SOLITARY WAVE SOLUTION OF HIGHER ORDER KADOMSTEV-PETVIASHVILI EQUATION FOR COMPLEX PLASMA

Apul Narayan Dev[1,*] and Jnanjyoti Sarma[2]

[1]Department of Science and Humanities, College of Science and Technology, RUB, Bhutan.
[2]Department of Mathematics, R. G. Baruah College, Guwahati-781025, Assam, India

[*]E-mail : apul@cst.edu.bt

ABSTRACT

The nonlinear wave phenomenon leading to the formation of coherent structures through solitary waves are studied in Kadomstev-Petviashvili (KP) equation and modified Kadomstev-Petviashvili (mKP) equations with the help of reductive perturbation technique. The KP equation for complex plasma consisting of non-isothermal electrons and Maxwellian ions in cold dust with the effect of negative (positive) dust charge fluctuation is derived. Similarly different type mKP equations for complex plasma consisting of trapped electrons and Maxwellian ions in cold dust with the effect of negative (positive) dust charge fluctuation are also derived by same reductive perturbation technique. The analytical solution of KP equation [1] and other higher order nonlinear wave equation such as mKP equation are derived by well known *tanh*-method [2] and dust acoustic solitary waves [3] and shock waves propagation for different situation are reported, which could be relevant in case of different space and astrophysical plasmas including Saturn's spokes, F-ring and also in laboratory results for both positive and negative dust charge fluctuation.

Keywords: *Solitary wave, KP equation, Reductive perturbation technique, tanh-method.*

Paper accepted for presentation at International Conference on Advances in Pure & Applied Mathematic (ICAPAM-2014), 7-9 March, 2014, Manali, INDIA.

DUST ACOUSTIC SHOCK WAVES IN WARM DUSTY PLASMAS

Apul Narayan Dev[1*] and Jnanjyoti Sarma[2]

[1]Department of Science and Humanities, College of Science and Technology, RUB, Bhutan.

[2]Department of Mathematics, R. G. Baruah College, Guwahati-781025, Assam.

e-mail: apul@cst.edu.bt

ABSTRACT

The nonlinear propagation of dust acoustic waves in warm dusty plasma system containing Boltzmann distributed of electrons and ions, arbitrary charged dust grains has been investigated by employing the reductive perturbation method. The nonlinear waves have been observed in the case of negative charged dust grains from the stationary solution of the Korteweg-de Vries (KdV) equation, Burgers equation and Korteweg-de Vries-Burgers (KdV-Burgers) equation. The analytical solution of KdV-Burgers and Burgers equation are numerically analyzed and DA shock waves propagation is reported. It is shown and theoretically discussed about the critical dust density $"_{dc}$. It is found that the solution of KdV equation represent a rarefactive (compressive) solitary waves if $"_d < "_{dc} ("_d > "_{dc})$, where $"_d$ is the dust density and the strength of dispersion term, the Burgers equation represent a negative (positive) shock waves when $"_d < "_{dc} ("_d > "_{dc})$ but with the combination of dispersion and dissipation term, the KdV-Burgers equation represent a positive (negative) shock waves when $"_d < "_{dc} ("_d > "_{dc})$. We observed the difference of shock wave profile of Burgers equation and KdV-Burgers equation with same parameter.

Keywords: Dusty plasma, Solitary Wave, Shock Wave and Viscosity.

Paper accepted for presentation at UGC Sponsored National Seminar on Plasma Science And Technology On 6th & 7th Nov/2013 Nabajyoti Colle, Barpeta, Assam , India

STUDY OF WATER QUALITY OF THREE MAJOR RIVERS OF BHUTAN

Basant Pradhan[1], Dr.Badal Kumar Mandal[2]

College of Science and Technology, Phuentsholing Bhutan, Royal University of Bhutan
Vellore Institute of Technology University, Tamil Nadu, India

ABSTRACT

The Punatshang Chu, Thim Chu and Pa Chu are rivers located in three different districts of Punakha, Thimphu, and Paro respectively and drain the region of Western Bhutan. These rivers ultimately drain their water in Brahmaputra, which is one of the major rivers that flow through the North East region of India towards Bay of Bengal.

