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Signal Processing for Remote Sensing Computer Processing of Remotely-Sensed Images Computer Processing of Remotely-Sensed Images **Computer Processing of Remotely-Sensed Images** *Image Processing for Remote Sensing* **Remote Sensing** *Signal and Image Processing for Remote Sensing* **Big Data Analytics for Satellite Image Processing and Remote Sensing Signal and Image Processing for Remote Sensing, Second Edition Information Processing for Remote Sensing** Machine Vision and Advanced Image Processing in Remote Sensing Introductory Digital Image Processing *Signal and Image Processing for Remote Sensing On-Board Processing for Satellite Remote Sensing Images* **Image Processing and GIS for Remote Sensing** *Math Physics Foundation of Advanced Remote Sensing Digital Image Processing* Recent Advances in Remote Sensing and Geoinformation Processing for Land Degradation Assessment *Remote Sensing Image Processing* **Frontiers of Remote Sensing Information Processing Mathematical Models for Remote Sensing Image Processing** *Introductory Digital Image Processing* **Remote Sensing Time Series Image Processing** *Digital Image Processing of Remotely Sensed Data* **Thermal Remote Sensing in Land Surface Processing** Remote Sensing and Digital Image Processing with R **Essential Image Processing and GIS for Remote Sensing Satellite Remote Sensing Remote Sensing Time Series Image Processing** *Digital Image Processing for Remote Sensing* **Techniques for Image Processing and Classifications in Remote Sensing** Frontiers of Remote Sensing Information Processing *Thermal Remote Sensing in Land Surface Processing* **Remote Sensing and Digital Image Processing with R - Lab Manual An Elevating Turntable for Remote Maintenance in the Processing-Refabrication Experiment** Theory and Applications of Optical Remote Sensing **Remote Sensing Image Processing Radar Remote Sensing of Urban Areas** *Remote Sensing Digital Image Analysis* **Processing of Remote Sensing Data** *Introductory Digital Image Processing*

Although remote sensing is recognized as a powerful tool, less attention has been given in the past to the use of thermal, and especially thermal infrared (TIR) remote sensing. TIR data is useful for understanding the fluxes and redistribution of materials as a key aspect of land surface processes and land-atmosphere inter-relationships. This book On-board image processing systems are used to maximize image data transmission efficiency for large volumes of data gathered by Earth observation satellites. This book explains the methods, mathematical models, and key technologies used for these systems. It introduces the background, basic concepts, and the architecture of on-board image processing, along with on-board detection of the image feature and matching, ground control point identification, on-board geometric correction, calibration, geographic registration, etc. • Describes algorithms and methodologies for on-board image processing with FPGA chips. • Migrates the traditional on-ground computing to on-board operation and the image processing is implemented on-board, not on-ground. • Introduces for the first time many key technologies and methods for on-board image processing. • Emphasizes the recent progress in image processing by using on-board FPGA chips. • Includes case studies from the author’s extensive research and experience on the topic. This book gives insights into emerging technologies for on-board processing and will benefit senior undergraduate and graduate students of remote sensing, information technology, computer science and engineering, electronic engineering, and geography, as well as researchers and professionals interested in satellite remote sensing image processing in academia, and governmental and commercial sectors. Written by leaders in the field of remote sensing information processing, this book covers the frontiers of remote sensors, especially with effective algorithms for signal/image processing and pattern recognition with remote sensing data. Sensor and data fusion issues, SAR images, hyperspectral images, and related special topics are also examined. Techniques making use of neural networks, wavelet transforms, and knowledge-based systems are emphasized. A special set of three chapters is devoted to seismic analysis and discrimination. In summary, the book provides an authoritative treatment of major topics in remote sensing information processing and defines new frontiers for these areas. Contents:Data MiningSAR Image ProcessingWavelet Analysis and ApplicationsMilitary Applications of Remote SensingMicrowave Remote SensingStatistical Pattern RecognitionAutomatic Target SegmentationNeural NetworksChange DetectionSeismic Signal ProcessingTime Series PredictionImage CompressionEmerging Topics Readership: Engineers and scientists dealing with remote sensing data in particular, and signals and images in general; computer scientists involved in software development on geophysical data analysis. Keywords:Remote Sensing Sensors;SAR (Synthentic Aperture Radar) Image Processing;Wavelet Analysis;Image Classification;Data Mining;Seismic Signal Processing;Neural Networks;Change Detection Land degradation and desertification are amongst the most severe threats to human welfare and the environment, as they affect the livelihoods of some 2 billion people in the worlds drylands, and they are directly connected to pressing global environmental problems, such as the loss of biological diversity or global climate change. Strategies to