Hyperspectral Image Processing And Analysis System Hipas

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Hyperspectral Data, Analysis Techniques, and Applications

In processing food, hyperspectral imaging, combined with intelligent software, enables digital sorters (or optical sorters) to identify and remove defects and foreign material that are invisible to traditional camera and laser sorters. Hyperspectral Imaging Analysis and Applications for Food Quality explores the theoretical and practical issues associated with the development, analysis, and application of essential image processing algorithms in order to exploit hyperspectral imaging for food quality evaluations. It outlines strategies and essential image processing routines that are necessary for making the appropriate decision during detection, classification, identification, quantification, and/or prediction processes. Features Covers practical issues associated with the development, analysis, and application of essential image processing for food quality applications Surveys the breadth of different image processing approaches

adopted over the years in attempting to implement hyperspectral imaging for food quality monitoring Explains the working principles of hyperspectral systems as well as the basic concept and structure of hyperspectral data Describes the different approaches used during image acquisition, data collection, and visualization The book is divided into three sections. Section I discusses the fundamentals of Imaging Systems: How can hyperspectral image cube acquisition be optimized? Also, two chapters deal with image segmentation, data extraction, and treatment. Seven chapters comprise Section II, which deals with Chemometrics. One explains the fundamentals of multivariate analysis and techniques while in six other chapters the reader will find information on and applications of a number of chemometric techniques: principal component analysis, partial least squares analysis, linear discriminant model, support vector machines, decision trees, and artificial neural networks. In the last section, Applications, numerous examples are given of applications of hyperspectral imaging systems in fish, meat, fruits, vegetables, medicinal herbs, dairy products, beverages, and food additives.

Remote Sensing

The book covers the most crucial parts of real-time hyperspectral image processing: causality and real-time capability. Recently, two new concepts of real time hyperspectral image processing, Progressive HyperSpectral Imaging (PHSI) and Recursive HyperSpectral Imaging (RHSI). Both of these can be used to design

algorithms and also form an integral part of real time hyperpsectral image processing. This book focuses on progressive nature in algorithms on their real-time and causal processing implementation in two major applications, endmember finding and anomaly detection, both of which are fundamental tasks in hyperspectral imaging but generally not encountered in multispectral imaging. This book is written to particularly address PHSI in real time processing, while a book, Recursive Hyperspectral Sample and Band Processing: Algorithm Architecture and Implementation (Springer 2016) can be considered as its companion book.

Hyperspectral Data Processing

Based on the integration of computer vision and spectrscopy techniques, hyperspectral imaging is a novel technology for obtaining both spatial and spectral information on a product. Used for nearly 20 years in the aerospace and military industries, more recently hyperspectral imaging has emerged and matured into one of the most powerful and rapidly growing methods of non-destructive food quality analysis and control. Hyperspectral Imaging for Food Quality Analysis and Control provides the core information about how this proven science can be practically applied for food quality assessment, including information on the equipment available and selection of the most appropriate of those instruments. Additionally, real-world food-industry-based examples are included, giving the reader important insights into the actual application of the science in evaluating

food products. Presentation of principles and instruments provides core understanding of how this science performs, as well as guideline on selecting the most appropriate equipment for implementation Includes real-world, practical application to demonstrate the viability and challenges of working with this technology Provides necessary information for making correct determination on use of hyperspectral imaging

Unsupervised Learning in Space and Time

This book includes some very recent applications and the newest emerging trends of hyper-spectral imaging (HSI). HSI is a very recent and strange beast, a sort of a melting pot of previous techniques and scientific interests, merging and concentrating the efforts of physicists, chemists, botanists, biologists, and physicians, to mention just a few, as well as experts in data crunching and statistical elaboration. For almost a century, scientific observation, from looking to planets and stars down to our own cells and below, could be divided into two main categories: analyzing objects on the basis of their physical dimension (recording size, position, weight, etc. and their variations) or on how the object emits, reflects, or absorbs part of the electromagnetic spectrum, i.e., spectroscopy. While the two aspects have been obviously entangled, instruments and skills have always been clearly distinct from each other. With HSI now available, this is no longer the case. This instrument can return specimen dimensionalities and spectroscopic properties

to any single pixel of your specimen, in a single set of data. HSI modality is ubiquitous and scale-invariant enough to be used to mark terrestrial resources on the basis of a land map obtained from satellite observation (actually, the oldest application of this type) or to understand if the cell you are looking at is cancerous or perfectly healthy. For all these reasons, HSI represents one of the most exciting methodologies of the new millennium.

