the electrical engineering and computer science literature, or the sometimes necessarily superficial treatments given in general texts on remote sensing.

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This book seeks to redress that situation. Both image enhancement and classification techniques are covered making the material relevant in those applications in which photointerpretation is used for information extraction and in those wherein information is obtained by classification.

Digital Image Processing has been the leading textbook in its field for more than 20 years. As was the case with the 1977 and 1987 editions by Gonzalez and Wintz, and the 1992 edition by Gonzalez and Woods, the present edition was prepared with students and instructors in mind. 771e

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material is timely, highly readable, and illustrated with numerous examples of practical significance. All mainstream areas of image processing are covered, including a totally revised introduction and discussion of image fundamentals, image enhancement in the spatial and frequency domains, restoration, color image processing, wavelets, image compression, morphology, segmentation, and image description. Coverage concludes with a discussion of the fundamentals of object recognition. Although the book is completely self-contained, a Companion Website (see inside front cover) provides additional

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support in the form of review material, answers to selected problems, laboratory project suggestions. and a score of other features. A supplementary instructor's manual is available to instructors who have adopted the book for classroom use. New Features *New chapters on wavelets, image morphology, and color image

With crystal clarity, this book conveys the most current principles in digital image processing, providing both the background theory and the practical applications to various industries, such as digital cinema, video compression, and streaming

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media. This book contains tons of useful features, including: * a chapter on the role of human vision in image visualization, * the MATLAB codes used to generate most of the figures and tables listed in the book, as well as a few MATLAB projects, * a 24-pg color insert * case studies to illustrate the practical application of the theory.

Digital image processing and analysis is a field that continues to experience rapid growth, with applications in many facets of our lives. Areas such as medicine, agriculture, manufacturing, transportation, communication systems, and space

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exploration are just a few of the application areas. This book takes an engineering approach to image processing and analysis, including more examples and images throughout the text than the previous edition. It provides more material for illustrating the concepts, along with new PowerPoint slides. The application development has been expanded and updated, and the related chapter provides step-by-step tutorial examples for this type of development. The new edition also includes supplementary exercises, as well as MATLAB-based exercises, to aid both the reader and student in development of

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their skills.

Volume 1: From Energy to Image

Remote Sensing Digital Image Analysis

Fundamentals of Digital Image Processing

Topological Algorithms for Digital Image Processing

Digital Image Processing Springer Science & Business Media

This authoritative text (the second part of a complete MSc course) provides mathematical methods required to describe images, image formation and different imaging systems, coupled with the principle techniques used for processing

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digital images. It is based on a course for postgraduates reading physics, electronic engineering, telecommunications engineering, information technology and computer science. This book relates the methods of processing and interpreting digital images to the 'physics' of imaging systems. Case studies reinforce the methods discussed, with examples of current research themes. Provides mathematical methods required to describe images, image formation and different imaging systems Outlines the principle techniques used for processing digital images Relates the methods of processing and

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interpreting digital images to the 'physics' of imaging systems

The digital revolution over the past several decades has advanced every facet of evidence detection, photography, optimization, and interpretation. Forensic scientists and practitioners have benefited tremendously from the move from film to digital. With proper procedures in place, digital images and casework capabilities have increased tremendously in both complexity and range due to a vast array of tools to enhance evidence and photography. Forensic Digital Image Processing: Optimization of

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Impression Evidence provides the forensic investigator with the tools and understanding to extract, optimize, and interpret the maximum evidence possible from crime scenes to increase identifications. The book begins by examining the emergence of forensic digital image processing, and the gradual improvement and acceptance of the science over the past four decades. Coverage includes looking at the issues of image integrity and authentication including forensic image optimization and the manipulation of images. Chapters explore techniques exploiting color theory, modes, and channels to optimize signal-to-

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noise ratio in images. One of the greatest assets of digital image technology is the ability to combine multiple images of the same subject to create a final, blended image: one that displays the desired evidence and is especially useful for fingerprint or footwear impression. Later chapters demonstrate image subtraction, focus stacking, and high dynamic range, utilizing images in optimum focus and with substrate interference diminished or removed entirely. The authors look at fast Fourier transform as an optimal tool for noise removal, addressing basic theory and diagnosis of the noise signatures. The

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book discusses the history of digital imaging techniques and their treatment within the court system. Forensic Digital Image Processing: Optimization of Impression Evidence serves as an invaluable resource and tool for practicing professionals—as well as those new to the field—to look at best practices, the latest technology, and advances in utilizing the increasing array of tools of the trade.