co Today, remote sensing technology is an essential tool for understanding the Earth and managing human-Earth interactions. There is a rapidly growing need for remote sensing and Earth observation technology that enables monitoring of world’s natural resources and environments, managing exposure to natural and man-made risks and more frequently occurring disasters, and helping the sustainability and productivity of natural and human ecosystems. The improvement in temporal resolution/revisit allows for the large accumulation of images for a specific location, creating a possibility for time series image analysis and eventual real-time assessments of scene dynamics. As an authoritative text, Remote Sensing Time Series Image Processing brings together active and recognized authors in the field of time series image analysis and presents to the readers the current state of knowledge and its future directions. Divided into three parts, the first addresses methods and techniques for generating time series image datasets. In particular, it provides guidance on the selection of cloud and cloud shadow detection algorithms for various applications. Part II examines feature development and information extraction methods for time series imagery. It presents some key remote sensing-based metrics, and their major applications in ecosystems and climate change studies. Part III illustrates various applications of time series image processing in land cover change, disturbance attribution, vegetation dynamics, and urbanization. This book is intended for researchers, practitioners, and students in both remote sensing and imaging science. It can be used as a textbook by undergraduate and graduate students majoring in remote sensing, imaging science, civil and electrical engineering, geography, geosciences, planning, environmental science, land use, energy, and GIS, and as a reference book by practitioners and professionals in the government, commercial, and industrial sectors. This book provides a state-of-the art overview of satellite archaeology and it is an invaluable volume for archaeologists, scientists, and managers interested in using satellite Earth Observation (EO) to improve the traditional approach for archaeological investigation, protection and management of Cultural Heritage. The recent increasing development of EO techniques and the tremendous advances in Information and Communication Technologies (ICT) have resulted primarily in Cultural Heritage applications. The book focuses on new challenging prospects for the use of EO in archaeology not only for probing the subsurface to unveil sites and artifacts, but also for the management and valorization as well as for the monitoring and preservation of cultural resources. The book provides a first-class understanding of this revolutionary scenario which was unthinkable several years ago. The book offers: (i) an excellent collection of outstanding articles focusing on satellite data processing, analysis and interpretation for archaeological applications, (ii) impressive case studies, (iii) striking examples of the high potential of the integration of multi-temporal, multi-scale, multi-sensors techniques. Each chapter is composed as an authoritative contribution to help the reader grasp the value of its content. The authors are renowned experts from the international scientific community. Audience: This book will be of interest to scientists in remote sensing applied to archeology, geoarcheology, paleo-environment, paleo-climate and cultural heritage. This book focuses on the mathematical and physical foundations of

remote sensing digital image processing and introduces key algorithms utilized in this area. The book fully introduces the basic mathematical and physical process of digital imaging, the basic theory and algorithm of pixel image processing, and the higher-order image processing algorithm and its application. This book skillfully and closely integrates theory, algorithms, and applications, making it simple for readers to understand and use. Researchers and students working in the fields of remote sensing, computer vision, geographic information science, electronic information, etc., can profit from this book. For their work and research in digital image processing, they can master the fundamentals of imaging and image processing techniques. Computer Processing of Remotely-Sensed Images A thorough introduction to computer processing of remotely-sensed images, processing methods, and applications Remote sensing is a crucial form of measurement that allows for the gauging of an object or space without direct physical contact, allowing for the assessment and recording of a target under conditions which would normally render access difficult or impossible. This is done through the analysis and interpretation of electromagnetic radiation (EMR) that is reflected or emitted by an object, surveyed and recorded by an observer or instrument that is not in contact with the target. This methodology is particularly of importance in Earth observation by remote sensing, wherein airborne or satellite-borne instruments of EMR provide data on the planet’s land, seas, ice, and atmosphere. This permits scientists to establish relationships between the measurements and the nature and distribution of phenomena on the Earth’s surface or within the atmosphere. Still relying on a visual and conceptual approach to the material, the fifth edition of this successful textbook provides students with methods of computer processing of remotely sensed data and introduces them to