Advanced Image Processing Techniques for Remotely Sensed Hyperspectral Data

Hyperspectral imaging or imaging spectroscopy is a novel technology for acquiring and analysing an image of a real scene by computers and other devices in order to obtain quantitative information for quality evaluation and process control. Image processing and analysis is the core technique in computer vision. With the continuous development in hardware and software for image processing and analysis, the application of hyperspectral imaging has been extended to the safety and quality evaluation of meat and produce. Especially in recent years, hyperspectral imaging has attracted much research and development attention, as a result rapid scientific and technological advances have increasingly taken place in food and agriculture, especially on safety and quality inspection, classification and evaluation of a wide range of food products, illustrating the great advantages

of using the technology for objective, rapid, non-destructive and automated safety inspection as well as quality control. Therefore, as the first reference book in the area, Hyperspectral Imaging Technology in Food and Agriculture focuses on these recent advances. The book is divided into three parts, which begins with an outline of the fundamentals of the technology, followed by full covering of the application in the most researched areas of meats, fruits, vegetables, grains and other foods, which mostly covers food safety and quality as well as remote sensing applicable for crop production. Hyperspectral Imaging Technology in Food and Agriculture is written by international peers who have both academic and professional credentials, with each chapter addressing in detail one aspect of the relevant technology, thus highlighting the truly international nature of the work. Therefore the book should provide the engineer and technologist working in research, development, and operations in the food and agricultural industry with critical, comprehensive and readily accessible information on the art and science of hyperspectral imaging technology. It should also serve as an essential reference source to undergraduate and postgraduate students and researchers in universities and research institutions.

Hyperspectral Imaging

Authored by a panel of experts in the field, this book focuses on hyperspectral image analysis, systems, and applications. With discussion of application-based

projects and case studies, this professional reference will bring you up-to-date on this pervasive technology, wether you are working in the military and defense fields, or in remote sensing technology, geoscience, or agriculture.

Signal and Image Processing for Remote Sensing

This book comprises a collection of papers by international experts, presented at the International Conference on NextGen Electronic Technologies (ICNETS2-2017). ICNETS2 encompassed six symposia covering all aspects of electronics and communications engineering domains, including relevant nano/micro materials and devices. Featuring the latest research on computational signal processing and analysis, the book is useful to researchers, professionals, and students working in the core areas of electronics and their applications, especially signal processing, embedded systems, and networking.

Hyperspectral Imaging Technology in Food and Agriculture

This book addresses one of the most important unsolved problems in artificial intelligence: the task of learning, in an unsupervised manner, from massive quantities of spatiotemporal visual data that are available at low cost. The book covers important scientific discoveries and findings, with a focus on the latest

advances in the field. Presenting a coherent structure, the book logically connects novel mathematical formulations and efficient computational solutions for a range of unsupervised learning tasks, including visual feature matching, learning and classification, object discovery, and semantic segmentation in video. The final part of the book proposes a general strategy for visual learning over several generations of student-teacher neural networks, along with a unique view on the future of unsupervised learning in real-world contexts. Offering a fresh approach to this difficult problem, several efficient, state-of-the-art unsupervised learning algorithms are reviewed in detail, complete with an analysis of their performance on various tasks, datasets, and experimental setups. By highlighting the interconnections between these methods, many seemingly diverse problems are elegantly brought together in a unified way. Serving as an invaluable guide to the computational tools and algorithms required to tackle the exciting challenges in the field, this book is a must-read for graduate students seeking a greater understanding of unsupervised learning, as well as researchers in computer vision, machine learning, robotics, and related disciplines.