A comprehensive digital image processing book that reflects new trends in this field such as document image compression and data compression standards. The book includes a

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complete rewrite of image data compression, a new chapter on image analysis, and a new section on image morphology.

Mathematical and Computational Methods

Optical and Digital Image Processing

Understanding Digital Image Processing

Handbook of Image Processing and Computer Vision

Digital Image Processing: Part I

A newly updated and revised edition of the classic introduction to digital image processing The Fourth Edition of Digital Image Processing provides a complete introduction to the field and includes new

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information that updates the state of the art. The text offers coverage of new topics and includes interactive computer display imaging examples and computer programming exercises that illustrate the theoretical content of the book. These exercises can be implemented using the Programmer's Imaging Kernel System (PIKS) application program interface included on the accompanying CD. Suitable as a textbook for students or as a reference for practitioners, this new edition provides a comprehensive treatment of these vital topics: Characterization of continuous images Image sampling and quantization techniques Two-dimensional signal processing techniques Image

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enhancement and restoration techniques Image analysis techniques Software implementation of image processing applications In addition, the bundled CD includes: A Solaris operating system executable version of the PIKS Scientific API A Windows operating system executable version of PIKS Scientific A Windows executable version of PIKSTool, a graphical user interface method of executing many of the PIKS Scientific operators without program compilation A PDF file format version of the PIKS Scientific C programmer's reference manual C program source demonstration programs A digital image database of most of the source images used in the book plus many others

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widely used in the literature Note: CD-ROM/DVD and other supplementary materials are not included as part of eBook file.

This textbook is the third of three volumes which provide a modern, algorithmic introduction to digital image processing, designed to be used both by learners desiring a firm foundation on which to build, and practitioners in search of critical analysis and concrete implementations of the most important techniques. This volume builds upon the introductory material presented in the first two volumes with additional key concepts and methods in image processing. Features: practical examples and carefully constructed chapter-ending exercises; real

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implementations, concise mathematical notation, and precise algorithmic descriptions designed for programmers and practitioners; easily adaptable Java code and completely worked-out examples for easy inclusion in existing applications; uses ImageJ; provides a supplementary website with the complete Java source code, test images, and corrections; additional presentation tools for instructors including a complete set of figures, tables, and mathematical elements.

Concentrating on the principles and techniques of image processing, this book provides an in-depth presentation of key topics, including many techniques not included in introductory texts.

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Practical implementation of the various image processing algorithms is an important step in learning the subject, and computer packages such as MATLAB facilitate this without the need to learn more complex programming languages. Whilst two chapters are devoted to the MATLAB programming environment and the image processing toolbox, the use of image processing algorithms using MATLAB is emphasised throughout the book, and every chapter is accompanied by a collection of exercises and programming assignments. Including coverage of colour and video image processing as well as object recognition, the book is augmented with supplementary MATLAB code and hints and solutions

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to problems are also provided.

Basic topological algorithms are the subject of this new book. It presents their underlying theory and discusses their applications. Due to the wide variety of topics treated in the seven chapters, no attempt has been made to standardize the notation and terminology used by the authors. Each chapter, however, is self-contained and can be read independently of the others. Some of the basic terminology and fundamental concepts of digital topology are reviewed in the appendix which also describes important areas of the field. A bibliography of over 360 references is also provided. The notations and terminologies used in this book will

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serve to introduce readers to the even wider variety that exists in the voluminous literature dealing with topological algorithms.

Binary Digital Image Processing

Introduction to Digital Image Processing

Digital Image Processing Methods

An Introduction

A Practical Approach with Examples in Matlab

This book provides basic theories and implementations using SCILAB open-source software for digital images. The book simplifies image processing theories and well as implementation of image processing algorithms, making it accessible to those with basic knowledge of image processing. This book includes many SCILAB programs at the end of each theory, which help in understanding concepts. The book

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includes more than sixty SCILAB programs of the image processing theory. In the appendix, readers will find a deeper glimpse into the research areas in the image processing.

