Classification of IRS LISS-III Images by using Artificial Neural Networks

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ABSTRACT

The purpose of this paper is to classify the LISS-III satellite images into different classes as agriculture, urban and water body. Here pixel based classification is used to classify each pixel of the satellite image as belonging to one of those three classes. To perform this classification, a neural network, back propagation technique is used. The neural network consists of three layers: Input layer, hidden layer and output layer. During training of a network, the sample inputs are given to the input layer which then propagate the hidden layer and then later to the output layer. Each neuron in hidden layer will receive the inputs from all the neurons of the corresponding synoptic weights and summed up. Each neuron of output layer will also get the input from all the neurons of hidden layer which are also multiplied with their corresponding weights. The outputs of the output layer are compared with desired result. The error between desired output and actual output is calculated to obtain error matrix. For each input, both local and global classification is obtained. In local classification, the neural network is trained using a particular image and that same image is given as input. In global classification, a new input is given for the network rather than the images with which it has been trained. Accuracy is then calculated for both the local and global classification.

General Terms

Image Mining, Classification Technique, Neural Networks, Pattern Recognition

Keywords

Image classification, Neural Networks, back propagation algorithm, LISS-III Multispectral images

1. INTRODUCTION

Neural networks are used as statistical tools in a variety of fields, including Psychology, Statistics, Engineering, Economics and even Physics. They are used also as models of cognitive processes by neuro and cognitive scientists. Basically, Neural networks are built from simple units, sometimes called neurons or cells, by analogy with the real thing. These units are linked by a set of weighted connections. Learning is usually accomplished by modification of the connection weights. Each unit codes or corresponds to a feature or a characteristic of a pattern that we want to analyze or that we want to use as predictor. These networks usually organize their units into several layers. The first layer is called the input layer, the last one is the output layer. The intermediate layers are called the hidden layers. The information to be analyzed is fed to the neurons of the first layer and then propagated to the next layer and so on until the last layer. Each

unit receives some information from other units and processes this information, which will be converted into the output of the unit. The goal of the network is to learn or to discover some association between input and output patterns, or to analyze, or to find the structure of the input patterns. The learning process is achieved through the modification of the connection weights between units. Bischof et al. [1992] describes multi spectral classification of land-sat images using neural networks. Heerman et al. [1992] describes the classification of multi spectral remote sensing data using a back propagation Neural network. Hepner et al.[1990] have given a comparison to conventional supervised classification by using minimal training set in Artificial Neural Network. Mohanty [1996] have classified remotely sensed data by using Artificial Neural Network based on software package. In this paper, Artificial Neural Network is used for classification of IRS-1D data, which has been implemented. The back propagation algorithm is applied for classification of image for each input in both local and global classifications are applied. In local classification, the neural network is trained using a particular image and that the same image is given as input. In global classification, a new input is given for the network rather than the images with which it has been trained. Accuracy is calculated for both local and global classification.

2. STUDY AREA AND CHARACTERISTICS

Indian Remote Sensing (IRS-1D) satellite gives PAN(Panchromatic) high spatial resolution and LISS-III [Linear Imaging self scanning sensor] gives high spectral resolution data. Indian Remote Sensing Satellite (IRS-1C/1D) gives high resolution PAN, LISS-III, WiFS data. Topographic maps on 1:50000 scale are used. Classified landuse / landcover [level III] map generated from LISS-III data is used to assess the damage to agriculture crops. The two data sets acquired for this research were collected via IRS-1D satellites using LISS-III sensors in the multispectral (MS) mode by NRSA, Hyderabad, Andhra Pradesh (A.P) , India. The characteristics of IRS-1D, LISS-III data are summarized in Table1.

3. METHODOLOGY

The purpose of this study is to classify satellite image by both local and global classifications and compare the accuracy of each of the classifications. In addition, the accuracy of the training is improved by finding the saturation point, where regardless of the number of Indian epochs through the training data, the accuracy will not increase further. The methodology is:

- To apply local classification to the input image for each of the training data sets 100, 500 and 1000 respectively.

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Information, Photonics and Communication Jyotsna Kumar Mandal,Kallol Bhattacharya,Ivy Majumdar,Surajit Mandal,2019-10-15 The book includes high quality papers presented at the Second National Conference of Information Photonics and Communication 2019 organized by the Department of Electronics devices and VLSI communication systems and networks signal processing and intelligent systems it includes topics such as RF and microwave communications wireless and mobile communication satellite communications signal image and video processing deep learning and optical networks

