

# Digital Image Processing Lab Manual

This book emphasizes the emerging building block of image processing domain, which is known as capsule networks for performing deep image recognition and processing for next-generation imaging science. Recent years have witnessed the continuous development of technologies and methodologies related to image processing, analysis and 3D modeling which have been implemented in the field of computer and image vision. The significant development of these technologies has led to an efficient solution called capsule networks [CapsNet] to solve the intricate challenges in recognizing complex image poses, visual tasks, and object deformation. Moreover, the breakneck growth of computation complexities and computing efficiency has initiated the significant developments of the effective and sophisticated capsule network algorithms and artificial intelligence [AI] tools into existence. The main contribution of this book is to explain and summarize the significant state-of-the-art research advances in the areas of capsule network [CapsNet] algorithms and architectures with real-time implications in the areas of image detection, remote sensing, biomedical image analysis, computer communications, machine vision, Internet of things, and data analytics techniques. Dr. Ahmet Mesrur Halefo?lu mostly deals with research fields in body imaging and neuroradiology with multidetector computed tomography and high-resolution

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magnetic resonance imaging. He has served as postdoctoral research fellow at Johns Hopkins Hospital. Currently, he is working as an associate professor of radiology in Istanbul, Turkey. He has more than 50 high-impact-factor publications and has written 3 book chapters. He is a member of Turkish Society of Radiology and European Society of Radiology. During the recent years, there have been major breakthroughs in MRI due to developments in scanner technology and pulse sequencing. These important achievements have led to remarkable improvements in neuroimaging and advanced techniques, including diffusion imaging, diffusion tensor imaging, perfusion imaging, magnetic resonance spectroscopy, and functional MRI. These advanced neuroimaging techniques have enabled us to achieve invaluable insights into tissue microstructure, microvasculature, metabolism, and brain connectivity. 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 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

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more challenging concepts, with the final chapter looking at the application of automated image classification (with Matlab examples) . Matlab 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](http://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 support both students and instructors alike.

55% new material in the latest edition of this “must-have for students and practitioners of image & video processing! This Handbook is intended to serve as the basic reference point on image and video processing, in the field, in the research laboratory, and in the classroom. Each chapter has been written by carefully selected, distinguished experts specializing in that topic and carefully reviewed by the Editor, Al Bovik, ensuring that the greatest depth of understanding be communicated to the reader. Coverage includes introductory, intermediate and advanced topics and as such, this book serves equally well as classroom textbook as reference resource. • Provides practicing engineers and students with a highly accessible resource

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for learning and using image/video processing theory and algorithms • Includes a new chapter on image processing education, which should prove invaluable for those developing or modifying their curricula • Covers the various image and video processing standards that exist and are emerging, driving today's explosive industry • Offers an understanding of what images are, how they are modeled, and gives an introduction to how they are perceived • Introduces the necessary, practical background to allow engineering students to acquire and process their own digital image or video data •

Culminates with a diverse set of applications chapters, covered in sufficient depth to serve as extensible models to the reader's own potential applications About the Editor... Al Bovik is the Cullen Trust for Higher Education Endowed Professor at The University of Texas at Austin, where he is the Director of the Laboratory for Image and Video Engineering (LIVE). He has published over 400 technical articles in the general area of image and video processing and holds two U.S. patents. Dr. Bovik was Distinguished Lecturer of the IEEE Signal Processing Society (2000), received the IEEE Signal Processing Society Meritorious Service Award (1998), the IEEE Third Millennium Medal (2000), and twice was a two-time Honorable Mention winner of the international Pattern Recognition Society Award. He is a Fellow of the IEEE, was Editor-in-Chief, of the IEEE Transactions on Image Processing (1996-2002), has served on and continues to serve on many other professional boards and panels, and was the Founding General Chairman of the IEEE International Conference on Image Processing which

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was held in Austin, Texas in 1994. \* No other resource for image and video processing contains the same breadth of up-to-date coverage \* Each chapter written by one or several of the top experts working in that area \* Includes all essential mathematics, techniques, and algorithms for every type of image and video processing used by electrical engineers, computer scientists, internet developers, bioengineers, and scientists in various, image-intensive disciplines

The Updated Second Edition of Fundamentals of Geographic Information Systems includes thirteen laboratory exercises integrated into the text itself. The labs are linked to particular chapter where the concepts described in the reading can be practiced immediately in a laboratory setting. The second edition of this well-received text on principles of geographic information systems (GIS) continues the author's style of "straight talk" in its presentation. The writing is accessible and easy to follow. Unlike most other texts, this book covers GIS design and modeling, reflecting the belief that modeling and analysis are at the heart of GIS. This enables students to understand how to use a GIS and what it does.