environmental applications which make use of remotely-sensed images. The new edition’s content has been rearranged to be more clearly focused on image processing methods and applications in remote sensing with new examples, including material on the Copernicus missions, microsatellites and recently launched SAR satellites, as well as time series analysis methods. The fifth edition of Computer Processing of Remotely-Sensed Images also contains: A cohesive presentation of the fundamental components of Earth observation remote sensing that is easy to understand and highly digestible Largely non-technical language providing insights into more advanced topics that may be too difficult for a non-mathematician to understand Illustrations and example boxes throughout the book to illustrate concepts, as well as revised examples that reflect the latest information References and links to the most up-to-date online and open access sources used by students Computer Processing of Remotely-Sensed Images is a highly insightful textbook for advanced undergraduates and postgraduate students taking courses in remote sensing and GIS in Geography, Geology, and Earth & Environmental Science departments. Digital Image Processing of Remotely Sensed Data presents a practical approach to digital image processing of remotely sensed data, with emphasis on application examples and algorithms. It explains where to get the data and what is available and what preprocessing is needed to prepare the imagery for processing. Research topics are described to indicate the limitations of computer methods. This book is comprised of seven chapters and begins with a summary of basic concepts used in remote sensing and digital imagery, followed by a discussion on sources of remotely sensed data. Two essential hardware ingredients in a digital image processing system, a computer and a display device, are then considered, along with the algorithms used in digital image processing. Examples of how digital image processing algorithms have been applied to real imagery for specific objectives are given, including the Kentucky water impoundment experiment and the land-use mapping initiative in Washington, D.C. The next section is devoted to research topics such as digital image shape detection; edge detection and regionalized terrain classification from satellite photography; and digital image enhancement for maximum interpretability using linear programming. This monograph will be of value to professional regional planners, natural resource managers, and others in fields ranging from hydrology and forestry to agronomy and geology. 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. 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. Written by leaders in the field of remote sensing information processing, this book covers the frontiers of remote sensors, especially with effective algorithms for signal/image processing and pattern recognition with remote sensing data. Sensor and data fusion issues, SAR images, hyperspectral images, and related special topics are also examined. Techniques making use of neural networks, wavelet transforms, and knowledge-based systems are emphasized. A special set of three chapters is devoted to seismic analysis and discrimination. In summary, the book provides an authoritative treatment of major topics in remote sensing information processing and defines new frontiers for these areas. Contents: Data Mining; SAR Image Processing; Wavelet Analysis and Applications; Military Applications of Remote Sensing; Microwave Remote Sensing; Statistical Pattern Recognition; Automatic Target Segmentation; Neural Networks; Change Detection; Seismic Signal Processing; Time Series Prediction; Image Compression; Emerging Topics. Readership: Engineers and scientists dealing with remote sensing data in particular, and signals and images in general; computer scientists involved in software development on geophysical data analysis. This book explores the current state of knowledge on remote sensing time series image processing and addresses all major aspects and components of time series image analysis with ample examples and applications. With the widespread availability of satellite and aircraft remote sensing image data in digital form, and the ready access most remote sensing practitioners have to computing systems for image interpretation, there is a need to draw together the range of digital image processing procedures and methodologies commonly used in this field into a single treatment. It is the intention of this book to provide such a function, at a level meaningful to the non-specialist digital image analyst, but in sufficient detail that algorithm limitations, alternative procedures and current trends can be appreciated. Often the applications specialist in remote sensing wishing to make use of digital processing procedures has had to depend upon either the mathematically detailed treatments of image processing found in the electrical engineering and computer science literature, or the sometimes necessarily superficial treatments given in general texts on remote

