Microscope Image Processing

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Methods and Applications, Second Edition
Image Analysis
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23rd International Conference, Lima, Peru, October 4–8, 2020, Proceedings, Part V
The Image Processing Handbook
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The Essential Guide to Image Processing
The Image Processing Handbook, Fifth Edition
Whole Slide Imaging
Focus on Bio-Image Informatics
Computer Processing of Electron Microscope Images
Biomedical Image Processing and Three-dimensional Microscopy
New Approaches to Image Processing based Failure Analysis of Nano-Scale ULSI Devices
Image Acquisition and Processing
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Deep Learning-enabled Cross-modality Image Transformation and Early Bacterial Colony Detection
Three-dimensional and Multidimensional Microscopy
Video Microscopy
10-13 February 1992, San Jose, California
Digital Image Processing Software Design for Electron Microscope Image Analysis
Image Acquisition and Processing
Scanning Electron Microscopy and X-Ray Microanalysis
Computer Control of a Scanning Electron Microscope for Digital Image Processing of Thermal-wave Images

SHANNON KENZIE

Quantitative Ion Microscopy by Digital Image Processing Oxford University Press
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 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.
Fluorescence Microscopy and Fluorescent Probes Springer Science & Business Media
Microscope Image Processing, Second Edition, introduces the basic fundamentals of image formation in microscopy including the importance of image digitization and display, which are key to quality visualization. Image processing and analysis are discussed in detail to provide readers with the tools necessary to improve the visual quality of images, and to extract quantitative information. Basic techniques such as image enhancement, filtering, segmentation, object measurement, and pattern recognition cover concepts integral to image processing. In addition, chapters on specific modern microscopy techniques such as fluorescence imaging, multispectral imaging, three-dimensional imaging and time-lapse imaging, introduce these key areas with emphasis on the differences among the various techniques. The new edition discusses recent developments in microscopy such as light sheet microscopy, digital microscopy, whole slide imaging, and the use of deep learning techniques for image segmentation and analysis with big data image informatics and management. Microscope Image Processing, Second Edition, is suitable for engineers, scientists, clinicians, post-graduate fellows and graduate students working in bioengineering, biomedical engineering, biology, medicine, chemistry, pharmacology and related fields, who use microscopes in their work and would like to understand the methodologies and capabilities of the latest digital image processing techniques or desire to develop their own image processing algorithms and software for specific applications. Presents a unique practical perspective of state-of-the-art microscope image processing and the development of specialized algorithms Each chapter includes in-depth analysis of methods coupled with the results of specific real-world experiments Co-edited by Kenneth R. Castleman, world-renowned pioneer in digital image processing and author of two seminal textbooks on the subject
Advanced Computing in Electron Microscopy Springer Science & Business Media
Automatic image analysis has become an important tool in many fields of biology, medicine, and other sciences. Since the first edition of Image Analysis: Methods and Applications, the development of both software and hardware technology has undergone quantum leaps. For example, specific mathematical filters have been developed for quality enhancement of original images and for extraction of specific features of interest. Also, more complex programs have been developed for the analysis of object forms in distinguishing cancer cells from normal tissue cells. Just as significant, three-dimensional analysis of proteins, organelles, or macroscopic objects is even more complex. In addition, recent space-based experiments have optimized techniques for the extraction of movement parameters of numerous motile objects. The second edition of Image Analysis: Methods and Applications addresses all these new developments. Moreover, two new chapters have been added. One focuses on images on the internet, and the other discusses microscope image restoration. These chapters add significantly to the existing body of information on Internet communication protocol and environment as well as to that on image file formats considerations. The materials also include a list of internet Web sites that pertain to digital images and software along with those that relate to image processing. With these considerations in mind, Image Analysis: Methods and Application, Second Edition is of incalculable value to professionals, academics, and users of all aspects of image analysis in biology and other areas of science.
Atomic Force Microscopy CRC Press
This Open Access textbook provides students and researchers in the life sciences with essential practical information on how to quantitatively analyze data images. It refrains from focusing on theory, and instead uses practical examples and step-by step protocols to familiarize readers with the most commonly used image processing and analysis platforms such as ImageJ, MatLab and Python. Besides gaining knowhow on algorithm usage, readers will learn how to create an analysis pipeline by scripting language; these skills are important in order to document reproducible image analysis workflows. The textbook is chiefly intended for advanced undergraduates in the life sciences and biomedicine without a theoretical background in data analysis, as well as for postdocs, staff scientists and faculty members who need to perform regular quantitative analyses of microscopy images.
Microscope Image Processing Springer Nature
Images are all around us! The proliferation of low-cost, high-quality imaging devices has led to an explosion in acquired images. When these images are acquired from a microscope, telescope, satellite, or medical imaging device, there is a statistical image processing task: the inference of something—an artery, a road, a DNA marker, an oil spill—from imagery, possibly noisy, blurry, or