These rivers are of great economic importance since they have been extensively utilized for the generation of hydropower, agriculture and domestic purposes.

This study is based upon short – term data collected between December 07 to April 08 consisting of following parameter that involve pH, conductivity, TDS, turbidity, alkalinity, hardness, DO, BOD_5, COD, chloride, sulphate, phosphate, sodium, potassium, lithium, calcium, lead, chromium from 15 different sampling spots that were selected along the course of these three rivers.

Based on the analysis report the quality of the river water in these rivers is affected by the anthropogenic activities such as unsanitary condition along the banks, improper disposal of solid wastes and the untreated domestic wastewaters discharged directly into them.

Addressing this issue, the quality of water can be improved and further deterioration can be curbed by taking appropriate measures involving the government authority and active community participation.

Keywords: *water quality, pollution*

This paper has been accepted for poster presentation at the international conference on emerging trends in chemical Sciences, 5-7 December 2013, VIT University.

PASSIVE INFRARED (PIR) SENSOR BASED SECURITY SYSTEM

Pema Chodon[1,2], Devi Maya Adhikari[1,3], Gopal Chandra Nepal[1,4], Rajen Biswa[1,5], Sangay Gyeltshen[1,6], Chencho[1,7]

Department of Electronics and Communication Engineering, College of Science and Technology, Phuentsholing, Bhutan[1]

2009059@cst.edu.bt[2], *2009019@cst.edu.bt*[3], *2009023@cst.edu.bt*[4], *2009070@cst.edu.bt*[5], *2009078@cst.edu.bt*[6], *chencho@cst.edu.bt*[7]

ABSTRACT

In this project, a PIR based security system which saves the power consumption and saves the memory space of the recording system has been proposed. It consists of four parts namely power supply, PIR sensor, lighting and recording system. A single phase of 230V, 50 Hz was used as the primary source to the circuit designed. Passive Infrared Radiation (PIR) sensor detects the change in infrared radiation of warm blooded moving object in its detection range. According to the change in IR, there will be a change in the voltages generated which was amplified and used to turn ON the webcam and lighting system through relay. Software was developed and installed in the computer to capture and record the video when the webcam gets turned ON. When an intruder comes in the detection range of the PIR sensor, it actuates the lighting system and the webcam. The software detects the webcam connection; it will start to record and save the video. Once the intruder moves out of detection range of the sensor, the webcam and light gets turn OFF. The software repeats the process. Thus the saves power consumption and the memory space utility of the recording system.

Keywords: *PIR sensor, security system, home security system, thief detection and recording*

Paper has been accepted by the International Journal of Electrical, Electronics and Computer Systems (IJEECS) for Volume 14 Issue 2, 2013 in Australia.

WEBCAM DRIVER TO AUTOMATICALLY RECORD AND SAVE VIDEO CAPTURED WHEN THE WEBCAM IS CONNECTED

Pema Chodon[1,2], Devi Maya Adhikari[1,3], Gopal Chandra Nepal[1,4], Rajen Biswa[1,5], Sangay Gyeltshen[1,6], Chencho[1,7]

Department of Electronics and Communication Engineering, College of Science and Technology, Phuentsholing, Bhutan[1]

2009059@cst.edu.bt[2], 2009019@cst.edu.bt[3], 2009023@cst.edu.bt[4], 2009070@cst.edu.bt[5], 2009078@cst.edu.bt[6], chencho@cst.edu.bt[7]

ABSTRACT

This paper presents the software program developed to be used in Passive Infrared Radiation (PIR) sensor based security system. The software program is developed using Microsoft Visual C++ 2010 and OpenCV 2.4.4 library files. When the PIR sensor detects the object within its detection range, the lighting and recording system simultaneously gets turned ON. The program developed for the recording system is installed in the computer. The program continuously checks if the webcam is ON. If the webcam is detected, the program will start capturing the video. When the object moves out of detection range of PIR sensor, the program turns OFF, consequently saving the video. The program continues to check for the status of the webcam when there is no intruder in the range. The developed software program saves the memory space of the system.