Hyperspectral Imaging for Food Quality Analysis and Control

Earth observation is the field of science concerned with the problem of monitoring and modeling the processes on the Earth surface and their interaction with the atmosphere. The Earth is continuously monitored with advanced optical and radar

sensors. The images are analyzed and processed to deliver useful products to individual users, agencies and public administrations. To deal with these problems, remote sensing image processing is nowadays a mature research area, and the techniques developed in the field allow many real-life applications with great societal value. For instance, urban monitoring, fire detection or flood prediction can have a great impact on economical and environmental issues. To attain such objectives, the remote sensing community has turned into a multidisciplinary field of science that embraces physics, signal theory, computer science, electronics and communications. From a machine learning and signal/image processing point of view, all the applications are tackled under specific formalisms, such as classification and clustering, regression and function approximation, data coding, restoration and enhancement, source unmixing, data fusion or feature selection and extraction. This book covers some of the fields in a comprehensive way. Table of Contents: Remote Sensing from Earth Observation Satellites / The Statistics of Remote Sensing Images / Remote Sensing Feature Selection and Extraction / {Classification / Spectral Mixture Analysis / Estimation of Physical Parameters

Hyperspectral Satellites and System Design

The main objective of this book is to provide a common platform for diverse concepts in satellite image processing. In particular it presents the state-of-the-art in Artificial Intelligence (AI) methodologies and shares findings that can be

translated into real-time applications to benefit humankind. Interdisciplinary in its scope, the book will be of interest to both newcomers and experienced scientists working in the fields of satellite image processing, geo-engineering, remote sensing and Artificial Intelligence. It can be also used as a supplementary textbook for graduate students in various engineering branches related to image processing.

Artificial Intelligence Techniques for Satellite Image Analysis

This book is about the novel aspects and future trends of the hyperspectral imaging in agriculture, food, and environment. The topics covered by this book are hyperspectral imaging and their applications in the nondestructive quality assessment of fruits and vegetables, hyperspectral imaging for assessing quality and safety of meat, multimode hyperspectral imaging for food quality and safety, models fitting to pattern recognition in hyperspectral images, sequential classification of hyperspectral images, graph construction for hyperspectral data unmixing, target visualization method to process hyperspectral image, and soil contamination mapping with hyperspectral imagery. This book is a general reference work for students, professional engineers, and readers with interest in the subject.

Hyperspectral Remote Sensing

Hyperspectral Data Processing: Algorithm Design andAnalysis is a culmination of the research conducted in theRemote Sensing Signal and Image Processing Laboratory (RSSIPL) atthe University of Maryland, Baltimore County. Specifically, ittreats hyperspectral image processing and hyperspectral signalprocessing as separate subjects in two different categories. Mostmaterials covered in this book can be used in conjunction with theauthor's first book, Hyperspectral Imaging: Techniques forSpectral Detection and Classification, without muchoverlap. Many results in this book are either new or have not beenexplored, presented, or published in the public domain. Theseinclude various aspects of endmember extraction, unsupervisedlinear spectral mixture analysis, hyperspectral informationcompression, hyperspectral signal coding and characterization, aswell as applications to conceal target detection, multispectralimaging, and magnetic resonance imaging. Hyperspectral DataProcessing contains eight major sections: Part I: provides fundamentals of hyperspectral dataprocessing Part II: offers various algorithm designs for endmemberextraction Part III: derives theory for supervised linear spectral mixtureanalysis Part IV: designs unsupervised methods for hyperspectral imageanalysis Part V: explores new concepts on hyperspectral informationcompression Parts VI & VII: develops techniques for hyperspectralsignal coding and characterization Part VIII: presents applications in multispectral imaging andmagnetic resonance imaging Hyperspectral Data Processing compiles an algorithmcompendium with MATLAB codes in an appendix to help readersimplement many important algorithms developed in this book andwrite

their own program codes without relying on softwarepackages. Hyperspectral Data Processing is a valuable reference forthose who have been involved with hyperspectral imaging and itstechniques, as well those who are new to the subject.

Imaging Spectroscopy for Scene Analysis

This book presents a detailed analysis of spectral imaging, describing how it can be used for the purposes of material identification, object recognition and scene understanding. The opportunities and challenges of combining spatial and spectral information are explored in depth, as are a wide range of applications. Features: discusses spectral image acquisition by hyperspectral cameras, and the process of spectral image formation; examines models of surface reflectance, the recovery of photometric invariants, and the estimation of the illuminant power spectrum from spectral imagery; describes spectrum representations for the interpolation of reflectance and radiance values, and the classification of spectra; reviews the use of imaging spectroscopy for material identification; explores the recovery of reflection geometry from image reflectance; investigates spectro-polarimetric imagery, and the recovery of object shape and material properties using polarimetric images captured from a single view.