Professionals in local and national government and in the private sector frequently need to draw on Geographical Information Systems (GIS), Remote Sensing (RS) and Global Positioning Systems (GPS), often in an integrated manner. This manual shows a hands-on operator how to work across the range of geospatial science and technology, whether as a user or as a contractor of services employing these

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technologies, and without either specialist education or substantial experience. The manual covers the fundamentals of each of these topical areas, providing the requisite mathematics, computer science and physics necessary to understand how the technologies work, assuming some elementary background in calculus and physics. It also shows how the technologies can be used together and focuses on their commonalities. A number of applications such as mapping and environmental modeling are presented, and a website accompanies the book.

This book is concerned with the aspects of real-time, parallel computing which are specific to the analysis of digitized images including both the symbolic and semantic data derived from such images. The subjects covered encompass processing, storing, and transmitting images and image data. A variety of techniques and algorithms for the analysis and manipulation of images are explored both theoretically and in terms of implementation in hardware and software. The book is organized into four topic areas: (1) theoretical development, (2) languages for image processing, (3) new computer techniques, and (4) implementation in special purpose real-time digital systems. Computer utilization, methodology, and design for image analysis presents special and unusual problems. One author (Nagao)\* points out that, "Human perception of a scene is very complex. It has not been made clear how perception functions, what one sees in a picture, and how one understands the whole picture. It is almost certain that one carries out a very quick trial-and-error process, starting from the detection of gross prominent features and then analyzing details, using one's knowledge of the world." Another author (Duff) makes the observation that, "It is therefore more difficult to write computer programs

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which deal with images than those which deal with numbers, human thinking about arithmetic being a largely conscious activity.

This systematically designed laboratory manual elucidates a number of techniques which help the students carry out various experiments in the field of digital signal processing, digital image processing, digital signal processor and digital communication through MATLAB® in a single volume. A step-wise discussion of the programming procedure using MATLAB® has been carried out in this book. The numerous programming examples for each digital signal processing lab, image processing lab, signal processor lab and digital communication lab have also been included. The book begins with an introductory chapter on MATLAB®, which will be very useful for a beginner. The concepts are explained with the aid of screenshots. Then it moves on to discuss the fundamental aspects in digital signal processing through MATLAB®, with a special emphasis given to the design of digital filters (FIR and IIR). Finally digital communication and image processing sections in the book help readers to understand the commonly used MATLAB® functions. At the end of this book, some basic experiments using DSP trainer kit have also been included.

**Audience** This book is intended for the undergraduate students of electronics and communication engineering, electronics and instrumentation engineering, and instrumentation and control engineering for their laboratory courses in digital signal processing, image processing and digital communication.

**Key Features**

- Includes about 115 different experiments.
- Contains several figures to reinforce the understanding of the techniques discussed.
- Gives systematic way of doing experiments such as Aim, Theory, Programs, Sample inputs and outputs, Viva voce questions and Examination questions.

First published in 1992, *The Image Processing Handbook* not

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only set the standard for professional references in this field, but also provided the first text truly accessible to undergraduate students and non-specialists. Each subsequent edition has reflected the continuing rapid advances in image processing, and the fourth edition is no exception.

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

Volume 1: Theory, instruments and techniques. - Volume 2: Interpretation and applications.

Space Image Processing covers the design and coding of PC software for processing and manipulating imagery obtained by satellites and other spacecraft. Although the contents relate to several scientific and technological fields, it serves as a programming book, providing readers with essential technical information for developing PC applications. The material focuses on images of the planet and other celestial bodies obtained by orbiting and non-orbiting spacecraft. This book is not about raster graphics in general, but about raster graphics processing as it applies to space imagery. Three



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parts divide the text: 1. Science - background at an introductory level - scientific principles underlying space imagery and its processing - topics related to space and remote sensing. 2. Technology - topics related to space imagery - geodesy, cartography, image data formats, image processing. 3. Programming - code examples for DOS and Windows programming on the PC - consideration of low-level and C++ code - routines with a tutorial and demonstrative purpose.