Whether for computer evaluation of otherworldly terrain or the latest high definition 3D blockbuster, digital image processing involves the acquisition, analysis, and processing of visual information by computer and requires a unique skill set that has yet to be defined a single text. Until now. Taking an applications-oriented, engineering approach, Digital Image Processing and Analysis provides the tools for developing and advancing computer and human vision applications and brings image processing and analysis together into a unified framework. Providing information and background in a logical, as-needed fashion, the author presents topics as they become necessary for understanding the practical imaging model under study.

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He offers a conceptual presentation of the material for a solid understanding of complex topics and discusses the theory and foundations of digital image processing and the algorithm development needed to advance the field. With liberal use of color through-out and more materials on the processing of color images than the previous edition, this book provides supplementary exercises, a new chapter on applications, and two major new tools that allow for batch processing, the analysis of imaging algorithms, and the overall research and development of imaging applications. It includes two new software tools, the Computer Vision and Image Processing Algorithm Test and Analysis Tool (CVIP-ATAT) and the CVIP Feature Extraction and Pattern Classification Tool (CVIP-FEPC). Divided into five major sections, this book provides the concepts and models required to analyze digital images and develop computer vision and

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human consumption applications as well as all the necessary information to use the CVIPtools environment for algorithm development, making it an ideal reference tool for this fast growing field.

Across three volumes, the Handbook of Image Processing and Computer Vision presents a comprehensive review of the full range of topics that comprise the field of computer vision, from the acquisition of signals and formation of images, to learning techniques for scene understanding. The authoritative insights presented within cover all aspects of the sensory subsystem required by an intelligent system to perceive the environment and act autonomously. Volume 1 (From Energy to Image) examines the formation, properties, and enhancement of a digital image. Topics and features:

- *Describes the fundamental processes in the field of artificial vision that enable the*

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formation of digital images from light energy • Covers light propagation, color perception, optical systems, and the analog-to-digital conversion of the signal • Discusses the information recorded in a digital image, and the image processing algorithms that can improve the visual qualities of the image • Reviews boundary extraction algorithms, key linear and geometric transformations, and techniques for image restoration • Presents a selection of different image segmentation algorithms, and of widely-used algorithms for the automatic detection of points of interest • Examines important algorithms for object recognition, texture analysis, 3D reconstruction, motion analysis, and camera calibration • Provides an introduction to four significant types of neural network, namely RBF, SOM, Hopfield, and deep neural networks This all-encompassing survey offers a complete reference for all students, researchers, and

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practitioners involved in developing intelligent machine vision systems. The work is also an invaluable resource for professionals within the IT/software and electronics industries involved in machine vision, imaging, and artificial intelligence. Dr. Cosimo Distanto is a Research Scientist in Computer Vision and Pattern Recognition in the Institute of Applied Sciences and Intelligent Systems (ISAI) at the Italian National Research Council (CNR). Dr. Arcangelo Distanto is a researcher and the former Director of the Institute of Intelligent Systems for Automation (ISSIA) at the CNR. His research interests are in the fields of Computer Vision, Pattern Recognition, Machine Learning, and Neural Computation.

Foreword. Acknowledgements. Notation. Preface. Digital topology. Discrete geometry. Algorithmic graph theory. Acquisition and storage. Distance transformations. Binary digital image characteristics. Image

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thinning. Some applications. References. Index.

Fundamentals and Applications

Forensic Digital Image Processing

A Signal Processing and Algorithmic Approach

Digital Color Image Processing

Digital Image Analysis and Processing

The subject of digital image processing has migrated from a graduate to a junior or senior level course as students become more proficient in mathematical background earlier in their college education. With that in mind, Introduction to Digital Image Processing is simpler in terms of mathematical derivations and eliminates derivations of advanced s

Avoiding heavy mathematics and lengthy programming details, Digital Image Processing: An Algorithmic Approach with

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MATLAB® presents an easy methodology for learning the fundamentals of image processing. The book applies the algorithms using MATLAB®, without bogging down students with syntactical and debugging issues. One chapter can typically be completed per week, with each chapter divided into three sections. The first section presents theoretical topics in a very simple and basic style with generic language and mathematics. The second section explains the theoretical concepts using flowcharts to streamline the concepts and to form a foundation for students to code in any programming language. The final section supplies MATLAB codes for reproducing the figures presented in the chapter. Programming-based exercises at the end of each chapter facilitate the learning of underlying concepts through practice. This textbook equips undergraduate students in computer engineering and science with an

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essential understanding of digital image processing. It will also help them comprehend more advanced topics and sophisticated mathematical material in later courses. A color insert is included in the text while various instructor resources are available on the author's website.

