Change detection for hyperspectral imagery researchgate .pdf

Techniques and Applications of Hyperspectral Image Analysis Advances in Hyperspectral Image Processing Techniques Hyperspectral Imaging in Agriculture, Food and Environment Hyperspectral Image Processing Hyperspectral Imaging Hyperspectral Image Analysis Cahnge Detection Methods for Hyperspectral Imagery Deep Learning for Hyperspectral Image Analysis and Classification Processing and Analysis of Hyperspectral Data Hyperspectral Data Processing Advanced Image Processing Techniques for Remotely Sensed Hyperspectral Data Hyperspectral Remote Sensing And Spectral Signature Applications Hyperspectral Imaging Integration of Spatial and Spectral Information for Hyperspectral Image Classification Hyperspectral Remote Sensing Hyperspectral Imaging for Fine to Medium Scale Applications in Environmental Sciences The Future of Hyperspectral Imaging Hyperspectral Imagery Real-Time Recursive Hyperspectral Sample and Band Processing Hyperspectral Data Exploitation Dimensionality Reduction of Hyperspectral Imagery Hyperspectral Imaging Technology in Food and Agriculture Hyperspectral Imaging Remote Sensing Hyperspectral Imaging in Agriculture, Food and Environment Automatic Target Recognition for Hyperspectral Imagery Using High-Order Statistics Hyperspectral Imaging Analysis and Applications for Food Quality Efficient Analysis of Hyperspectral Remote Sensing Imagery Algorithms for Multispectral and Hyperspectral Imagery Hyperspectral Data Compression An Invariant Display Strategy for Hyperspectral Imagery An Invariant Display Strategy for Hyperspectral Imagery Hyperspectral Remote Sensing An Invariant Display Strategy for Hyperspectral Imagery Hyperspectral Imaging for Food Quality Analysis and Control Dimensionality Reduction for Hyperspectral Imagery Spectral-Spatial Classification of Hyperspectral Remote Sensing Images New Data Analysis and Dimensionality Reduction Methods for Hyperspectral Imagery Hyperspectral Image Fusion Pattern Classification and Reconstruction for Hyperspectral Imagery Real-Time Progressive Hyperspectral Image Processing

<u>Techniques and Applications of Hyperspectral Image Analysis</u> *2007-09-27*

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

Advances in Hyperspectral Image Processing Techniques *2022-11-09*

advances in hyperspectral image processing techniques authoritative and comprehensive resource covering recent hyperspectral imaging techniques from theory to applications advances in hyperspectral image processing techniques is derived from recent developments of hyperspectral imaging hsi techniques along with new applications in the field covering many new ideas that have been explored and have led to various new directions in the past few years the work gathers an array of disparate research into one resource and explores its numerous applications across a wide variety of disciplinary areas in particular it includes an introductory chapter on fundamentals of hsi and a chapter on extensive use of hsi techniques in satellite on orbit and on board processing to aid readers involved in these specific fields the book s content is based on the expertise of invited scholars and is categorized into six parts part i provides general theory part ii presents various band selection techniques for hyperspectral images part iii reviews recent developments on compressive sensing for hyperspectral imaging part iv includes fusion of hyperspectral images part v covers hyperspectral data unmixing part vi offers different views on hyperspectral image classification specific sample topics covered in advances in hyperspectral image processing techniques include two fundamental principles of hyperspectral imaging constrained band selection for hyperspectral imaging and class information based band selection for hyperspectral image classification restricted entropy and spectrum properties for hyperspectral imaging and endmember finding in compressively sensed band domain hyperspectral and lidar data fusion fusion of band selection methods for hyperspectral imaging and fusion using multi dimensional information advances in spectral unmixing of hyperspectral data and fully constrained least squares linear spectral mixture analysis sparse representation based hyperspectral image classification collaborative hyperspectral image classification class feature weighted hyperspectral image classification target detection approach to hyperspectral image classification with many applications beyond traditional remote sensing ranging from defense and intelligence to agriculture to forestry to environmental monitoring to food safety and inspection to medical imaging advances in hyperspectral image processing techniques is an essential resource on the topic for industry professionals researchers academics and graduate students working in the field