Remote Compositional Analysis

Unsupervised Process Monitoring and Fault Diagnosis with Machine Learning Methods

Techniques and Applications of Hyperspectral Image Analysis gives an introduction to the field of image analysis using hyperspectral techniques, and includes definitions and instrument descriptions. Other imaging topics that are covered are segmentation, regression and classification. The book discusses how high quality images of large data files can be structured and archived. Imaging techniques also demand accurate calibration, and are covered in sections about multivariate calibration techniques. The book explains the most important instruments for hyperspectral imaging in more technical detail. A number of applications from medical and chemical imaging are presented and there is an emphasis on data analysis including modeling, data visualization, model testing and statistical interpretation.

Remote Sensing Image Analysis: Including the Spatial Domain

Based on the integration of computer vision and spectrscopy techniques, hyperspectral imaging is a novel technology for obtaining both spatial and spectral information on a product. Used for nearly 20 years in the aerospace and military

industries, more recently hyperspectral imaging has emerged and matured into one of the most powerful and rapidly growing methods of non-destructive food quality analysis and control. Hyperspectral Imaging for Food Quality Analysis and Control provides the core information about how this proven science can be practically applied for food quality assessment, including information on the equipment available and selection of the most appropriate of those instruments. Additionally, real-world food-industry-based examples are included, giving the reader important insights into the actual application of the science in evaluating food products. Presentation of principles and instruments provides core understanding of how this science performs, as well as guideline on selecting the most appropriate equipment for implementation Includes real-world, practical application to demonstrate the viability and challenges of working with this technology Provides necessary information for making correct determination on use of hyperspectral imaging

Real-Time Progressive Hyperspectral Image Processing

This unique text/reference describes in detail the latest advances in unsupervised process monitoring and fault diagnosis with machine learning methods. Abundant case studies throughout the text demonstrate the efficacy of each method in real-world settings. The broad coverage examines such cutting-edge topics as the use of information theory to enhance unsupervised learning in tree-based methods, the

extension of kernel methods to multiple kernel learning for feature extraction from data, and the incremental training of multilayer perceptrons to construct deep architectures for enhanced data projections. Topics and features: discusses machine learning frameworks based on artificial neural networks, statistical learning theory and kernel-based methods, and tree-based methods; examines the application of machine learning to steady state and dynamic operations, with a focus on unsupervised learning; describes the use of spectral methods in process fault diagnosis.

Hyperspectral Imaging Remote Sensing

Comprehensive overview of the spectroscopic, mineralogical, and geochemical techniques used in planetary remote sensing.

Hyperspectral Imaging

Domesticated crops are the result of artificial selection for particular phenotypes or, in some cases, natural selection for an adaptive trait. Plant traits can be identified through image-based plant phenotyping, a process that was, until recently, strenous and time-consuming. Intelligent Image Analysis for Plant Phenotyping reviews information on time-saving techniques, using computer vision

and imaging technologies. These methodologies provide an automated, non-invasive, and scalable mechanism by which to define and collect plant phenotypes. Beautifully illustrated, with numerous color images, the book focuses on phenotypes measured from individual plants under controlled experimental conditions, which are widely available in high-throughput systems. Features: Presents methodologies for image processing, including data-driven and machine learning techniques for plant phenotyping. Features information on advanced techniques for extracting phenotypes through images and image sequences captured in a variety of modalities. Includes real-world scientific problems, including predicting yield by modeling interactions between plant data and environmental information. Discusses the challenge of translating images into biologically informative quantitative phenotypes. A practical resource for students, researchers, and practitioners, this book is invaluable for those working in the emerging fields at the intersection of computer vision and plant sciences.

Mathematical Models for Remote Sensing Image Processing

Based on the authors' research, this book introduces the main processing techniques in hyperspectral imaging. In this context, SVM-based classification, distance comparison-based endmember extraction, SVM-based spectral unmixing, spatial attraction model-based sub-pixel mapping and MAP/POCS-based super-resolution reconstruction are discussed in depth. Readers will gain a

comprehensive understanding of these cutting-edge hyperspectral imaging techniques. Researchers and graduate students in fields such as remote sensing, surveying and mapping, geosciences and information systems will benefit from this valuable resource.