sensing. This book seeks to redress that situation. Both image enhancement and classification techniques are covered making the material relevant in those applications in which photointerpretation is used for information extraction and in those wherein information is obtained by classification. Techniques for Image Processing and Classifications in Remote Sensing provides an introduction to the fundamentals of computer image processing and classification (commonly called ""pattern recognition"" in other applications). The book begins with a discussion of digital scanners and imagery, and two key mathematical concepts for image processing and classification—spatial filtering and statistical pattern recognition. This is followed by separate chapters on image processing and classification techniques that are widely used in the remote sensing community. The emphasis throughout is on techniques that assist in the analysis of images, not particular applications of these techniques. The book also has four appendixes, featuring a bibliography; an introduction to computer binary data representation and image data formats; a discussion of interactive image processing; and a selection of exam questions from the Image Processing Laboratory course at the University of Arizona. This book is intended for use as either a primary source in an introductory image processing course or as a supplementary text in an intermediate-level remote sensing course. The academic level addressed is upper-division undergraduate or beginning graduate, and familiarity with calculus and basic vector and matrix concepts is assumed. 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 Although remote sensing is recognized as a powerful tool, less attention has been given in the past to the use of thermal, and especially thermal infrared (TIR) remote sensing. TIR data is useful for understanding the fluxes and redistribution of materials as a key aspect of land surface processes and land-atmosphere inter-relationships. This book Edited by leaders in the field, with contributions by a panel of experts, Image Processing for Remote Sensing explores new and unconventional mathematics methods. The coverage includes the physics and mathematical algorithms of SAR images, a comprehensive treatment of MRF-based remote sensing image classification, statistical approaches for Containing useful information sources for the management of natural resources, this comprehensive text covers a large range of spatial resolutions and spectral characteristics. The book deals with the data sources and their physical interpretation, as well as processing techniques, such as visual interpretation and automated classifications, textural and structural processing and photogrammetry. There is a section on accuracy assessment and various applications relating to crops, grasslands, soils, landscapes, mines and coasts. The CD-ROM contains software and image data sets explaining the statistical methods of reference and contains a light version of the TeraVue software enabling the reader to compute the different processing spatial data. This book provides the most comprehensive study of information processing techniques and issues in remote sensing. Topics covered include image and signal processing, pattern recognition and feature extraction for remote sensing, neural networks and wavelet transforms in remote sensing, remote sensing of ocean and coastal environment, SAR image filtering and segmentation, knowledge-based systems, software and hardware issues, data compression, change detection, etc. Emphasis is placed on environmental issues of remote sensing.With 58 color illustrations. This fourth and full colour edition updates and expands a widely-used textbook aimed at advanced undergraduate and postgraduate students taking courses in remote sensing and GIS in Geography, Geology and Earth/Environmental Science departments. Existing material has been brought up to date and new material has been added. In particular, a new chapter, exploring the two-way links between remote sensing and environmental GIS, has been added. New and updated material includes: A website at www.wiley.com/go/mather4 that provides access to an updated and expanded version of the MIPS image processing software for Microsoft Windows, PowerPoint slideshows of the figures from each chapter, and case studies, including full data sets, Includes new chapter on Remote Sensing and Environmental GIS that provides insights into the ways in which remotely-sensed data can be used synergistically with other spatial data sets, including hydrogeological and archaeological applications, New section on image processing from a computer science perspective presented in a non-technical way, including some remarks on statistics, New material on image transforms, including the analysis of temporal change and data fusion techniques, New material on image classification including decision trees, support vector machines and independent components analysis, and Now in full colour throughout. This book provides the material required for a single semester course in Environmental Remote Sensing plus additional, more advanced, reading for students specialising in some aspect of the subject. It is written largely in non-technical language yet it provides insights into more advanced topics that some may consider too difficult for a non-mathematician to understand. The case studies available from the website are fully-documented research projects complete with original data sets. For readers who do not have access to commercial image processing software, MIPS provides a licence-free, intuitive and comprehensive alternative. Essential Image Processing and GIS for Remote Sensing is an accessible overview of the subject and successfully draws together these three key areas in a balanced and comprehensive manner. The book provides an overview of essential techniques and a selection of key case studies in a variety of application areas. Key concepts and ideas are introduced in