incomplete. A great many textbooks have been written on image processing. However this book does not so much focus on images, per se, but rather on spatial data sets, with one or more measurements taken over a two or higher dimensional space, and to which standard image-processing algorithms may not apply. There are many important data analysis methods developed in this text for such statistical image problems. Examples abound throughout remote sensing (satellite data mapping, data assimilation, climate-change studies, land use), medical imaging (organ segmentation, anomaly detection), computer vision (image classification, segmentation), and other 2D/3D problems (biological imaging, porous media). The goal, then, of this text is to address methods for solving multidimensional statistical problems. The text strikes a balance between mathematics and theory on the one hand, versus applications and algorithms on the other, by deliberately developing the basic theory (Part I), the mathematical modeling (Part II), and the algorithmic and numerical methods (Part III) of solving a given problem. The particular emphases of the book include inverse problems, multidimensional modeling, random fields, and hierarchical methods.

Image Acquisition and Processing ... Springer

A complete introduction to the basic and intermediate concepts of image processing from the leading people in the field Up-to-date content, including statistical modeling of natural, anistropic diffusion, image quality and the latest developments in JPEG 2000 This comprehensive and state-of-the art approach to image processing gives engineers and students a thorough introduction, and includes full coverage of key applications: image watermarking, fingerprint recognition, face recognition and iris recognition and medical imaging. "This book combines basic image processing techniques with some of the most advanced procedures. Introductory chapters dedicated to general principles are presented alongside detailed application-orientated ones. As a result it is suitably adapted for different classes of readers, ranging from Master to PhD students and beyond." – Prof. Jean-Philippe Thiran, EPFL, Lausanne, Switzerland "Al Bovik's compendium proceeds systematically from fundamentals to today's research frontiers. Professor Bovik, himself a highly respected leader in the field, has invited an all-star team of contributors. Students, researchers, and practitioners of image processing alike should benefit from the Essential Guide." – Prof. Bernd Girod, Stanford University, USA "This book is informative, easy to read with plenty of examples, and allows great flexibility in tailoring a course on image processing or analysis." – Prof. Pamela Cosman, University of California, San Diego, USA A complete and modern introduction to the basic and intermediate concepts of image processing – edited and written by the leading people in the field An essential reference for all types of engineers working on image processing applications Up-to-date content, including statistical modelling of natural, anisotropic diffusion, image quality and the latest developments in JPEG 2000

Methods and Applications, Second Edition Springer Science & Business Media

Atomic force microscopes are very important tools for the advancement of science and technology. This book provides an introduction to the microscopes so that scientists and engineers can learn both how to use them, and what they can do.

Image Analysis Springer Science & Business Media

Digital image processing, an integral part of microscopy, is increasingly important to the fields of medicine and scientific research. This book provides a unique one-stop reference on the theory, technique, and applications of this technology.

Medical Image Computing and Computer Assisted Intervention – MICCAI 2020 Microscope Image Processing

Image Processing and Acquisition using Python provides readers with a sound foundation in both image acquisition and image processing—one of the first books to integrate these topics together. By improving readers' knowledge of image acquisition techniques and corresponding image processing, the book will help them perform experiments more effectively and cost efficiently as well as analyze and measure more accurately. Long recognized as one of the easiest languages for non-programmers to learn, Python is used in a variety of practical examples. A refresher for more experienced readers, the first part of the book presents an introduction to Python, Python modules, reading and writing images using Python, and an introduction to images. The second part discusses the basics of image processing, including pre/post processing using filters, segmentation, morphological operations, and measurements. The last part describes image acquisition using various modalities, such as x-ray, CT, MRI, light microscopy, and electron microscopy. These modalities encompass most of the common image acquisition methods currently used by researchers in academia and industry.