Hyperspectral Imaging in Agriculture, Food and Environment

This book presents new methods of analyzing and processing hyperspectral medical images, which can be used in diagnostics, for example for dermatological images. The algorithms proposed are fully automatic and the results obtained are fully reproducible. Their operation was tested on a set of several thousands of hyperspectral images and they were implemented in Matlab. The presented source code can be used without licensing restrictions. This is a valuable resource for computer scientists, bioengineers, doctoral students, and dermatologists interested in contemporary analysis methods.

Hyperspectral Remote Sensing

This book reviews the state of the art in algorithmic approaches addressing the practical challenges that arise with hyperspectral image analysis tasks, with a focus on emerging trends in machine learning and image

processing/understanding. It presents advances in deep learning, multiple instance learning, sparse representation based learning, low-dimensional manifold models, anomalous change detection, target recognition, sensor fusion and super-resolution for robust multispectral and hyperspectral image understanding. It presents research from leading international experts who have made foundational contributions in these areas. The book covers a diverse array of applications of multispectral/hyperspectral imagery in the context of these algorithms, including remote sensing, face recognition and biomedicine. This book would be particularly beneficial to graduate students and researchers who are taking advanced courses in (or are working in) the areas of image analysis, machine learning and remote sensing with multi-channel optical imagery. Researchers and professionals in academia and industry working in areas such as electrical engineering, civil and environmental engineering, geosciences and biomedical image processing, who work with multi-channel optical data will find this book useful.

Hyperspectral Imaging for Food Quality Analysis and Control

This book is a completely updated, greatly expanded version of the previously successful volume by the author. The Second Edition includes new results and data, and discusses a unified framework and rationale for designing and evaluating image processing algorithms. Written from the viewpoint that image processing supports remote sensing science, this book describes physical models for remote

sensing phenomenology and sensors and how they contribute to models for remote-sensing data. The text then presents image processing techniques and interprets them in terms of these models. Spectral, spatial, and geometric models are used to introduce advanced image processing techniques such as hyperspectral image analysis, fusion of multisensor images, and digital elevationmodel extraction from stereo imagery. The material is suited for graduate level engineering, physical and natural science courses, or practicing remote sensing scientists. Each chapter is enhanced by student exercises designed to stimulate an understanding of the material. Over 300 figuresare produced specifically for this book, and numerous tables provide a rich bibliography of the research literature.

Multivariate Image Analysis

Hyperspectral Imaging, Volume 32, presents a comprehensive exploration of the different analytical methodologies applied on hyperspectral imaging and a state-of-the-art analysis of applications in different scientific and industrial areas. This book presents, for the first time, a comprehensive collection of the main multivariate algorithms used for hyperspectral image analysis in different fields of application. The benefits, drawbacks and suitability of each are fully discussed, along with examples of their application. Users will find state-of-the art information on the machinery for hyperspectral image acquisition, along with a critical assessment of

the usage of hyperspectral imaging in diverse scientific fields. Provides a comprehensive roadmap of hyperspectral image analysis, with benefits and considerations for each method discussed Covers state-of-the-art applications in different scientific fields Discusses the implementation of hyperspectral devices in different environments

The Future of Hyperspectral Imaging

A practical and self-contained guide to the principles, techniques, models and tools of imaging spectroscopy. Bringing together material from essential physics and digital signal processing, it covers key topics such as sensor design and calibration, atmospheric inversion and model techniques, and processing and exploitation algorithms. Readers will learn how to apply the main algorithms to practical problems, how to choose the best algorithm for a particular application, and how to process and interpret hyperspectral imaging data. A wealth of additional materials accompany the book online, including example projects and data for students, and problem solutions and viewgraphs for instructors. This is an essential text for senior undergraduate and graduate students looking to learn the fundamentals of imaging spectroscopy, and an invaluable reference for scientists and engineers working in the field.