a clear and logical manner and described through the provision of numerous relevant conceptual illustrations. Mathematical detail is kept to a minimum and only referred to where necessary for ease of understanding. Such concepts are explained through common sense terms rather than in rigorous mathematical detail when explaining image processing and GIS techniques, to enable students to grasp the essentials of a notoriously challenging subject area. The book is clearly divided into three parts, with the first part introducing essential image processing techniques for remote sensing. The second part looks at GIS and begins with an overview of the concepts, structures and mechanisms by which GIS operates. Finally the third part introduces Remote Sensing Applications. Throughout the book the relationships between GIS, Image Processing and Remote Sensing are clearly identified to ensure that students are able to apply the various techniques that have been covered appropriately. The latter chapters use numerous relevant case studies to illustrate various remote sensing, image processing and GIS applications in practice. Written by leaders in the field, Signal Processing for Remote Sensing explores the data acquisitions segment of remote sensing. Each chapter presents a major research result or the most up to date development of a topic. The book includes a chapter by Dr. Norden Huang, inventor of the Huang-Hilbert transform who, along with and Dr. Steven Lo This Lab Manual is a companion to the textbook Remote Sensing and Digital Image Processing with R. It covers examples of natural resource data analysis applications including numerous, practical problem-solving exercises, and case studies that use the free and open-source platform R. The intuitive, structural workflow helps students better understand a scientific approach to each case study in the book and learn how to replicate, transplant, and expand the workflow for further exploration with new data, models, and areas of interest. Features Aims to expand theoretical approaches of remote sensing and digital image processing through multidisciplinary applications using R and R packages. Engages students in learning theory through hands-on real-life projects. All chapters are structured with solved exercises and homework and encourage readers to understand the potential and the limitations of the environments. Covers data analysis in the free and open-source R platform, which makes remote sensing accessible to anyone with a computer. Explores current trends and developments in remote sensing in homework assignments with data to further explore the use of free multispectral remote sensing data, including very high spatial resolution information. Undergraduate- and graduate-level

students will benefit from the exercises in this Lab Manual, because they are applicable to a variety of subjects including environmental science, agriculture engineering, as well as natural and social sciences. Students will gain a deeper understanding and first-hand experience with remote sensing and digital processing, with a learn-by-doing methodology using applicable examples in natural resources. 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. Continuing in the footsteps of the pioneering first edition, Signal and Image Processing for Remote Sensing, Second Edition explores the most up-to-date signal and image processing methods for dealing with remote sensing problems. Although most data from satellites are in image form, signal processing can contribute significantly in extracting information from remotely sensed waveforms or time series data. This book combines both, providing a unique balance between the role of signal processing and image processing. Featuring contributions from worldwide experts, this book continues to emphasize mathematical approaches. Not limited to satellite data, it also considers signals and images from hydroacoustic, seismic, microwave, and other sensors. Chapters cover important topics in signal and image processing and discuss techniques for dealing with remote sensing problems. Each chapter offers an introduction to the topic before delving into research results, making the book accessible to a broad audience. This second edition reflects the considerable advances that have occurred in the field, with 23 of 27 chapters being new or entirely rewritten. Coverage includes new mathematical developments such as compressive sensing, empirical mode decomposition, and sparse representation, as well as new component analysis methods such as non-negative matrix and tensor factorization. The book also presents new experimental results on SAR and hyperspectral image processing. The emphasis is on mathematical techniques that will far outlast the rapidly changing sensor, software, and hardware technologies. Written for industrial and academic researchers and graduate students alike, this book helps readers connect the "dots" in image and signal processing. New in This Edition The second edition includes four chapters from the first edition, plus 23 new or entirely rewritten chapters, and 190 new figures. New topics covered include: Compressive sensing The mixed pixel problem with hyperspectral images Hyperspectral image (HSI) target detection and classification based on sparse representation An ISAR technique for refocusing moving targets in SAR images Empirical mode decomposition for signal processing Feature extraction for classification of remote sensing signals and images Active learning methods in classification of remote sensing images