Keywords: *detection, PIR Sensor, recording, security*

Paper has been accepted by IFRSA's International Journal of Computing for Volume 3 Issue 3, 2013 in New Delhi, India.

DUST ACOUSTIC SHOCK WAVES WITH MAXWELLIAN ELECTRONS AND IONS IN WARM DUSTY PLASMA

Apul Narayan Dev[1],*and Jnanjyoti Sarma[2]

1Department of Science and Humanities, College of Science and Technology, RUB, Bhutan.
2Department of Mathematics, R. G. Baruah College, Guwahati-781025, Assam.

apulnarayan@gmail.com, apul@cst.edu.bt

ABSTRACT

The propagation of dust acoustic waves in unmagnetized warm dusty plasma system containing Maxwellian electrons and ions with positive and negative charge dust grains have emerged as an active topic of research in the nonlinear plasma physics area through out the last decades due to its potential application in space and astrophysical plasma as well as in laboratory. Many researchers have studied the Korteweg-de-Vries-Burgers (KdV-Burgers) equation using a set of generalized hydrodynamic (GH) equations by reductive perturbation method [1] and thereby reported the properties of the solitons and shock waves for strongly coupled unmagnetized dusty plasmas [3, 4].

However, in this article the salient features of nonlinear propagation of solitary waves in warm dusty plasmas without viscosity effect for positive and negative dust charge fluctuation have been studied by deriving Korteweg-de Vries-Burgers (KdV-Burgers) equation. The analytical solution of KdVBurgers equation is numerically analyzed and DA shock waves propagation is reported, which could be relevant in case of different space and astrophysical plasmas including Saturn's spokes, F-ring, etc. It is shown and theoretically discussed about the critical dust density *dc n* in Saturn's F-ring and laboratory values for both positive and negative dust charge fluctuation. The effect caused by dispersive and dissipation are also discussed. It is found that the solution of KdV equation represent a rarefactive (compressive) solitary waves if *nd* □*ndc nd* □*ndc* , where *d n* is the dust density and the strength of dispersion term, the Burgers equation represent a negative (positive) shock waves when *d dc d dc n* □*n n* □*n* but with the combination of dispersion and dissipation term, the KdV-Burgers equation represent a positive (negative) shock waves when *d dc d dc n* □*n n* □*n* . The effects of some important parameters for Saturn's F-ring such as 4 3 10 , 2 10 , 10 *e i d T* □*KV T* □□*KV z* □and typical laboratory plasma [4], 3 2 3 9 10 , 3 10 , 3 10 *e i d T* □□*KV T* □□*KV z* □□to the shock wave solution are illustrated from the wave evaluation for both dust positive and negative dust charge fluctuation.

3-D Burgers Equation and KP-Burgers Equation in Dusty Plasma
3rd International Conference On Frontiers of Mathematics & Applications (ICFMA-2014) January 29 – 31, 2014

SUPPORT VECTOR RANDOM FIELD BASED APPROACH TOWARDS OBJECT BASED CLASSIFICATION OF REMOTELY SENSED IMAGERY

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Remote sensing techniques are widely used for land cover classification and related analyses; however the availability of high resolution images has limited the accuracy of pixel based approaches. In this paper, we have analyzed the feasibility of incorporating contextual information to a support machine and have evaluated its performances with reference to the traditional approaches. Accuracy improvement of the proposed approach may be attributed to the effectiveness in combining spatial and spectral information.

Keywords: *Vector machines, object extraction*

Conference: IEEE ISPCC 2014

A WEB BASED SEMI-AUTOMATIC FRAME WORK FOR ASTROBIOLOGICAL RESEARCHES

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Astrobiology addresses the possibility of extraterrestrial life and explores measures towards its recognition. Researches in this context are founded upon the premise that indicators of life encountered in space will be recognizable. However, effective recognition can be accomplished through a universal adaptation of life signatures without restricting solely to those attributes that represent local solutions to the challenges of survival. The life indicators should be modelled with reference to temporal and environmental variations specific to each planet and time. In this paper, we investigate a semi-automatic open source frame work for the accurate detection and interpretation of life signatures by facilitating public participation, in a similar way as adopted by SETI@home project. The involvement of public in identifying patterns can bring a thrust to the mission and is implemented using semi-automatic framework. Different advanced intelligent methodologies may augment the integration of this human machine analysis. Automatic and manual evaluations along with dynamic learning strategy have been adopted to provide accurate results. The system also helps to provide a deep public understanding about space agency's works and facilitate a mass involvement in the astrobiological studies. It will surely help to motivate young eager minds to pursue a career in this field.