Invasive Cardiology: A Manual for Cath Lab Personnel, Third Edition was recently honored with 4 Stars from Doody's Book Review! Completely revised and updated, the Third Edition of Invasive Cardiology: A Manual for Cath Lab Personnel, is written specifically for nurses, technologists, and allied health personnel working in the catheterization laboratory. Topics cover all aspects of the catheterization laboratory including cardiovascular anatomy, radiography, angiography, technical duties of the staff, right and left heart catheterization, PCI, invasive ultrasound, valvuloplasty, hemostasis, pediatric interventions, pharmacology, emergency procedures, and many others.

LAB PRIMER THROUGH MATLAB®DIGITAL SIGNAL PROCESSING, DIGITAL IMAGE PROCESSING, DIGITAL SIGNAL PROCESSOR AND DIGITAL COMMUNICATION PHI Learning Pvt. Ltd.

UP-TO-DATE, TECHNICALLY ACCURATE COVERAGE OF ESSENTIAL TOPICS IN IMAGE AND VIDEO PROCESSING This is the first book to combine image and video processing with a practical

MATLAB®-oriented approach in order to demonstrate the most important image and video techniques and

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algorithms. Utilizing minimal math, the contents are presented in a clear, objective manner, emphasizing and encouraging experimentation. The book has been organized into two parts. Part I: Image Processing begins with an overview of the field, then introduces the fundamental concepts, notation, and terminology associated with image representation and basic image processing operations. Next, it discusses MATLAB® and its Image Processing Toolbox with the start of a series of chapters with hands-on activities and step-by-step tutorials. These chapters cover image acquisition and digitization; arithmetic, logic, and geometric operations; point-based, histogram-based, and neighborhood-based image enhancement techniques; the Fourier Transform and relevant frequency-domain image filtering techniques; image restoration; mathematical morphology; edge detection techniques; image segmentation; image compression and coding; and feature extraction and representation. Part II: Video Processing presents the main concepts and terminology associated with analog video signals and systems, as well as digital video formats and standards. It then describes the technically involved problem of standards conversion, discusses motion estimation and compensation techniques, shows how video sequences can be filtered, and concludes with an example of a solution to object detection and tracking in video sequences using MATLAB®. Extra features of this book include: More than 30 MATLAB® tutorials, which consist of step-by-step guides to exploring image and video processing techniques using MATLAB® Chapters

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supported by figures, examples, illustrative problems, and exercises Useful websites and an extensive list of bibliographical references This accessible text is ideal for upper-level undergraduate and graduate students in digital image and video processing courses, as well as for engineers, researchers, software developers, practitioners, and anyone who wishes to learn about these increasingly popular topics on their own.

Clinical laboratory directors and staff working with blood samples will benefit from the essential information in this hematology focused publication in Clinics in Laboratory Medicine. Leading a field of expert authors are two renown physicians in the field - Dr Carlo Brugnara and Dr Alexander Kratz. They present topics such as White Blood Cell Counts: Reference Methodology; Integration of Automated Heme and Bone Marrow Analysis; Red Cell Dynamics; Red Cell Diagnosis other than Anemia; Laboratory and Genetic Assessment of Iron Deficiency in Blood Donors; Body Fluid Cell Counting; Platelets: The Few, the Young, and the Active; Reticulocytes; Quality Control of Automated Cell Counters; Digital Image Analysis of Blood Cells; Blood Cell Counters in Urgent Care Settings; Novel Parameters in Blood Cell Counters; and the Development and Future of Automated Blood Cell Counters.

Now in its fifth edition, John C. Russ's monumental image processing reference is an even more complete, modern, and hands-on tool than ever before. The Image Processing Handbook, Fifth Edition is fully updated and expanded to reflect the latest developments in the field. Written by an expert with unequalled experience and

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authority, it offers clear guidance on how to create, select, and use the most appropriate algorithms for a specific application. What's new in the Fifth Edition? · A new chapter on the human visual process that explains which visual cues elicit a response from the viewer · Description of the latest hardware and software for image acquisition and printing, reflecting the proliferation of the digital camera · New material on multichannel images, including a major section on principal components analysis · Expanded sections on deconvolution, extended dynamic range images, and image enlargement and interpolation · More than 600 new and revised figures and illustrations for a total of more than 2000 illustrations · 20% more references to the most up-to-date literature Written in a relaxed and reader-friendly style, *The Image Processing Handbook, Fifth Edition* guides you through the myriad tools available for image processing and helps you understand how to select and apply each one.