Signal subspace identification of hyperspectral data Wavelet-based multi/hyperspectral image restoration and fusion The second edition is not intended to replace the first edition entirely and readers are encouraged to read both editions of the book for a more complete picture of signal and image processing in remote sensing. See Signal and Image Processing for Remote Sensing (CRC Press 2006). A comprehensive introduction to the principles and applications of remote sensing, written by contributors actively involved in optical remote sensing research. Special attention is paid to the interrelationship between land surfaces and the intervening atmosphere. Focusing specifically on the spectral region of 0.04 to 16 microns, this book covers a wide range of techniques and their practical implementations. Demonstrates how the same basic measurements can be used in several different applications to obtain quantitative measurements. 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 Following the successful publication of the 1st edition in 2009, the 2nd edition maintains its aim to provide an application-driven package of essential techniques in image processing and GIS, together with case studies for demonstration and guidance in remote sensing applications. The book therefore has a “3 in 1” structure which pinpoints the intersection between these three individual disciplines and successfully draws them together in a balanced and comprehensive manner. The book conveys in-depth knowledge of image processing and GIS techniques in an accessible and comprehensive manner, with clear explanations and conceptual illustrations used throughout to enhance student learning. The understanding of key concepts is always emphasised with minimal assumption of prior mathematical experience. The book is heavily based on the authors’ own research. Many of the author-designed image processing techniques are popular around the world. For instance, the SFIM technique has long been adopted by ASTRIUM for mass-production of their standard “Pan-sharpen” imagery data. The new edition also includes a completely new chapter on subpixel technology and new case studies, based on their recent research. For junior/graduate-level courses in Remote Sensing in Geography, Geology, Forestry, and Biology. This text focuses exclusively on the art and science of digital image processing of satellite and aircraft-derived remotely-sensed data for resource management. Extensively illustrated, it explains how to extract biophysical information from remote sensor data for almost all multidisciplinary land-based environmental projects. Part of the Prentice Hall Series Geographic Information Science. For junior/graduate-level courses in Remote Sensing in Geography, Geology, Forestry, and Biology. This revision of Introductory Digital Image Processing: A Remote Sensing Perspective continues to focus on digital image processing of aircraft- and satellite-derived, remotely sensed data for Earth resource management applications. Extensively illustrated, it explains how to extract biophysical information from remote sensor data for almost all multidisciplinary land-based environmental projects. Part of the Prentice Hall Series Geographic Information Science. One of the key milestones of radar remote sensing for civil applications was the launch of the European Remote Sensing Satellite 1 (ERS 1) in 1991. The platform carried a variety of sensors; the Synthetic Aperture Radar (SAR) is widely cons- ered to be the most important. This active sensing technique provides all-day and all-weather mapping capability of considerably ?ne spatial resolution. ERS 1 and its sister system ERS 2 (launch 1995) were primarily designed for ocean app- cations, but soon the focus of attention turned to onshore mapping. Examples for typical applications are land cover classi?cation also in tropical zones and mo- toring of glaciers or urban growth. In parallel, international Space Shuttle Missions dedicated to radar remote sensing were conducted starting already in the 1980s. The most prominent were the SIR-C/X-SAR mission focussing on the investigation of multi-frequency and multi-polarization SAR data and the famous Shuttle Radar Topography Mission (SRTM). Data acquired during the latter enabled to derive a DEM of almost global coverage by means of SAR Interferometry. It is indispe-ableeventodayandformanyregionsthebestelevationmodelavailable. Differential SAR Interferometry based on time series of imagery of the ERS satellites and their successor Envisat became an important and unique technique for surface defor- tion monitoring. The spatial resolution of those devices is in the order of some tens of meters. Remotely-sensed images of the Earth's surface provide a valuable source of information about the geographical distribution and properties of natural and cultural features. This fully revised and updated edition of a