Microscope Image Processing William Andrew

Logarithmic Image Processing: Theory and Applications, the latest volume in the series that merges two long-running serials, Advances in Electronics and Electron Physics and Advances in Optical and Electron Microscopy and features cutting-edge articles on recent developments in all areas of microscopy, digital image processing, and many related subjects in electron physics. Merges two long-running serials, Advances in Electronics and Electron Physics and Advances in Optical and Electron Microscopy into a single volume Contains the latest information on logarithmic image processing and its theory and applications Features cutting-edge articles on recent developments in all areas of microscopy, digital image processing, and many related subjects in electron physics

Image Acquisition and Processing CRC Press

This new volume, number 123, of Methods in Cell Biology looks at methods for quantitative imaging in cell biology. It covers both theoretical and practical aspects of using optical fluorescence microscopy and image analysis techniques for quantitative applications. The introductory chapters cover fundamental concepts and techniques important for obtaining accurate and precise quantitative data from imaging systems. These chapters address how choice of microscope, fluorophores, and digital detector impact the quality of quantitative data, and include step-by-step protocols for capturing and analyzing quantitative images. Common quantitative applications, including co-localization, ratiometric imaging, and counting molecules, are covered in detail. Practical chapters cover topics critical to getting the most out of your imaging system, from microscope maintenance to creating standardized samples for measuring resolution. Later chapters cover recent advances in quantitative imaging techniques, including super-resolution and light sheet microscopy. With cutting-edge material, this comprehensive collection is intended to guide researchers for years to come. Covers sections on model systems and functional studies, imaging-based approaches and emerging studies Chapters are written by experts in the field Cutting-edge

material
23rd International Conference, Lima, Peru, October 4–8, 2020, Proceedings, Part V Academic Press
The seven-volume set LNCS 12261, 12262, 12263, 12264, 12265, 12266, and 12267 constitutes the refereed proceedings of the 23rd International Conference on Medical Image Computing and Computer-Assisted Intervention, MICCAI 2020, held in Lima, Peru, in October 2020. The conference was held virtually due to the COVID-19 pandemic. The 542 revised full papers presented were carefully reviewed and selected from 1809 submissions in a double-blind review process. The papers are organized in the following topical sections: Part I: machine learning methodologies Part II: image reconstruction; prediction and diagnosis; cross-domain methods and reconstruction; domain adaptation; machine learning applications; generative adversarial networks Part III: CAI applications; image registration; instrumentation and surgical phase detection; navigation and visualization; ultrasound imaging; video image analysis Part IV: segmentation; shape models and landmark detection Part V: biological, optical, microscopic imaging; cell segmentation and stain normalization; histopathology image analysis; opthalmology Part VI: angiography and vessel analysis; breast imaging; colonoscopy; dermatology; fetal imaging; heart and lung imaging; musculoskeletal imaging Part VI: brain development and atlases; DWI and tractography; functional brain networks; neuroimaging; positron emission tomography

The Image Processing Handbook Springer
Towards the end of the 1960s, a number of quite different circumstances combined to launch a period of intense activity in the digital processing of electron micro graphs. First, many years of work on correcting the resolution-limiting aberrations of electron microscope objectives had shown that these optical impediments to very high resolution could indeed be overcome, but only at the cost of immense exper imental difficulty; thanks largely to the theoretical work of K. -J. Hanszen and his colleagues and to the experimental work of F. Thon, the notions of transfer func tions were beginning to supplant or complement the concepts of geometrical optics in electron optical thinking; and finally, large fast computers, capable of manipu lating big image matrices in a reasonable time, were widely accessible. Thus the idea that recorded electron microscope images could be improved in some way or rendered more informative by subsequent computer processing gradually gained ground. At first, most effort was concentrated on three-dimensional reconstruction, particu larly of specimens with natural symmetry that could be exploited, and on linear operations on weakly scattering specimens (Chap. I). In 1973, however, R. W. Gerchberg and W. O. Saxton described an iterative algorithm that in principle yielded the phase and amplitude of the electron wave emerging from a strongly scattering speci men.