Hyperspectral Imaging in Agriculture, Food and Environment *2018-08-01*

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 Image Processing *2015-07-15*

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

<u>Hyperspectral Imaging</u> *2019-09-29*

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

Hyperspectral Image Analysis *2020-04-27*

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

Cahnge Detection Methods for Hyperspectral Imagery *2007*

this thesis studies the detection of changes using hyperspectral images change detection cd is the process of identifying and examining temporal and spectral changes in signals detection and analysis of change provide valuable information of possible transformations in a scene hyperspectral imaging hsi sensors are capable of collecting data at hundreds of narrow spectral bands such sensors provide high resolution spatial and spectrally rich information that can be exploited for cd this work develops and implements various cd algorithms for detection of changes using hyperspectral images the main objectives are to study and develop different hsi change detection algorithms the explored methods were implemented in order to compare the performance on close in hsi data the methods studied in this thesis include image differencing image ratioing principal component analysis linear chronochrome a modified correlation coefficient and a kernel dissimilarity measure hyperspectral imagery of different scenarios was collected and used to test and validate the methods presented in this study the algorithms were implemented using matlab and the performance of algorithms is presented in terms of false alarm rates and missed changes

Deep Learning for Hyperspectral Image Analysis and Classification *2021-02-20*

this book focuses on deep learning based methods for hyperspectral image hsi analysis unsupervised spectral spatial adaptive band noise factor based formulation is devised for hsi noise detection and band categorization the method to characterize the bands along with the noise estimation of hsis will benefit subsequent remote sensing techniques significantly this book develops on two fronts on the one hand it is aimed at domain professionals who want to have an updated overview of how hyperspectral acquisition techniques can combine with deep learning architectures to solve specific tasks in different application fields on the other hand the authors want to target the machine learning and computer vision experts by giving them a picture of how deep learning technologies are applied to hyperspectral data from a multidisciplinary perspective the presence of these two viewpoints and the inclusion of application fields of remote sensing by deep learning are the original contributions of this review which also highlights some potentialities and critical issues related to the observed development trends

Processing and Analysis of Hyperspectral Data *2020-01-22*

hyperspectral imagery has received considerable attention in the last decade as it provides rich spectral information and allows the analysis of objects that are unidentifiable by traditional imaging techniques it has a wide range of applications including remote sensing industry sorting food analysis biomedical imaging etc however in contrast to rgb images from which information can be intuitively extracted hyperspectral data is only useful with proper processing and analysis this book covers theoretical advances of hyperspectral image processing and applications of hyperspectral processing including unmixing classification super resolution and quality estimation with classical and deep learning methods

Hyperspectral Data Processing *2013-02-01*

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

Advanced Image Processing Techniques for Remotely Sensed Hyperspectral Data *2013-03-09*

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

Hyperspectral Remote Sensing And Spectral Signature Applications *2023-07*

hyperspectral imaging is an emerging modern technique in modern remote sensing that expands and removes capability of multispectral image analysis it takes advantage of hundreds of continuous spectral channels to uncover materials that usually cannot be resolved by multispectral sensothis book is a collection of research papers of indian scientist working in the field of hyperspectral remote sensing and spectral signature applications this has been organized in a way that all the s are logically connected and can be referred back and the forth one another for more details the title of hyperspectral remote sensing and spectral signature applications is use to reflect its focus on spectral techniques i e non literal techniques that are especially designed and developed for hyperspectral imagery rather than multispectral imagery