highly regarded textbook deals with the mechanics of processing remotely-senses images. Presented in an accessible manner, the book covers a wide range of image processing and pattern recognition techniques. Features include: New topics on LiDAR data processing, SAR interferometry, the analysis of imaging spectrometer image sets and the use of the wavelet transform. An accompanying CD-ROM with: updated MIPS software, including modules for standard procedures such as image display, filtering, image transforms, graph plotting, import of data from a range of sensors. A set of exercises, including data sets, illustrating the application of discussed methods using the MIPS software. An extensive list of WWW resources including colour illustrations for easy download. For further information, including exercises and latest software information visit the Author's Website at: http://homepage.ntlworld.com/paul.mather/ComputerProcessing3/ Since 1994, the European Commission has undertaken various actions to expand the use of Earth observation (EO) from space in the Union and to stimulate value-added services based on the use of Earth observation satellite data.' By supporting research and technological development activities in this area, DG XII responded to the need to increase the cost-effectiveness of space derived environmental information. At the same time, it has contributed to a better exploitation of this unique technology, which is a key source of data for environmental monitoring from local to global scale. MAVIRIC is part of the investment made in the context of the Environ ment and Climate Programme (1994-1998) to strengthen applied techniques, based on a better understanding of the link between the remote sensing signal and the underlying bio- geo-physical processes. Translation of this scientific know-how into practical algorithms or methods is a priority in order to con vert more quickly, effectively and accurately space signals into geographical information. Now the availability of high spatial resolution satellite data is rapidly evolving and the fusion of data from different sensors including radar sensors is progressing well, the question arises whether existing machine vision approaches could be advantageously used by the remote sensing community. Automatic feature/object extraction from remotely sensed images looks very attractive in terms of processing time, standardisation and implementation of operational processing chains, but it remains highly complex when applied to natural scenes. For junior/graduate-level courses in Remote Sensing in Geography, Geology, Forestry, and Biology. Introductory Digital Image Processing: A Remote Sensing Perspective focuses on digital image processing of aircraft- and satellite-derived, remotely sensed data for Earth resource management applications. Extensively illustrated, it explains how to extract biophysical information from remote sensor data for almost all multidisciplinary land-based environmental projects. Part of the Pearson Series Geographic Information Science. Now in full color, the Fourth Edition provides up-to-date information on analytical methods used to analyze digital remote sensing data. Each chapter contains a substantive reference list that can be used by students and scientists as a starting place for their digital image processing project or research. A new appendix provides sources of imagery and other geospatial information. This new textbook on remote sensing and digital image processing of natural resources includes numerous, practical problem-solving exercises and applications of sensors and satellite systems using remote sensing data collection resources, and emphasizes the free and open-source platform R. It explains basic concepts of remote sensing and multidisciplinary applications using R language and R packages, by engaging students in learning theory through hands-on, real-life projects. All chapters are structured with learning objectives, computation, questions, solved exercises, resources, and research suggestions. Features Explains the theory of passive and active remote sensing and its applications in water, soil, vegetation, and atmosphere. Covers data analysis in the free and open-source R platform, which makes remote sensing accessible to anyone with a computer. Includes case studies from different environments with free software algorithms and an R toolset for active learning and a learn-by-doing approach. Provides hands-on exercises at the end of each chapter and encourages readers to understand the potential and the limitations of the environments, remote sensing targets, and process. Explores current trends and developments in remote sensing in homework assignments with data to further explore the use of free multispectral remote sensing data, including very high spatial resolution data sources for target recognition with image processing techniques. While the focus of the book is on environmental and agriculture engineering, it can be applied widely to a variety of subjects such as physical, natural, and social sciences. Students in upper-level undergraduate or graduate programs, taking courses in remote sensing, geoprocessing, civil and environmental engineering, geosciences, environmental sciences, electrical engineering, biology, and hydrology will also benefit from the learning objectives in the book. Professionals who use remote sensing and digital processing will also find this text enlightening. The scope of image processing and recognition has broadened due to the gap in scientific visualization. Thus, new imaging techniques have developed, and it is imperative to study this progression for optimal utilization. Big Data Analytics for Satellite Image Processing and Remote Sensing is a critical scholarly resource that examines the challenges and difficulties of implementing big data in image processing for remote sensing and related areas. Featuring coverage on a broad range of topics, such as distributed computing, parallel processing, and spatial data, this book is geared towards scientists, professionals, researchers, and academicians seeking current research on the use of big data analytics in satellite image processing and remote sensing.