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mathematical modeling fields *Computational Intelligence and Information Technology* Vinu V Das,Nessy Thankachan,2011-12-10 This book constitutes the proceedings of the First International Conference on Computational Intelligence and Information Technology CIIT 2011 held in Pune India in November 2011 The 58 revised full papers 67 revised short papers and 32 poster papers presented were carefully reviewed and selected from 483 initial submissions The papers are contributed by innovative academics and industrial experts in the field of computer science information technology computational engineering mobile communication and security and offer a stage to a common forum where a constructive dialog on theoretical concepts practical ideas and results of the state of the art can be developed *Artificial Intelligence and Evolutionary Algorithms in Engineering Systems* L Padma Suresh,Subhransu Sekhar Dash,Bijaya Ketan Panigrahi,2014-11-25 The book is a collection of high quality peer reviewed research papers presented in Proceedings of International Conference on Artificial Intelligence and Evolutionary Algorithms in Engineering Systems ICAEES 2014 held at Noorul Islam Centre for Higher Education Kumaracoil India These research papers provide the latest developments in the broad area of use of artificial intelligence and evolutionary algorithms in engineering systems The book discusses wide variety of industrial engineering and scientific applications of the emerging techniques It presents invited papers from the inventors originators of new applications and advanced technologies *Sensors and Image Processing* Shabana Urooj,Jitendra Virmani,2017-10-03 This volume comprises the select proceedings of the annual convention of the Computer Society of India Divided into 10 topical volumes the proceedings present papers on state of the art research surveys and succinct reviews The volumes cover diverse topics ranging from communications networks to big data analytics and from system architecture to cyber security This volume focuses on Sensors and Image Processing The contents of this book will be useful to researchers and students alike Historical Land Use/Land Cover Classification Using Remote Sensing Wafi Al-Fares,2013-06-25 Although the development of remote sensing techniques focuses greatly on construction of new sensors with higher spatial and spectral resolution it is advisable to also use data of older sensors especially the LANDSAT mission when the historical mapping of land use land cover and monitoring of their dynamics are needed Using data from LANDSAT missions as well as from Terra ASTER Sensors the authors shows in his book maps of historical land cover changes with a focus on agricultural irrigation projects The kernel of this study was whether how and to what extent applying the various remotely sensed data that were used here would be an effective approach to classify the historical and current land use land cover to monitor the dynamics of land use land cover during the last four decades to map the development of the irrigation areas and to classify the major strategic winter and summer irrigated agricultural crops in the study area of the Euphrates River Basin **Artificial Intelligence Perspectives and Applications** Radek Silhavy,Roman Senkerik,Zuzana Kominkova Oplatkova,Zdenka Prokopova,Petr Silhavy,2015-04-25 This volume is based on the research papers presented in the 4th Computer Science On line Conference The volume Artificial Intelligence Perspectives and Applications presents new

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comprehensive scientific knowledge base on water resource management and sustainability It covers geo engineering and scientific problems case studies and sustainable solutions in the water resources management domain Additionally and of equal importance the chapters of the book provide in depth coverage on water resource vulnerability water quality wastewater treatment application of remote sensing and geographical information systems hydrological modeling and harvesting climate variability and runoff sediment discharge and irrigation planning community participation in water governance internet of things and machine learning applications for sustainable water resources management This practical state of the art reference book is a valuable resource for students researchers scientists policymakers spatio temporal designers of water resource systems various stake holders interested in hydro climatology and sustainable water resources management *Object Detection with Deep Learning Models* S Poonkuntran,Rajesh Kumar Dhanraj,Balamurugan Balusamy,2022-11-01 Object Detection with Deep Learning Models discusses recent advances in object detection and recognition using deep learning methods which have achieved great success in the field of computer vision and image processing It provides a systematic and methodical overview of the latest developments in deep learning theory and its applications to computer vision illustrating them using key topics including object detection face analysis 3D object recognition and image retrieval The book offers a rich blend of theory and practice It is suitable for students researchers and practitioners interested in deep learning computer vision and beyond and can also be used as a reference book The comprehensive comparison of various deep learning applications helps readers with a basic understanding of machine learning and calculus grasp the theories and inspires applications in other computer vision tasks Features A structured overview of deep learning in object detection A diversified collection of applications of object detection using deep neural networks Emphasize agriculture and remote sensing domains Exclusive discussion on moving object detection <u>Advances in Photogrammetry, Remote Sensing and Spatial Information Sciences: 2008 ISPRS Congress Book</u> Zhilin Li,Jun Chen,Emmanuel Baltsavias,2008-07-01 Published on the occasion of the XXIst Congress of the International Society for Photogrammetry and Remote Sensing ISPRS in Beiijng China in 2008 Advances in Photogrammetry Remote Sensing and Spatial Information Sciences 2008 ISPRS Congress Book is a compilation of 34 contributions from 62 researchers active within the ISPRS The book covers <u>Advances in Geospatial Technologies for Natural Resource Management</u> Ravi Shankar Dwivedi,2024-11-19 Timely and reliable information on natural resources regarding their potential and limitations is a prerequisite for sustainable development Geospatial technologies offer immense potential in providing such information in a timely and cost effective manner Using orbital sensors data in conjunction with airborne and proximal sensors data to generate information on soils and agricultural resources forests mineral resources fossil fuel wetlands water resources and marine resources this book focuses on the advancements in technologies applicable to managing these resources It addresses global issues like climate change and land degradation neutrality and introduces spatial data infrastructure SDI as