Hyperspectral Imaging *2013-12-11*

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

Integration of Spatial and Spectral Information for Hyperspectral Image Classification 2008

hyperspectral imaging has become a powerful tool in biomedical and agriculture fields in the recent years and the interest amongst researchers has increased immensely hyperspectral imaging combines conventional imaging and spectroscopy to acquire both spatial and spectral information from an object consequently a hyperspectral image data contains not only spectral information of objects but also the spatial arrangement of objects information captured in neighboring locations may provide useful supplementary knowledge for analysis therefore this dissertation investigates the integration of information from both the spectral and spatial domains to enhance hyperspectral image classification performance the major impediment to the combined spatial and spectral approach is that most spatial methods were only developed for single image band based on the traditional single image based local geary measure this dissertation successfully proposes a multidimensional local spatial autocorrelation mlsa for hyperspectral image data based on the proposed spatial measure this research work develops a collaborative band selection strategy that combines both the spectral separability measure divergence and spatial homogeneity measure mlsa for hyperspectral band selection task in order to calculate the divergence more efficiently a set of recursive equations for the calculation of divergence with an additional band is derived to overcome the computational restrictions moreover this

dissertation proposes a collaborative classification method which integrates the spectral distance and spatial autocorrelation during the decision making process therefore this method fully utilizes the spatial spectral relationships inherent in the data and thus improves the classification performance in addition the usefulness of the proposed band selection and classification method is evaluated with four case studies the case studies include detection and identification of tumor on poultry carcasses fecal on apple surface cancer on mouse skin and crop in agricultural filed using hyperspectral imagery through the case studies the performances of the proposed methods are assessed it clearly shows the necessity and efficiency of integrating spatial information for hyperspectral image processing

Hyperspectral Remote Sensing 2020-08-05

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

Hyperspectral Imaging for Fine to Medium Scale Applications in Environmental Sciences *2021-05-14*

the aim of the special issue hyperspectral imaging for fine to medium scale applications in environmental sciences was to present a selection of innovative studies using hyperspectral imaging hsi in different thematic fields this intention reflects the technical developments in the last three decades which have brought the capacity of hsi to provide spectrally spatially and temporally detailed data favoured by e g hyperspectral snapshot technologies miniaturized hyperspectral sensors and hyperspectral microscopy imaging the present book comprises a suite of papers in various fields of environmental sciences geology mineral exploration digital soil mapping mapping and characterization of vegetation and sensing of water bodies including under ice and underwater applications in addition there are two rather methodically technically oriented contributions dealing with the optimized processing of uav data and on the design and test of a multi channel optical receiver for ground based applications all in all this compilation documents that hsi is a multi faceted research topic and will remain so in the future

The Future of Hyperspectral Imaging *2019-11-20*

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

Hyperspectral Imagery *2002*

hyperspectral imagery or hsi is a sophisticated versatile intelligence gathering technology that could potentially enable the us military to make significant strides towards improving the preparation for and execution of its missions many of the difficulties in bringing the promise of hsi to fruition have very little to do with the technology itself as will be discussed shortly hsi technology has been successfully demonstrated in a variety of diverse applications in point of fact it is the versatility of hsi that may be hindering its implementation into the mainstream of the u s military s intelligence gathering capability the objective of this paper is threefold the first goal is to introduce the reader to both the technology itself and the myriad potential applications of hyperspectral imagery the second goal is to realistically examine the challenges that hsi must overcome specifically in the areas of how hsi fits into the world of joint vision intelligence doctrine and the intelligence cycle finally the paper will provide a series of recommendations some focused on organizational issues and others on acquisition issues that will address the majority of the challenges faced by the intelligence community as they endeavor to incorporate an hsi capability into the u s intelligence community

Real-Time Recursive Hyperspectral Sample and Band Processing *2017-04-23*

this book explores recursive architectures in designing progressive hyperspectral imaging algorithms in particular it makes progressive imaging algorithms recursive by introducing the concept of kalman filtering in algorithm design so that hyperspectral imagery can be processed not only progressively sample by sample or band by band but also recursively via recursive equations this book can be considered a companion book of author s books real time progressive hyperspectral image processing published by springer in 2016