Techniques and Applications of Hyperspectral Image Analysis

Hyperspectral Imaging, Volume 32, presents a comprehensive exploration of the different analytical methodologies applied on hyperspectral imaging and a state-of-the-art analysis of applications in different scientific and industrial areas. This book presents, for the first time, a comprehensive collection of the main multivariate algorithms used for hyperspectral image analysis in different fields of application. The benefits, drawbacks and suitability of each are fully discussed, along with examples of their application. Users will find state-of-the art information on the machinery for hyperspectral image acquisition, along with a critical assessment of the usage of hyperspectral imaging in diverse scientific fields. Provides a comprehensive roadmap of hyperspectral image analysis, with benefits and considerations for each method discussed Covers state-of-the-art applications in different scientific fields Discusses the implementation of hyperspectral devices in different environments

Chemical Imaging Analysis

Hyperspectral Satellites and System Design is the first book on this subject. It provides a systematic analysis and detailed design of the entire development process of hyperspectral satellites. Derived from the author's 25-year firsthand

experience as a technical lead of space missions at the Canadian Space Agency, the book offers engineers, scientists, and decision-makers detailed knowledge and guidelines on hyperspectral satellite system design, trade-offs, performance modeling and simulation, optimization from component to system level, subsystem design, and implementation strategies. This information will help reduce the risk, shorten the development period, and lower the cost of hyperspectral satellite missions. This book is a must-have reference for professionals in developing hyperspectral satellites and data applications. It is also an excellent introductory book for early practitioners and students who want to learn more about hyperspectral satellites and their applications.

Hyperspectral Imaging Analysis and Applications for Food Quality

Optical imaging is a rapidly emerging imaging technique that has been successfjully translated into biomedical applications ranging from clinical diagnosis to molecular biology. This book includes an introductory section to explore various optical imaging devices and their functionality and roles for biomedical applications such as dermatology and ophthalmology. Recent developments as exemplified with the authors research are explored in detail. In depth discussion of other disease conditions and their diagnosis with optical imaging techniques are also

covered.

Computational Signal Processing and Analysis

Most data from satellites are in image form, thus most books in the remote sensing field deal exclusively with image processing. However, signal processing can contribute significantly in extracting information from the remotely sensed waveforms or time series data. Pioneering the combination of the two processes, Signal and Image Processing for Remote Sensing provides a balance between the role of signal processing and image processing in remote sensing. Featuring contributions from worldwide experts, this book emphasizes mathematical approaches. Divided into two parts, Part I examines signal processing for remote sensing and Part II explores image processing. Not limited to the problems with data from satellite sensors, the book considers other sensors which acquire data remotely, including signals and images from infrasound, seismic, microwave, and satellite sensors. It covers a broader scope of issues in remote sensing information processing than other books in this area. With rapid technological advances, the mathematical techniques provided will far outlast the sensor, software and hardware technologies. Focusing on methodologies of signal processing and image processing in remote sensing, this book discusses unique techniques for dealing with remote sensing problems.

Hyperspectral Image Analysis

This book maximizes reader insights into the field of mathematical models and methods for the processing of two-dimensional remote sensing images. It presents a broad analysis of the field, encompassing passive and active sensors, hyperspectral images, synthetic aperture radar (SAR), interferometric SAR, and polarimetric SAR data. At the same time, it addresses highly topical subjects involving remote sensing data types (e.g., very high-resolution images, multiangular or multiresolution data, and satellite image time series) and analysis methodologies (e.g., probabilistic graphical models, hierarchical image representations, kernel machines, data fusion, and compressive sensing) that currently have primary importance in the field of mathematical modelling for remote sensing and image processing. Each chapter focuses on a particular type of remote sensing data and/or on a specific methodological area, presenting both a thorough analysis of the previous literature and a methodological and experimental discussion of at least two advanced mathematical methods for information extraction from remote sensing data. This organization ensures that both tutorial information and advanced subjects are covered. With each chapter being written by research scientists from (at least) two different institutions, it offers multiple professional experiences and perspectives on each subject. The book also provides expert analysis and commentary from leading remote sensing and image processing researchers, many of whom serve on the editorial boards of

prestigious international journals in these fields, and are actively involved in international scientific societies. Providing the reader with a comprehensive picture of the overall advances and the current cutting-edge developments in the field of mathematical models for remote sensing image analysis, this book is ideal as both a reference resource and a textbook for graduate and doctoral students as well as for remote sensing scientists and practitioners.