In recent years, Moore's law has fostered the steady growth of the field of digital image processing, though the computational complexity remains a problem for most of the digital image processing applications. In parallel, the research domain of optical image processing has matured, potentially bypassing the problems digital approaches were suffering and bringing new applications. The advancement of technology calls for applications and knowledge at the intersection of both areas but there is a clear knowledge gap between the digital signal processing and the optical

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processing communities. This book covers the fundamental basis of the optical and image processing techniques by integrating contributions from both optical and digital research communities to solve current application bottlenecks, and give rise to new applications and solutions. Besides focusing on joint research, it also aims at disseminating the knowledge existing in both domains. Applications covered include image restoration, medical imaging, surveillance, holography, etc... "a very good book that deserves to be on the bookshelf of a serious student or scientist working in these areas." Source: Optics and Photonics News

An introduction to color in three-dimensional image processing and the emerging area of multi-spectral image processing The importance of color information in digital image processing is greater than ever. However, the transition from scalar to vector-

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valued image functions has not yet been generally covered in most textbooks. Now, Digital Color Image Processing fills this pressing need with a detailed introduction to this important topic. In four comprehensive sections, this book covers: The fundamentals and requirements for color image processing from a vector-valued viewpoint Techniques for preprocessing color images Three-dimensional scene analysis using color information, as well as the emerging area of multi-spectral imaging Applications of color image processing, presented via the examination of two case studies In addition to introducing readers to important new technologies in the field, Digital Color Image Processing also contains novel topics such as: techniques for improving three-dimensional reconstruction, three-dimensional computer vision, and emerging areas of safety and security applications in luggage inspection and video

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surveillance of high-security facilities. Complete with full-color illustrations and two applications chapters, Digital Color Image Processing is the only book that covers the breadth of the subject under one convenient cover. It is written at a level that is accessible for first- and second-year graduate students in electrical and computer engineering and computer science courses, and that is also appropriate for researchers who wish to extend their knowledge in the area of color image processing.

Human and Computer Vision Applications with CVIPtools, Second Edition

Digital Image Processing Techniques

Digital Image Processing and Analysis

Digital Image Processing with Application to Digital Cinema

An Algorithmic Introduction Using Java

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This long-established and well-received monograph offers an integral view of image processing - from image acquisition to the extraction of the data of interest - written by a physical scientists for other scientists. Supplements discussion of the general concepts is supplemented with examples from applications on PC-based image processing systems and ready-to-use implementations of important algorithms. Completely

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revised and extended, the most notable extensions being a detailed discussion on random variables and fields, 3-D imaging techniques and a unified approach to regularized parameter estimation. Complete text of the book is now available on the accompanying CD-ROM. It is hyperlinked so that it can be used in a very flexible way. CD-ROM contains a full set of exercises to all topics covered by this book and a runtime version of the image processing

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software heurisko. A large collection of images, image sequences, and volumetric images is available for practice exercises

This open access book gives a complete and comprehensive introduction to the fields of medical imaging systems, as designed for a broad range of applications. The authors of the book first explain the foundations of system theory and image processing, before highlighting several modalities in a

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dedicated chapter. The initial focus is on modalities that are closely related to traditional camera systems such as endoscopy and microscopy. This is followed by more complex image formation processes: magnetic resonance imaging, X-ray projection imaging, computed tomography, X-ray phase-contrast imaging, nuclear imaging, ultrasound, and optical coherence tomography.

Two-Dimensional Systems and

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Mathematical Preliminaries - Image Perception - Image Sampling and Quantization - Image Transforms - Image Representation by Stochastic Models - Image Enhancement - Image Filtering and Restoration - Image Analysis and Computer Vision - Image Reconstruction From Projections - Image Data Compression.