Keywords: *Astrobiology, Extra-terrestrial, Remote sensing*

Journal: Elsevier Journal of space sciences and remote sensing

AN INTELLIGENT APPROACH TOWARDS AUTOMATIC SHAPE MODELING AND OBJECT EXTRACTION FROM SATELLITE IMAGES USING CELLULAR AUTOMATA-BASED ALGORITHMS

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Automatic feature extraction has witnessed the use of many intelligent methodologies over the past decade. However, inadequate modeling of feature shape and contextual knowledge has limited the detection accuracy. In this article, we present a framework for accurate feature shape modeling and contextual knowledge representation using advanced techniques such as Vector Machines, Cellular Neural Network (CNN), coreset, and Cellular Automata (CA). CNN was found to be effective in modeling different complex features, and the complexity of the approach was considerably reduced using corset optimization. Spectral and spatial information was dynamically combined using adaptive kernels when representing contextual knowledge. The methodologies were compared with contemporary methods using different statistical measures. Application of the algorithms to satellite images revealed considerable success. The methodology was also effective in providing intelligent interpolation and interpretation of random features.

AN EVOLUTIONARY COMPUTING FRAME WORK TOWARD OBJECT EXTRACTION FROM SATELLITE IMAGES

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Image interpretation domains have witnessed the application of many intelligent methodologies over the past decade; however the effective use of evolutionary computing techniques for feature detection has been less explored. In this paper, we critically analyze the possibility of using cellular neural network for accurate feature detection. Contextual knowledge has been effectively represented by incorporating spectral and spatial aspects using adaptive kernel strategy. Developed methodology has been compared with traditional approaches in an object based context and investigations revealed that considerable success has been achieved with the procedure. Intelligent interpretation, automatic interpolation, and effective contextual representations are the features of the system.

Keywords: *evolutionary computing, object extraction, interpretation*

Journal: IEEE Transactions of Geosciecne& Remote sensing

A COMPARATIVE ANALYSIS ON THE APPLICABILITY OF ENTROPY IN REMOTE SENSING

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Entropy is the measure of uncertainty in any data and is adopted for maximisation of mutual information in many remote sensing operations. The availability of wide entropy variations motivated us for an investigation over the suitability preference of these versions to specific operations. The popular available versions like Tsalli's, Shannon's, and Renyi's entropies have been analysed in context of various remote sensing operations namely thresholding, clustering and registration. These methodologies have been evaluated with reference to the study area using different statistical parameters. Renyi's entropy has been found to be suitable for image registration purpose followed by Tsalli's and Shannon; whereas Tsalli's entropy has been found preferable for thresholding and clustering.

Keywords: *Entropy, remote sensing, thresholding*

Journal: Springer Indian Journal of Remote sensing

A SEMANTIC PARSING APPROACH FOR BHUTANESE LANGUAGE OF DZONGKHA

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Developments in the computational analysis of Dzongkha have been limited due to the syntactic complexity of the language. Though the natural language processing domains have witnessed rapid developments over the past decade; very few works has been done in Dzongkha despite of being the national language of Bhutan. In this paper, we have investigated the major problems in Dzongkha processing and have proposed a semantic parsing approach for effective processing of this language. We have used a probabilistic approach and have used the linguistic rules in Dzongkha to remove the ambiguities. Semantic representations along with belief net concepts have been used to increase the accuracy of segmentation, syntactic and semantic analyses. The proposed frame work has been able to solve the major issues related to Dzongkha processing, however needs to be further improved to include all the syntactic variations.