Microscope Image Processing John Wiley & Sons
In the last decade, since the publication of the first edition of Scanning Electron Microscopy and X-ray Microanalysis, there has been a great expansion in the capabilities of the basic SEM and EPMA. High resolution imaging has been developed with the aid of an extensive range of field emission gun (FEG) microscopes. The magnification ranges of these instruments now overlap those of the transmission electron microscope. Low-voltage microscopy using the FEG now allows for the observation of noncoated samples. In addition, advances in the develop ment of x-ray wavelength and energy dispersive spectrometers allow for the measurement of low-energy x-rays, particularly from the light elements (B, C, N, 0). In the area of x-ray microanalysis, great advances have been made, particularly with the "phi rho z" [Ij)(pz)] technique for solid samples, and with other quantitation methods for thin films, particles, rough surfaces, and the light elements. In addition, x-ray imaging has advanced from the conventional technique of "dot mapping" to the method of quantitative compositional imaging. Beyond this, new software has allowed the development of much more meaningful displays for both imaging and quantitative analysis results and the capability for integrating the data to obtain specific information such as precipitate size, chemical analysis in designated areas or along specific directions, and local chemical inhomogeneities.

Image Processing and Acquisition using Python Academic Press
Ever since television became practical in the early 1950s, closed-circuit television (CCTV) in conjunction with the light microscope has provided large screen display, raised image contrast, and made the images formed by ultraviolet and infrared rays visible. With the introduction of large-scale integrated circuits in the last decade, TV equipment has improved by leaps and bounds, as has its application in microscopy. With modem CCTV, sometimes with the help of digital computers, we can distill the image from a scene that appears to be nothing but noise; capture fluorescence too dim to be seen; visualize structures far below the limit of resolution; crispen images hidden in fog; measure, count, and sort objects; and record in time-lapsed and high-speed sequences through the light microscope without great difficulty. In fact, video is becoming indispensable for harnessing the fullest capacity of the light microscope, a capacity that itself is much greater than could have been envisioned just a few years ago. The time seemed ripe then to review the basics of video, and of microscopy, and to examine how the two could best be combined to accomplish these tasks. The Marine Biological Laboratory short courses on Analytical and Quantitative Light Microscopy in Biology, Medicine, and the Materials Sciences, and the many inquiries I received on video microscopy, supported such an effort, and Kirk Jensen of Plenum Press persuaded me of its worth.

Handbook of Biological Confocal Microscopy Springer Science & Business Media
This third edition of a classic text in biological microscopy includes detailed descriptions and in-depth comparisons of parts of the microscope itself, digital aspects of data acquisition and properties of fluorescent dyes, the techniques of 3D specimen preparation and the fundamental limitations, and practical complexities of quantitative confocal fluorescence imaging. Coverage includes practical multiphoton, photodamage and phototoxicity, 3D FRET, 3D microscopy correlated with micro-MNR, CARS, second and third harmonic signals, ion imaging in 3D, scanning RAMAN, plant specimens, practical 3D microscopy and correlated optical tomography.

Processing and Analysis Management Springer Science & Business Media
This volume of Advances Anatomy Embryology and Cell Biology focuses on the emerging field of bio-image informatics, presenting novel and exciting ways of handling and interpreting large image data sets. A collection of focused reviews written by key players in the field highlights the major directions and provides an excellent reference work for both young and experienced researchers.