This book introduces the fundamental concepts of modern digital image processing. It aims to help the

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students, scientists, and practitioners to understand the concepts through clear explanations, illustrations and examples. The discussion of the general concepts is supplemented with examples from applications and ready-to-use implementations of concepts in MATLAB®. Program code of some important concepts in programming language 'C' is provided. To explain the concepts, MATLAB® functions are used throughout the book. MATLAB® Version 9.3 (R2017b),

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Image Acquisition Toolbox Version 5.3 (R2017b), Image Processing Toolbox, Version 10.1 (R2017b) have been used to create the book material. Meant for students and practicing engineers, this book provides a clear, comprehensive and up-to-date introduction to Digital Image Processing in a pragmatic manner. Digital Image Processing using SCILAB Digital Image Processing: Part II Fundamentals of Three-dimensional Digital Image Processing

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Digital Image Processing for Medical Applications

Optimization of Impression Evidence

This book offers readers an essential introduction to the fundamentals of digital image processing. Pursuing a signal processing and algorithmic approach, it makes the fundamentals of digital image processing accessible and easy to learn. It is written in a clear and concise manner with a large number of 4 x 4 and 8 x 8 examples, figures and

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detailed explanations. Each concept is developed from the basic principles and described in detail with equal emphasis on theory and practice. The book is accompanied by a companion website that provides several MATLAB programs for the implementation of image processing algorithms. The book also offers comprehensive coverage of the following topics: Enhancement, Transform processing, Restoration, Registration, Reconstruction from projections, Morphological image processing, Edge detection, Object

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representation and classification, Compression, and Color processing. Computer Imaging: Digital Image Analysis and Processing brings together analysis and processing in a unified framework, providing a valuable foundation for understanding both computer vision and image processing applications. Taking an engineering approach, the text integrates theory with a conceptual and application-oriented style, allowing you to immediately understand how each topic fits into the overall structure of practical

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application development. Divided into five major parts, the book begins by introducing the concepts and definitions necessary to understand computer imaging. The second part describes image analysis and provides the tools, concepts, and models required to analyze digital images and develop computer vision applications. Part III discusses application areas for the processing of images, emphasizing human visual perception. Part IV delivers the information required to apply a CVIptools environment to algorithm

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development. The text concludes with appendices that provide supplemental imaging information and assist with the programming exercises found in each chapter. The author presents topics as needed for understanding each practical imaging model being studied. This motivates the reader to master the topics and also makes the book useful as a reference. The CVIptools software integrated throughout the book, now in a new Windows version, provides practical examples and encourages you to conduct

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additional exploration via tutorials and programming exercises provided with each chapter.

Possibly the best book available as a text for a first course in digital image processing, this book can be used for both upper level courses in computer science or electrical engineering, and also can be applied to the industrial market.

Written as an introduction for undergraduate students, this textbook covers the most important methods in digital image processing. Formal and

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mathematical aspects are discussed at a fundamental level and various practical examples and exercises supplement the text. The book uses the image processing environment ImageJ, freely distributed by the National Institute of Health. A comprehensive website supports the book, and contains full source code for all examples in the book, a question and answer forum, slides for instructors, etc. Digital Image Processing in Java is the definitive textbook for computer science students studying image processing and

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digital processing.

Digital Image Processing

An Introduction to Digital Image

Processing

Computer Imaging

A Discrete Approach

A Course on Digital Image Processing with

MATLAB

Digital Image Processing Techniques is a state-of-the-art review of digital image processing techniques, with emphasis on the processing approaches and their associated algorithms. A canonical set of image processing problems that represent the class of

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functions typically required in most image processing applications is presented. Each chapter broadly addresses the problem being considered; the best techniques for this particular problem and how they work; their strengths and limitations; and how the techniques are actually implemented as well as their computational aspects. Comprised of eight chapters, this volume begins with a discussion on processing techniques associated with the following tasks: image enhancement, restoration, detection and estimation, reconstruction, and analysis, along with image data compression and image spectral estimation. The second section describes hardware and software systems for digital image processing. Aspects of

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commercially available systems that combine both processing and display functions are considered, as are future prospects for their technological and architectural evolution. The specifics of system design trade-offs are explicitly presented in detail. This book will be of interest to students, practitioners, and researchers in various disciplines including digital signal processing, computer science, statistical communications theory, control systems, and applied physics.