Keywords: *Parsing, Dzongkha, semantics*

Journal: Springer International Journal of Speech technology

INTELLIGENT ADAPTIVE RESAMPLING TECHNIQUE FOR THE PROCESSING OF REMOTELY SENSED IMAGERY

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Resampling techniques are being widely used at different stages of satellite image processing. The existing methodologies cannot perfectly recover features from a completely undersampled image and hence an intelligent adaptive resampling methodology is required. We address these issues and adopt an error metric from the available literature to define interpolation quality. We also propose a new resampling scheme that adapts itself with regard to the pixel and texture variation in the image. The proposed cellular neural network (CNN)-based hybrid method has been found to outperform existing methods as it adapts itself with reference to the change in sub pixel variation.

Keywords: *adaptive resampling, CNN, image pre-processing*

Journal: Taylor & Francis Annals of GIS

A BI-LINGUAL APPROACH TOWARDS DZONGKHA PARSING

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

We describe how simple, commonly understood statistical models, such as statistical dependency parsers, probabilistic context-free grammars, and word-to-word translation models, can be effectively combined into a unified bilingual parser that jointly searches for the best English parse, Dzongkha parse, and word alignment, wherethese hidden structures all constrain each other. The model used for parsing is completely factored into the two parsers and the TM, allowing separate parameter estimation. We evaluate our bilingual parser on the Penn DzongkhaTreebank and against several baseline systems and show improvements parsing Dzongkha with very limited labeled data.

Keywords: *context free grammar, Dzongkha, parsing, bi-lingual parsing*

Journal: ACM Transactions on computational linguistics

A SEMIAUTOMATIC FOREST MANAGEMENT APPROACH USING REMOTE SENSING TECHNIQUES

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Remote sensing satellite images are effectively used as a tool for decision making in various fields, especially in forest management and related analyses. Different geospatial parameters are required for effective decision making and the possibility of an integrated framework for automation of various analyses has been investigated. Advanced web mining and intelligent techniques have been adopted for the development of a comprehensive open-source framework for this purpose. The effectiveness of the developed methodology has been discussed and illustrated with reference to study areas using various statistical parameters. Adoption of a cellular neural network (CNN) for feature modeling and open-source data for automatic mining seemed to be effective. The developed methodologies were found to outperform existing ones with regard to accuracy and complexity. Investigations revealed that use of CNN is very effective in shape modeling, and improves accuracy of detection.

Keywords: *remote sensing, mining, forest*

Journal: Taylor & Francis Journal of Forest Technology

A COMPARATIVE ANALYSIS OF DIFFERENT DEM INTERPOLATION METHODS

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Visualization of geospatial entities generally entails Digital Elevation Models (DEMs) that are interpolated to establish three dimensional co-ordinates for the entire terrain. The accuracy of generated terrain model depends on the interpolation mechanism adopted and hence it is needed to investigate the comparative performance of different approaches in this context. General interpolation techniques namely Inverse Distance Weighted, kriging, ANUDEM, Nearest Neighbor, and Spline approaches have been compared. Differential ground field survey has been conducted to generate reference DEM as well as specific set of test points for comparative evaluation. We have also investigated the suitability of Shuttle Radar Topographic Mapper Digital Elevation Mapper for Indian terrain by comparing it with the Survey of India (SOI) Digital Elevation Model (DEM). Contours were generated at different intervals for comparative analysis and found SRTM as more suitable. The terrain sensitivity of various methods has also been analyzed with reference to the study area.

Keywords: *DEM, interpolation, ANUDEM, kriging*

Journal: Elsevier: Journal of Remote sensing & Space sciences

A TERRAIN-BASED HYBRID APPROACH TOWARDS DEM INTERPOLATION

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

3D visualization in remote sensing generally adopts digital elevation models (DEMs) that are interpolated to establish 3D co-ordinates for the entire terrain. The accuracy of the generated terrain models depends on the type of interpolation mechanism adopted. Generally available methods in this context use point data values and their distribution; however, terrain characteristics such as shape are not generally considered in the interpolation. We propose an adaptive interpolation strategy that considers the terrain features for improving the estimation accuracy. In this research, we have compared the proposed approach with different contemporary interpolation techniques, such as inverse distance weighting, kriging (KRG), nearest neighbour and spline methods. Comparative analysis of the proposed technique with contemporary approaches revealed that considerable success has been achieved with the procedure. Investigations have also been done to analyse the sensitivity of the approach to terrain smoothness.