a mechanism for sharing geospatial data This book also provides an in depth discussion on drones crowdsourcing cloud computing Internet of Things machine learning and their applications FEATURES Contains a comprehensive resource on the latest developments in geospatial technologies and their use in monitoring natural resources productivity mapping and modeling Explains the geo computation methods and online algorithm developments Includes clear guidance on how best to use geospatial data for various applications Discusses case studies from a variety of fields and current trends in the management of natural resources Provides future scenarios concerning platforms sensors data analysis and interpretation techniques This book is written for remote sensing and GIS professionals in environmental institutions and government who are involved in natural resource management projects Senior undergraduate and graduate level students in Earth sciences geography or environmental management can also use this text for supplementary reading **Geospatial Technology to Support Communities and Policy** Swagata Ghosh,Maya Kumari,Varun Narayan Mishra,2024-02-26 This book covers theoretical concepts of climate change related phenomena different components of geospatial technology and application of geospatial technology on analysis of climate changes Besides the book will also cover different characteristics of climate resilience how resilience relates to the adaptation and mitigation and role of geospatial science techniques and tools in building climate resilience of a society This text is suitable for researchers academicians urban planners environmentalists policy makers scientists ecologists administrators etc **Urban Expansion, Land Cover and Soil Ecosystem Services** Ciro Gardi,2017-04-07 More than half of the world population now lives in cities and urban expansion continues as rural people move to cities This results in the loss of land for other purposes particularly soil for agriculture and drainage This book presents a review of current knowledge of the extension and projected expansion of urban areas at a global scale Focusing on the impact of the process of land take on soil resources and the ecosystem services that they provide it describes approaches and methodologies for detecting and measuring urban areas based mainly on remote sensing together with a review of models and projected data on urban expansion The most innovative aspect includes an analysis of the drivers and especially the impacts of soil sealing and land take on ecosystem services including agriculture and food security biodiversity hydrology climate and landscape Case studies of cities from Europe China and Latin America are included The aim is not only to present and analyse this important environmental challenge but also to propose and discuss solutions for the limitation mitigation and compensation of this process *HYDROLOGY AND WATERSHED MANAGEMENT* K. Ramamohan Reddy,B. Venkateswara Rao,C. Sarala,2014-10-20 The Proceeding contains the following sections i Groundwater Exploration and Exploitation ii RS iii Watershed Management Hydrological Socio Economic and Cultural Models iv Water and Wastewater Treatment Technologies v Rainwater Harvesting and Rural and Urban Water Supplies vi Floods Reservoir Sedimentation and Seawater Intrusion vii Water Quality Pollution and Environment viii Irrigation Management ix Water Logging and Water Productivity in Agriculture x Groundwater Quality xi Hydrologic Parameter Estimation and Modelling xii Climate Change

Water Food and Environmental Security xiii Groundwater Recharge and Modelling xiv Computational Methods in Hydrology xv Soil and Water Conservation Technologies **Recent Technologies for Disaster Management and Risk Reduction** Praveen Kumar Rai,Prafull Singh,Varun Narayan Mishra,2021-08-21 This book explains to governments decision makers and disaster professionals the potential uses of recent technologies for disaster monitoring and risk reduction based on the knowledge and experience of prominent experts researchers in the relevant fields It discusses the application of recent technological developments for emerging disaster risks in today s societies and deliberates on the various aspects of disaster risk reduction strategies especially through sustainable community resilience and responses This book consists of selected invited papers on disaster management which focus on community resilience and responses towards disaster risk reduction based on experiences and closely examines the coordinated research activities involving all stakeholders especially the communities at risk Many regions of the world and aspects of disaster risk and its management are covered It is described how recent technologies will support better understanding and action to reduce the number and impact of disasters in future The principal audience for this book is researchers urban planners policy makers as well as students **Handbook of Engineering Hydrology (Three-Volume Set)** Saeid Eslamian,2018-10-03 While most books examine only the classical aspects of hydrology this three volume set covers multiple aspects of hydrology and includes contributions from experts from more than 30 countries It examines new approaches addresses growing concerns about hydrological and ecological connectivity and considers the worldwide impact of climate change *Geospatial Technology for Water Resource Applications* Prashant K. Srivastava,Prem Chandra Pandey,Pavan Kumar,Akhilesh Singh Raghubanshi,Dawei Han,2016-07-26 This book advances the scientific understanding development and application of geospatial technologies related to water resource management It presents recent developments and applications specifically by utilizing new earth observation datasets such as TRMM GPM AMSR E 2 SMOS SMAP and GCOM in combination with GIS artificial intelligence and hybrid techniques By linking geospatial techniques with new satellite missions for earth and environmental science the book promotes the synergistic and multidisciplinary activities of scientists and users working in the field of hydrological sciences

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