This is an introductory to intermediate level text on the science of image processing, which employs the Matlab programming language to illustrate some of the elementary, key concepts in modern image

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processing and pattern recognition. The approach taken is essentially practical and the book offers a framework within which the concepts can be understood by a series of well chosen examples, exercises and computer experiments, drawing on specific examples from within science, medicine and engineering. Clearly divided into eleven distinct chapters, the book begins with a fast-start introduction to image processing to enhance the accessibility of later topics. Subsequent chapters offer increasingly advanced discussion of topics involving more challenging concepts, with the final chapter looking at the application of automated image classification (with Matlab examples) . Matlab

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is frequently used in the book as a tool for demonstrations, conducting experiments and for solving problems, as it is both ideally suited to this role and is widely available. Prior experience of Matlab is not required and those without access to Matlab can still benefit from the independent presentation of topics and numerous examples.

Features a companion website

www.wiley.com/go/solomon/fundamentals containing a Matlab fast-start primer, further exercises, examples, instructor resources and accessibility to all files corresponding to the examples and exercises within the book itself. Includes numerous examples, graded exercises and computer experiments to

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support both students and instructors alike.

This book is a detailed description of the basics of three-dimensional digital image processing. A 3D digital image (abbreviated as “3D image” below) is a digitalized representation of a 3D object or an entire 3D space, stored in a computer as a 3D array.

Whereas normal digital image processing is concerned with screens that are a collection of square shapes called “pixels” and their corresponding density levels, the “image plane” in three dimensions is represented by a division into cubical graphical elements (called “voxels”) that represent corresponding density levels.

In the context of image processing, in

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manycases3Dimageprocessingwill refer to the input of multiple 2D images and performing processing in order to understand the 3D space (or “scene”) that they depict. This is a result of research into how to use input from image sensors such as television cameras as a basis for learning about a 3D scene, thereby replicating the sense of vision for humans or intelligent robots, and this has been the central problem in image processing research since the 1970s. However, a completely di?erent type of image with its own new problems, the 3D digital image discussed in this book, rapidly took prominence in the 1980s, particularly in the ?eld of medical imaging. These were recordings of human bodies

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obtained through computed (or “computerized”) tomography (CT), images that recorded not only the external, visible surface of the subject but also, to some degree of resolution, its internal structure. This was a type of image that no one had experienced before. This unique reference presents in-depth coverage of the latest methods and applications of digital image processing describing various computer architectures ideal for satisfying specific image processing demands.

Principles of Digital Image Processing

Medical Imaging Systems

Advanced Methods

An Algorithmic Approach with MATLAB

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Applications with MATLAB and CVIPtools

Hands-on text for a first course aimed at end-users, focusing on concepts, practical issues and problem solving. Introduce your students to image processing with the industry's most prized text For 40 years, Image Processing has been the foundational text for the study of digital image processing. The book is suited for students at the college senior and first-year graduate level with prior

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background in mathematical analysis, vectors, matrices, probability, statistics, linear systems, and computer programming. As in all earlier editions, the focus of this edition of the book is on fundamentals. The 4th Edition, which celebrates the book's 40th anniversary, is based on an extensive survey of faculty, students, and independent readers in 150 institutions from 30 countries. Their feedback led to expanded or new

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coverage of topics such as deep learning and deep neural networks, including convolutional neural nets, the scale-invariant feature transform (SIFT), maximally-stable extremal regions (MSERs), graph cuts, k-means clustering and superpixels, active contours (snakes and level sets), and exact histogram matching. Major improvements were made in reorganizing the material on image transforms into a more cohesive presentation, and in the

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discussion of spatial kernels and spatial filtering. Major revisions and additions were made to examples and homework exercises throughout the book. For the first time, we added MATLAB projects at the end of every chapter, and compiled support packages for you and your teacher containing, solutions, image databases, and sample code. The support materials for this title can be found at www.ImageProcessingPlace.com

An Introductory Guide

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Digital Signal and Image Processing
Using MATLAB
PIKS Scientific Inside