*The Criminalistics Laboratory Manual: The Basics of Forensic Investigation* provides students with little to no prior knowledge of forensic science with a practical crime scene processing experience. The manual starts with an original crime scene narrative setting up the crime students are to solve. This narrative is picked up in each of the forensic science lab activities, tying each forensic discipline together to show the integrated workings of a real crime lab. After the completion of all of the exercises, the student will be able to solve the homicide based on forensic evidence.

Is an introduction to digital image processing from an

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elementary perspective. The book covers topics that can be introduced with simple mathematics so students can learn the concepts without getting overwhelmed by mathematical detail.

This book is a printed edition of the Special Issue "Color Image Processing" that was published in J. Imaging

This book is evolved from the experience of the author who taught all lab courses in his three decades of teaching in various universities in India. The objective of this lab manual

is to provide information to undergraduate students to

practice experiments in electronics laboratories. This book

covers 118 experiments for linear/analog integrated circuits lab, communication engineering lab, power electronics lab,

microwave lab and optical communication lab. The

experiments described in this book enable the students to

learn:

- Various analog integrated circuits and their functions

- Analog and digital communication techniques

- Power electronics circuits and their functions

- Microwave

- equipment and components

- Optical communication devices

This book is intended for the B.Tech students of Electronics

and Communication Engineering, Electrical and Electronics

Engineering, Biomedical Electronics, Instrumentation and

Control, Computer Science, and Applied Electronics. It is

designed not only for engineering students, but can also be

used by BSc/MSc (Physics) and Diploma students. **KEY**

**FEATURES**

- Contains aim, components and equipment

- required, theory, circuit diagram, pin-outs of active devices,

- design, tables, graphs, alternate circuits, and troubleshooting

- techniques for each experiment

- Includes viva voce and

- examination questions with their answers

- Provides

- exposure on various devices

**TARGET AUDIENCE**

- B.Tech

- (Electronics and Communication Engineering, Electrical and

- Electronics Engineering, Biomedical Electronics,

- Instrumentation and Control, Computer Science, and Applied

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Electronics) • BSc/MSc (Physics) • Diploma (Engineering)

The tenth edition of *The Manual of Photography* is an indispensable textbook for anyone who is serious about photography. It is ideal if you want to gain insight into the underlying scientific principles of photography and digital imaging, whether you are a professional photographer, lab technician, researcher or student in the field, or simply an enthusiastic amateur. This comprehensive guide takes you from capture to output in both digital and film media, with sections on lens use, darkroom techniques, digital cameras and scanners, image editing techniques and processes, workflow, digital file formats and image archiving. This iconic text was first published in 1890 and has aided many thousands of photographers in developing their own techniques and understanding of the medium. Now in full colour, *The Manual of Photography* still retains its clear, reader-friendly style and is filled with images and illustrations demonstrating the key principles. Not only giving you the skills and know-how to take stunning photographs, but will also allowing you to fully understand the science behind the creation of great images.

Technical Report from the year 2014 in the subject Computer Science - Technical Computer Science, , language: English, abstract: This is Laboratory Manual of Digital Signal Processing. All experiments are performed on MATLAB, e.g.:  
List of Experiments  
1 To represent basic signals like: Unit Impulse, Ramp, Unit Step, Exponential.  
2 To generate discrete sine and cosine signals with given sampling frequency.  
3 To represent complex exponential as a function of real and imaginary part.  
4 To determine impulse and step response of two vectors using MATLAB.  
5 To perform convolution between two vectors using MATLAB.  
6 To perform cross correlation between two vectors using MATLAB. [...]