Hyperspectral Data Exploitation

The quantity of visual information encountered experimentally by scientists across a wide range of fields has grown dramatically in recent years. As a result, the importance of dealing with multivariate data (data obtained by measuring a number of different quantities simultaneously) present in images has become much more important, and the requirement for techniques which are able to manage and analyse these data has become crucial for the practising scientist in many diverse disciplines. Multivariate Image Analysis gives the reader a sound understanding of the importance of, and the principles behind, multivariate image analysis. A short introduction to the image and its perception is followed by a discussion of some popular techniques of multivariate image formation, taken from fields such as microscopy, remote sensing and medical imaging. The principles behind one of the key multivariate techniques, principal components analysis, are thoroughly explained without going too far into the theory: The important concepts

of residual visualization and local modelling are explained. Throughout, the power of the techniques discussed is demonstrated with the use of simple worked examples to illustrate the concepts, and more complex examples to indicate to the reader how a complete analysis would be carried out. The book is richly illustrated with colour images. Multivariate Image Analysis is of great interest to all those involved in the analysis of data contained in complex images. The techniques discussed are widely applicable, and are finding use in fields such as microscopy, satellite remote sensing, medical imaging, radiology, analytical chemistry, spectroscopy and astronomy.

Hybrid Intelligence for Image Analysis and Understanding

Chemical Imaging Analysis covers the advancements made over the last 50 years in chemical imaging analysis, including different analytical techniques and the ways they were developed and refined to link the composition and structure of manmade and natural materials at the nano/micro scale to the functional behavior at the macroscopic scale. In a development process that started in the early 1960s, a variety of specialized analytical techniques was developed – or adapted from existing techniques – and these techniques have matured into versatile and powerful tools for visualizing structural and compositional heterogeneity. This text explores that journey, providing a general overview of imaging techniques in diverse fields, including mass spectrometry, optical spectrometry including X-rays,

electron microscopy, and beam techniques. Provides comprehensive coverage of analytical techniques used in chemical imaging analysis Explores a variety of specialized techniques Provides a general overview of imaging techniques in diverse fields

Hyperspectral Imaging

A synergy of techniques on hybrid intelligence for real-life image analysis Hybrid Intelligence for Image Analysis and Understanding brings together research on the latest results and progress in the development of hybrid intelligent techniques for faithful image analysis and understanding. As such, the focus is on the methods of computational intelligence, with an emphasis on hybrid intelligent methods applied to image analysis and understanding. The book offers a diverse range of hybrid intelligence techniques under the umbrellas of image thresholding, image segmentation, image analysis and video analysis. Key features: Provides in-depth analysis of hybrid intelligent paradigms. Divided into self-contained chapters. Provides ample case studies, illustrations and photographs of real-life examples to illustrate findings and applications of different hybrid intelligent paradigms. Offers new solutions to recent problems in computer science, specifically in the application of hybrid intelligent techniques for image analysis and understanding, using well-known contemporary algorithms. The book is essential reading for lecturers, researchers and graduate students in electrical engineering and

computer science.

Hyperspectral Image Processing

Advanced imaging spectral technology and hyperspectral analysis techniques for multiple applications are the key features of the book. This book will present in one volume complete solutions from concepts, fundamentals, and methods of acquisition of hyperspectral data to analyses and applications of the data in a very coherent manner. It will help readers to fully understand basic theories of HRS, how to utilize various field spectrometers and bioinstruments, the importance of radiometric correction and atmospheric correction, the use of analysis, tools and software, and determine what to do with HRS technology and data.

Hyperspectral Remote Sensing

Hyperspectral Imaging: Techniques for Spectral Detection and Classification is an outgrowth of the research conducted over the years in the Remote Sensing Signal and Image Processing Laboratory (RSSIPL) at the University of Maryland, Baltimore County. It explores applications of statistical signal processing to hyperspectral imaging and further develops non-literal (spectral) techniques for subpixel detection and mixed pixel classification. This text is the first of its kind on the topic

and can be considered a recipe book offering various techniques for hyperspectral data exploitation. In particular, some known techniques, such as OSP (Orthogonal Subspace Projection) and CEM (Constrained Energy Minimization) that were previously developed in the RSSIPL, are discussed in great detail. This book is self-contained and can serve as a valuable and useful reference for researchers in academia and practitioners in government and industry.