Hyperspectral Data Exploitation *2007-06-11*

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

Dimensionality Reduction of Hyperspectral Imagery 2023-10-04

this book provides information about different types of dimensionality reduction dr methods and their effectiveness in hyperspectral data processing the authors first explain how hyperspectral imagery hsi plays an important role in remote sensing due to its high spectral resolution that enables better identification of different materials on the earth s surface the authors go on to describe potential challenges due to hsi being acquired in hundreds of narrow and contiguous bands represented as a 3 dimensional image cube often causing the bands to contain information redundancy they then show how processing a large number of bands adds challenges in terms of computation complexity that reduces efficiency the authors then present how dr is an essential step in hyperspectral data analysis to solve these issues overall the book helps readers understand the dr processes and its impact in effective hsi analysis

Hyperspectral Imaging Technology in Food and Agriculture 2015-09-29

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 Remote Sensing 2016-10-20

understand the seminal principles current techniques and tools of imaging spectroscopy with this self contained introductory guide

Hyperspectral Imaging in Agriculture, Food and Environment 2018

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

Automatic Target Recognition for Hyperspectral Imagery Using High-Order Statistics *2006*

due to recent advances in hyperspectral imaging sensors many subtle unknown signal sources that cannot be resolved by multispectral sensors can be now uncovered for target detection discrimination and identification because the information about such sources is generally not available automatic target recognition atr presents a great challenge to hyperspectral image analysts many approaches developed for atr are based on second order statistics in the past years this paper investigates atr techniques using high order statistics for atr in hyperspectral imagery most interesting targets usually occur with low probabilities and small population and they generally cannot be described by second order statistics under such circumstances using high order statistics to perform target detection have been shown by experiments in this paper to be more effective than using second order statistics in order to further address a challenging issue in determining the number of signal sources needed to be detected a recently developed concept of virtual dimensionality vd is used to estimate this number the experiments demonstrate that using high order statistics based techniques in conjunction with the vd to perform atr are indeed very effective

Hyperspectral Imaging Analysis and Applications for Food Quality 2018-11-16

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

Efficient Analysis of Hyperspectral Remote Sensing Imagery 2019

this dissertation develops new techniques to reduce the computational complexity for hyperspectral remote sensing image analysis specific techniques are applied with regards to different applications of hyperspectral imagery i e classification target detection the contribution of this dissertation can be summarized as follows 1 a time efficient version combining multiple collaborative representations model is proposed for hyperspectral image classification collaborative representation cr can be implemented either with a dictionary containing training samples of all classes or class specific a collaborative representation optimized classifier with tikhonov regularization croct is proposed to avoid the redundant operations in all class and class specific versions 2 an efficient probabilistic collaborative representation is presented for hyperspectral image classification its performance is evaluated on different types of spatial features of hyperspectral imagery including shape feature i e extended multi attribute feature global feature i e gabor feature and local feature i e local binary pattern experimental results show the probabilistic collaborative representation based classifier procrc has excellent performance in terms of both accuracy and computational cost compared with the original crc and regularized versions of crc 3 fast nonlinear classification and an explicit kernel approach are built for multispectral and hyperspectral imagery respectively to improve the kernel version of collaborative representation based algorithms experimental results show that using artificial bands generated from a simple band ratio function can yield better classification accuracy than the nonlinear kernel method and also reduce computational cost in addition the explicit kernel mapping approach can yield high accuracy as the original kernel versions of cr based algorithms but with similarly low computational cost as in the original linear crc classifiers 4 efficient band selection approaches are proposed for hyperspectral target detection a maximum sub maximum ratio msr metric has been applied for band selection which can well gauge the target background separation efficient evolutionary searching methods such as particle swarm optimization and firefly algorithm are used in conjunction with maximum sub maximum ratio metric for band selection experimental results show that the proposed band selection approach can select a small band set while yielding similar detection performance compared with using all the original bands