Keywords: *Hybrid, terrain, DEM, interpolation*

Journal:IEEE Transactions of Geo Science & Remote sensing

GLACIAL LAKE MONITORING AND HAZARD ASSESSMENT USING MULTIPLE SATELLITE DATASETS

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Detection of glacial lakes has become a concern for the researchers due to its rapid changing nature and triggering of calamities causing outbursts. Assessment of glacial lakes for potential outburst requires thorough analysis of the glaciers as well as other conditions for which remote sensing technique can be used. However multispectral data alone cannot suffice the purpose due to the miss classifications caused by shadow cast as well as turbidity variance. In this paper we investigate how low spatial resolution hyperspectral data can be used with multispectral image to achieve effective glacial lake detection and hazard assessment. An evolutionary computing approach is suggested to predict the hazardous glaciers and has been found to be accurate with reference to the state of art inventories. We have concentrated on only a few causes of outbursts due to restricted availability of data and further investigations are needed for modeling more causes so as to improve the accuracy.

Keywords: *multispectral, hyperspectral, glacial lake, GLOF*

Journal: Journal of Photogrammetry & Remote sensing, American Society of Photogrammetry & remote sensing

AN INVESTIGATION OVER THE MODELING OF WATER SCARCITY USING LAND COVER AND DRAINAGE PATTERN ALTERNATIONS

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Developing countries that are primarily agrarian economies are suffering from the random outbreaks of droughts. Prediction of the water scarcity at least to an extent can help in effective planning and hence to reduce the gaps in scientific understanding. The interdependency among the determination factors suggests possible modeling of these outbreaks based on land cover. Empirical observations over 20-30 years have suggested that the land cover alternations play a key role in determining the alternations of stream flow as well as ground water prospects. In this paper we suggest the use of evolutionary computing techniques for modeling the change in water prospects and thereby effective prediction of droughts. Evaluation of the approach over 12 sub regions in three distinct parts of the Indian subcontinent revealed a high accuracy of prediction.

Keywords: *drought prediction, stream, drainage pattern, water scarcity, land cover*

Journal: Nature Climate change

A CNN BASED HYBRID APPROACH TOWARDS AUTOMATIC IMAGE REGISTRATION

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Image registration is a key component of various image processing operations which involve the analysis of different image data sets. Automatic image registration domains have witnessed the application of many intelligent methodologies over the past decade; however inability to properly model object shape as well as contextual information had limited the attainable accuracy. In this paper, we propose a framework for accurate feature shape modeling and adaptive resampling using advanced techniques such as Vector Machines, Cellular Neural Network (CNN), SIFT, coreset, and Cellular Automata. CNN has found to be effective in improving feature matching as well as resampling stages of registration and complexity of the approach has been considerably reduced using corset optimization The salient features of this work are cellular neural network approach based SIFT feature point optimisation, adaptive resampling and intelligent object modelling. Developed methodology has been compared with contemporary methods using different statistical measures. Investigations over various satellite images revealed that considerable success was achieved with the approach. System has dynamically used spectral and spatial information for representing contextual knowledge using CNN-prolog approach. Methodology also illustrated to be effective in providing intelligent interpretation and adaptive resampling.

Keywords: *CNN, image registration, remote sensing, vector machines*

Journal: Journal of Photogrammetry & Remote sensing, American Society of Photogrammetry & remote sensing