The Essential Guide to Image Processing Springer Science & Business Media
Recent developments of deep learning-enabled image transformation and object detection in microscopic images has revolutionized traditional computational imaging techniques and outperformed many digital image processing algorithms in both speed and quality. This dissertation

introduces a set of novel deep learning techniques for cross-modality image super-resolution, virtual histological staining, and early bacterial colony using time-lapsed coherent microscopic images. This dissertation first introduces a deep learning-based method to correct distortions introduced by mobile-phone-based microscopes is introduced, which facilitates the production of high-resolution, denoised and color-corrected images, matching the performance of benchtop microscopes with high-end objective lenses, also extending their limited depth-of-field. Inspired mobile-phone microscope to benchtop microscope image transformation, a deep learning-enabled super-resolution framework across different fluorescence microscopy modalities is also demonstrated. Using this framework, the resolution of wide-field images acquired with low-numerical-aperture (NA) objectives were improved to match the resolution that is acquired using high-NA objectives. The framework was further applied to cross-modality super-resolution transformation of confocal microscopy images to match the resolution acquired with a stimulated emission depletion (STED) microscope, and transformation of total internal reflection fluorescence (TIRF) microscopy images of subcellular structures within cells and tissues to match the results obtained with a TIRF-based structured illumination microscope. The similar cross-modality image transformation framework can also transform autofluorescence images of unlabeled tissue sections into the equivalence of the bright-field images captured with histologically stained versions of the same samples. A blind comparison, by board-certified pathologists, of this virtual staining method and standard histological staining using microscopic images of human tissue sections of the salivary gland, thyroid, kidney, liver, and lung, and involving different types of stain, showed no major discordances. Other than image transformation, a deep learning-based live bacteria detection system was also developed which periodically captures coherent microscopy images of bacterial growth inside a 60-mm-diameter agar plate and analyses these time-lapsed holograms for the rapid detection of bacterial growth and the classification of the corresponding species. This system shortens the detection time of Escherichia coli and total coliform bacteria in water samples by >12 h compared to the Environmental Protection Agency (EPA)-approved methods, achieved a limit of detection (LOD) of ~1 colony forming unit (CFU)/L in 9 h of total test time. This platform is highly suitable for integration with the existing methods currently used for bacteria detection on agar plates.

The Image Processing Handbook, Fifth Edition CRC Press

This open access book provides a comprehensive overview of the application of the newest laser and microscope/ophthalmoscope technology in the field of high resolution imaging in microscopy and ophthalmology. Starting by describing High-Resolution 3D Light Microscopy with STED and RESOLFT, the book goes on to cover retinal and anterior segment imaging and image-guided treatment and also discusses the development of adaptive optics in vision science and ophthalmology. Using an interdisciplinary approach, the reader will learn about the latest developments and most up to date technology in the field and how these translate to a medical setting. High Resolution Imaging in Microscopy and Ophthalmology – New Frontiers in Biomedical Optics has been written by leading experts in the field and offers insights on engineering, biology, and medicine, thus being a valuable addition for scientists, engineers, and clinicians with technical and medical interest who would like to understand the equipment, the applications and the medical/biological background. Lastly, this book is dedicated to the memory of Dr. Gerhard Zinser, co-founder of Heidelberg Engineering GmbH, a scientist, a husband, a brother, a colleague, and a friend.

Whole Slide Imaging Academic Press

Digital image processing, an integral part of microscopy, is increasingly important to the fields of medicine and scientific research. This book provides a unique one-stop reference on the theory, technique, and applications of this technology. Written by leading experts in the field, this book presents a unique practical perspective of state-of-the-art microscope image processing and the development of specialized algorithms. It contains in-depth analysis of methods coupled with the results of specific real-world experiments. Microscope Image Processing covers image digitization and display, object measurement and classification, autofocusing, and structured illumination. Key Features: Detailed descriptions of many leading-edge methods and algorithms In-depth analysis of the method and experimental results, taken from real-life examples Emphasis on computational and algorithmic aspects of microscope image processing Advanced material on geometric, morphological, and wavelet image processing, fluorescence, three-dimensional and time-lapse microscopy, microscope image enhancement, MultiSpectral imaging, and image data management This book is of interest to all scientists, engineers, clinicians, post-graduate fellows, and graduate students working in the fields of biology, medicine, chemistry, pharmacology, and other related fields. Anyone who uses microscopes in their work and needs to understand the methodologies and capabilities of the latest digital image processing techniques will find this book invaluable. Presents a unique practical perspective of state-of-the-art microcope image processing and the development of specialized algorithms Each chapter includes in-depth analysis of methods coupled with the results of specific real-world experiments Co-edited by Kenneth R. Castleman, world-renowned pioneer in digital image processing and author of two seminal textbooks on the subject