Algorithms for Multispectral and Hyperspectral Imagery *1998*

hyperspectral data compression provides a survey of recent results in the field of compression of remote sensed 3d data with a particular interest in hyperspectral imagery chapter 1 addresses compression architecture and reviews and compares compression methods chapters 2 through 4 focus on lossless compression where the decompressed image must be bit for bit identical to the original chapter 5 contributed

by the editors describes a lossless algorithm based on vector quantization with extensions to near lossless and possibly lossy compression for efficient browning and pure pixel classification chapter 6 deals with near lossless compression while chapter 7 considers lossy techniques constrained by almost perfect classification chapters 8 through 12 address lossy compression of hyperspectral imagery where there is a tradeoff between compression achieved and the quality of the decompressed image chapter 13 examines artifacts that can arise from lossy compression

Hyperspectral Data Compression *2006-06-03*

remotely sensed data produced by hyperspectral imagers contains hundreds of contiguous narrow spectral bands at each spatial pixel the substantial dimensionality and unique character of hyperspectral imagery requires display techniques that differ from traditional image analysis tools this study investigated the appropriate methodologies for displaying hyperspectral images based on the physical principles of human color vision and a generalized set of linear transformations principal components pc analysis is a powerful tool for reducing the dimensionality of a data set and pc based strategies were explored in creating a broadly applicable image display strategy it is shown that the invariant display strategy and generalized eigenvectors developed within this study offer a first look capability for a wide variety of spectral scenes pc transformations utilizing this generalized set of eigenvectors allow for real time initial classification detailed investigation of the relationship between the pc eigenvectors and dissimilar image content shows that this strategy is robust enough to provide an accurate initial scene classification

<u>An Invariant Display Strategy for Hyperspectral Imagery</u> *2000*

remotely sensed data produced by hyperspectral imagers contains hundreds of contiguous narrow spectral bands at each spatial pixel the substantial dimensionality and unique character of hyperspectral imagery requires display techniques that differ from traditional image analysis tools this study investigated the appropriate methodologies for displaying hyperspectral images based on the physical principles of human color vision and a generalized set of linear transformations principal components pc analysis is a powerful tool for reducing the dimensionality of a data set and pc based strategies were explored in creating a broadly applicable image display strategy it is shown that the invariant display strategy and generalized eigenvectors developed within this study offer a first look capability for a wide variety of spectral scenes pc transformations utilizing this generalized set of eigenvectors allow for real time initial classification detailed investigation of the relationship between the pc eigenvectors and dissimilar image content shows that this strategy is robust enough to provide an accurate initial scene classification

An Invariant Display Strategy for Hyperspectral Imagery 2000-12

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 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

Hyperspectral Remote Sensing 2012

remotely sensed data produced by byperspectral imagers contains hundreds of contiguous narrow spectral bands at each spatial pixel the substantial dimensionality and unique character of hyperspectral imagery requires display techniques that differ from those provided by traditional image analysis tools this study investigated techniques enabling the display of hyperspecual images without the interference of in scene characteristics that lead to biased representations depending on the content of every image under analysis utilizing the principal components analysis transformation it is possible to simplify the representation requirements while maintaining the information contained in the scene the introduction of an external eigenvector containing few spectral characteristics into the original scene data removes most of the spectral bias allowing for an accurate detection of the constituent elements the subsequent shift of the resulting data to match the respective hue directions in the dataspace allows for image color fidelity based on the true composition of the image while all the environmental influence has been removed and the final outcome is readily perceived by the human vision

An Invariant Display Strategy for Hyperspectral Imagery *2001-09*

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

Hyperspectral Imaging for Food Quality Analysis and Control *2010-06-29*

in this dissertation dimensionality reduction for hyperspectral remote sensing imagery is investigated to alleviate practical application difficulties caused by high data dimension band selection and band clustering are applied for this purpose based on availability of object prior information supervised semi supervised and unsupervised techniques are proposed to take advantage of modern computational