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Remote sensing has undergone profound changes over the past two decades as GPS, GIS, and sensor advances have significantly expanded the user community and availability of images. New tools, such as automation, cloud-based services, drones, and artificial intelligence, continue to expand and enhance the discipline. Along with comprehensive coverage and clarity, Sabins and Ellis establish a solid foundation for the insightful use of remote sensing with an emphasis on principles and a focus on sensor technology and image acquisition. The Fourth Edition presents a valuable discussion of the growing and permeating use of technologies such as drones and manned aircraft imaging, DEMs, and lidar. The authors explain the scientific and societal impacts of remote sensing, review digital image processing and GIS, provide case histories from areas around the globe, and describe practical applications of remote sensing to the environment, renewable and nonrenewable resources, land use/land cover, natural hazards, and climate change. • Remote Sensing Digital Database includes 27 examples of satellite and airborne imagery that can be used to jumpstart labs and class projects. The database includes descriptions, georeferenced images, DEMs, maps, and metadata. Users can display, process, and interpret images with open-source and commercial image processing and GIS software. • Flexible, revealing, and instructive, the Digital Image Processing Lab Manual provides 12 step-by-step exercises on the following topics: an introduction to ENVI, Landsat multispectral processing, image processing, band ratios and principal components, georeferencing, DEMs and lidar, IHS and image sharpening, unsupervised classification, supervised classification, hyperspectral, and change detection and radar. • Introductory and instructional videos describe and guide users on ways to access and utilize the Remote Sensing Digital Database and

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the Digital Image Processing Lab Manual. • Answer Keys are available for instructors for questions in the text as well as the Digital Image Processing Lab Manual.

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. The 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 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

This book provides up-to-date and practical knowledge in all aspects of whole slide imaging (WSI) by experts in the field. This includes a historical perspective on the evolution of this technology, technical aspects of making a great whole slide image, the various applications of



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whole slide imaging and future applications using WSI for computer-aided diagnosis. The goal is to provide practical knowledge and address knowledge gaps in this emerging field. This book is unique because it addresses an emerging area in pathology for which currently there is only limited information about the practical aspects of deploying this technology. For example, there are no established selection criteria for choosing new scanners and a knowledge base with the key information. The authors of the various chapters have years of real-world experience in selecting and implementing WSI solutions in various aspects of pathology practice. This text also discusses practical tips and pearls to address the selection of a WSI vendor, technology details, implementing this technology and provide an overview of its everyday uses in all areas of pathology. Chapters include important information on how to integrate digital slides with laboratory information system and how to streamline the “digital workflow” with the intent of saving time, saving money, reducing errors, improving efficiency and accuracy, and ultimately benefiting patient outcomes. Whole Slide Imaging: Current Applications and Future Directions is designed to present a comprehensive and state-of-the-art approach to WSI within the broad area of digital pathology. It aims to give the readers a look at WSI with a deeper lens and also envision the future of pathology imaging as it pertains to WSI and associated digital innovations.

Representing an evolutionary leap, the integration of optical technologies into mechatronic systems adds a new dimension to an already multifaceted field. Optical

elements enhance the functionality of mechatronics and in many cases introduce entirely new capabilities. Likewise, mechatronic elements bring the same synergistic effects to optical systems. However, most books focus on traditional mechatronics while only briefly discussing, or omitting completely, the characteristics of optomechatronic technology. Bringing together the fundamentals and underlying concepts, Optomechatronics provides a detailed introduction to this growing field. With emphasis on the importance of interdisciplinary, multiple-technology fusion, this book threads together the background, definition, and characteristics of the field with an integrated view of various disciplines, a system-oriented approach, and a combined view of the macro/micro worlds. It begins with an analysis of a variety of practical optomechatronic systems to identify the underlying concepts and features of each area composing the field. These systems include optics, machine vision, feedback control, and micro-optomechanical systems (MOEMS). From this platform, the author demonstrates how to fuse the optical, mechanical, electronic, and microprocessor elements to realize desired functionalities. Finally, the book examines whole optomechatronic systems comprising the components described in the previous section. Whether you are new to the field or have experience in a different engineering discipline, Optomechatronics supplies the necessary tools to harness the benefits that optical technologies bring to this important emerging area. This book comprehensively reviews the various automated and semi-automated signal and image

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processing techniques, as well as deep-learning-based image analysis techniques, used in healthcare diagnostics. It highlights a range of data pre-processing methods used in signal processing for effective data mining in remote healthcare, and discusses pre-processing using filter techniques, noise removal, and contrast-enhanced methods for improving image quality. The book discusses the status quo of artificial intelligence in medical applications, as well as its future. Further, it offers a glimpse of feature extraction methods for reducing dimensionality and extracting discriminatory information hidden in biomedical signals. Given its scope, the book is intended for academics, researchers and practitioners interested in the latest real-world technological innovations.

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