Intelligent Image Analysis for Plant Phenotyping

The first of its kind, this book reviews image processing tools and techniques including Independent Component Analysis, Mutual Information, Markov Random Field Models and Support Vector Machines. The book also explores a number of experimental examples based on a variety of remote sensors. The book will be useful to people involved in hyperspectral imaging research, as well as by remote-sensing data like geologists, hydrologists, environmental scientists, civil engineers and computer scientists.

Optical Imaging for Biomedical and Clinical Applications

Hyperspectral remote sensing is an emerging, multidisciplinary field with diverse applications that builds on the principles of material spectroscopy, radiative

transfer, imaging spectrometry, and hyperspectral data processing. While there are many resources that suitably cover these areas individually and focus on specific aspects of the hyperspectral remote sensing field, this book provides a holistic treatment that thoroughly captures its multidisciplinary nature. The content is oriented toward the physical principles of hyperspectral remote sensing as opposed to applications of hyperspectral technology. Readers can expect to finish the book armed with the required knowledge to understand the immense literature available in this technology area and apply their knowledge to the understanding of material spectral properties, the design of hyperspectral systems, the analysis of hyperspectral imagery, and the application of the technology to specific problems.

Remote Sensing Image Processing

Remote Sensing image analysis is mostly done using only spectral information on a pixel by pixel basis. Information captured in neighbouring cells, or information about patterns surrounding the pixel of interest often provides useful supplementary information. This book presents a wide range of innovative and advanced image processing methods for including spatial information, captured by neighbouring pixels in remotely sensed images, to improve image interpretation or image classification. Presented methods include different types of variogram analysis, various methods for texture quantification, smart kernel operators, pattern recognition techniques, image segmentation methods, sub-pixel methods,

wavelets and advanced spectral mixture analysis techniques. Apart from explaining the working methods in detail a wide range of applications is presented covering land cover and land use mapping, environmental applications such as heavy metal pollution, urban mapping and geological applications to detect hydrocarbon seeps. The book is meant for professionals, PhD students and graduates who use remote sensing image analysis, image interpretation and image classification in their work related to disciplines such as geography, geology, botany, ecology, forestry, cartography, soil science, engineering and urban and regional planning.

Hyperspectral Remote Sensing

Land management issues, such as mapping tree species, recognizing invasive plants, and identifying key geologic features, require an understanding of complex technical issues before the best decisions can be made. Hyperspectral remote sensing is one the technologies that can help with reliable detection and identification. Presenting the fundamentals of remote sensing at an introductory level, Hyperspectral Remote Sensing: Principles and Applications explores all major aspects of hyperspectral image acquisition, exploitation, interpretation, and applications. The book begins with several chapters on the basic concepts and underlying principles of remote sensing images. It introduces spectral radiometry concepts, such as radiance, irradiance, flux, and blackbody radiation; covers

imaging spectrometers, examining spectral range, full width half maximum (FWHM), resolution, sampling, signal-to-noise ratio (SNR), and multispectral and hyperspectral sensor systems; and addresses atmospheric interactions. The book then discusses information extraction, with chapters covering the underlying physics principles that lead to the creation of an image and the interpretation of the image's information. The final chapters describe case studies that illustrate the use of hyperspectral remote sensing in agriculture, environmental monitoring, forestry, and geology. After reading this book, you will have a better understanding of how to evaluate different approaches to hyperspectral analyses and to determine which approaches will work for your applications.

Processing of Hyperspectral Medical Images

Hyperspectral Remote Sensing: Theory and Applications offers the latest information on the techniques, advances and wide-ranging applications of hyperspectral remote sensing, such as forestry, agriculture, water resources, soil and geology, among others. The book also presents hyperspectral data integration with other sources, such as LiDAR, Multi-spectral data, and other remote sensing techniques. Researchers who use this resource will be able to understand and implement the technology and data in their respective fields. As such, it is a valuable reference for researchers and data analysts in remote sensing and Earth Observation fields and those in ecology, agriculture, hydrology and geology.

Includes the theory of hyperspectral remote sensing, along with techniques and applications across a variety of disciplines Presents the processing, methods and techniques utilized for hyperspectral remote sensing and in-situ data collection Provides an overview of the state-of-the-art, including algorithms, techniques and case studies

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