architecture parallel implementations on cluster and graphics processing units gpu are developed the impact of dimensionality reduction on the following data analysis is also evaluated specific contributions are as below 1 a similarity based unsupervised band selection algorithm is developed to select distinctive and informative bands which outperforms other existing unsupervised band selection approaches in the literature 2 an efficient supervised band selection method based on minimum estimated abundance covariance is developed which outperforms other frequently used metrics template created by james nail 2010 this new method does not need to conduct classification during band selection process or examine original bands band combinations as do traditional approaches 3 an efficient semi supervised band clustering method is proposed which uses class signatures to conduct band partition compared to traditional unsupervised clustering computational complexity is significantly reduced 4 parallel gpu implementations with computational cost saving strategies for the developed algorithms are designed to facilitate onboard processing 5 as an application example band selection results are used for urban land cover classification with a few selected bands classification accuracy can be greatly improved compared to the one using all the original bands or those from other frequently used dimensionality reduction methods

Dimensionality Reduction for Hyperspectral Imagery *2011*

this comprehensive new resource brings you up to date on recent developments in the classification of hyperspectral images using both spectral and spatial information including advanced statistical approaches and methods the inclusion of spatial information to traditional approaches for hyperspectral classification has been one of the most active and relevant innovative lines of research in remote sensing during recent years this book gives you insight into several important challenges when performing hyperspectral image classification related to the imbalance between high dimensionality and limited availability of training samples or the presence of mixed pixels in the data this book also shows you how to integrate spatial and spectral information in order to take advantage of the benefits that both sources of information provide

Spectral-Spatial Classification of Hyperspectral Remote Sensing Images *2015-09-01*

hyperspectral image fusion is the first text dedicated to the fusion techniques for such a huge volume of data consisting of a very large number of images this monograph brings out recent advances in the research in the area of visualization of hyperspectral data it provides a set of pixel based fusion techniques each of which is based on a different framework and has its own advantages and disadvantages the techniques are presented with complete details so that practitioners can easily implement them it is also demonstrated how one can select only a few specific bands to speed up the process of fusion by exploiting spatial correlation within successive bands of the hyperspectral data while the techniques for fusion of hyperspectral images are being developed it is also important to establish a framework for objective assessment of such techniques this monograph has a dedicated chapter describing various fusion performance measures that are applicable to hyperspectral image fusion this monograph also presents a notion of consistency of a fusion technique which can be used to verify the suitability and applicability of a technique for fusion of a very large number of images this book will be a highly useful resource to the students researchers academicians and practitioners in the specific area of hyperspectral image fusion as well as generic image fusion

New Data Analysis and Dimensionality Reduction Methods for Hyperspectral Imagery *2022*

in this dissertation novel techniques for hyperspectral classification and signal reconstruction from random projections are presented a classification paradigm designed to exploit the rich statistical structure of hyperspectral data is proposed the proposed framework employs the local fisher s discriminant analysis to reduce the dimensionality of the data while preserving its multimodal structure followed by a subsequent gaussian mixture model or support vector machine classifier an extension of this framework in a kernel induced space is also studied this classification approach employs a maximum likelihood classifier and dimensionality reduction based on a kernel local fisher s discriminant analysis the technique imposes an additional constraint on the kernel mapping it ensures that neighboring points in the input space stay close by in the projected subspace in a typical remote sensing flow the sender needs to invoke an appropriate compression strategy for downlinking signals e g imagery to a base station signal acquisition using random projections significantly decreases the sender side computational cost while preserving useful information in this dissertation a novel class dependent hyperspectral image reconstruction strategy is also proposed the proposed method employs statistics pertinent to each class as opposed to the average statistics estimated over the entire dataset resulting in a more accurate reconstruction from random projections an integrated spectral spatial model for signal reconstruction from random projections is also developed in this approach spatially homogeneous segments are combined with spectral pixel wise classification results in the projected subspace an appropriate reconstruction strategy such as compressive projection principal component analysis cppca is employed individually in each category based on this integrated map the proposed method provides better reconstruction performance as compared to traditional methods and the class dependent cppca approach

Hyperspectral Image Fusion *2013-05-25*

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

Pattern Classification and Reconstruction for Hyperspectral Imagery 2012

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