GEOINT TOOL FOR WAR GROUNDS: A GENERALIZATION

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

An Automatic Tool for Geointelligence from Remotely Sensed Imagery Geospatial intelligence involves exploitation of imagery and geospatial information to describe, assess, and visually depict physical features and geographically referenced activities on the earth. It integrates various disciplines to provide innovative, versatile and comprehensive solutions for meeting today's demanding intelligence requirements. Geospatial intelligence Preparation of the Environment (GPE) process which is adopted for the development of GEOINT products is a systematic four-component process. It is adapted from the military specific approach to include civilian non-traditional threat problems and may be used for military operations as well as non-battlefield actions such as disaster relief, noncombatant evacuations, general security requirements etc. In this paper, we propose a framework for automation of GEOINT development process using advanced techniques such as Vector Machines, Cellular Neural Network (CNN), SIFT, coreset, and Cellular Automata. Automatic translation of image in to interpretable data form will enhance the automation of various GPE components and facilitate the reduction of information extraction time, manual dependency and error rates. Analytic conclusions can be inferred automatically using intelligent interpretation systems which will simulate human experts. Salient features of this work are automation of different analyses, effective contextual modelling, image compatible rule representation, random feature modelling, intelligent interpretation, and automatic interpolation. Frame work also facilitates the use of spectral and spatial information for representing contextual knowledge using CNN-prolog approach. Developed methodology has been compared with contemporary methods using different statistical measures. Investigations over various satellite images revealed that considerable success was achieved with the approach.

Keywords:*Geointelligence, disaster relief, GPE, combat*

Conference: Geo-intelligence India, 2013

AN ENHANCED NEURAL NETWORK BASED APPROACH TOWARDS OBJECT EXTRACTION

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

The improvements in spectral and spatial resolution of the satellite images have facilitated the automatic extraction and identification of the features from satellite images and aerial photographs. An automatic object extraction method is presented for extracting and identifying the various objects from satellite images and the accuracy of the system is verified with regard to IRS satellite images. The system is based on neural network and simulates the process of visual interpretation from remote sensing images and hence increases the efficiency of image analysis. This approach obtains the basic characteristics of the various features and the performance is enhanced by the automatic learning approach, intelligent interpretation, and intelligent interpolation. The major advantage of the method is its simplicity and that the system identifies the features not only based on pixel value but also based on the shape, haralick features etc of the objects. Further the system allows flexibility for identifying the features within the same category based on size and shape. The successful application of the system verified its effectiveness and the accuracy of the system were assessed by ground truth verification.

Keywords: *neural network, object extraction, image analysis*

Journal: Journal of International Journal of Photogrammetry and Remote Sensing

COMPARATIVE ANALYSIS OF COMMON EDGE DETECTION TECHNIQUES IN CONTEXT OF OBJECT EXTRACTION

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Edges characterize boundaries and are therefore a problem of fundamental importance in image processing and particularly in automatic feature extraction. In this paper a comparative study of various edge detection techniques and band wise analysis of these algorithms in the context of object extraction with regard to remote sensing satellite images from the Indian Remote Sensing Satellite (IRS) sensors LISS-III, LISS-IV &Cartosat-I as well as Google Earth is presented. The comparison has been done between commonly used edge detection algorithms like Sobel, Canny, Prewitt, Roberts, Laplacian and Zero Crossing. Analysis results have shown that the Canny's algorithm is best suitable for the object extraction in most contexts due to fact that it yields less number of false edges, while Sobel is also a good option with lesser time and space complexity. The band wise analyses of the algorithms have also been done to find the suitability of band for the extraction of various features and it has been observed that linear features like roads, railway lines etc. can be detected more efficiently using infrared wavelength range images.

Keywords: *edge detection, object extraction, gradient*

Journal: Journal of International Journal of Photogrammetry and Remote Sensing

EFFECTIVE FOREST FIRE MANAGEMENT USING RS TECHNIQUES

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Remote sensing is effectively used as a tool for decision making in various fields, especially in forest management because of its spatial analysis and display capabilities. Conservation of forests in an era of urban growth is a critical task that requires effective integrated analyses. Forest fires, both natural as well as artificial, are a threat to the environment and hence should be effectively alleviated. Earth observation techniques are increasingly used for the purposes as it provides a bird eye view of the situation. Different geospatial parameters are required for effective decision making and a comprehensive approach is needed to intelligently integrate data from different sources.

We have investigated the possibility of an integrated frame work to explore reliable semiautomatic modelling of random features and phenomenon for effective forest fire management. The proposed approach will explore the use of evolutionary computing as well as artificial intelligence techniques for integrated forest fire management using open source strategies and enhance civic involvement in the task. Review of various literatures revealed the lack of a comprehensiveapproach for facilitating accurate decisions. Monitoring, prevention, management and prediction of forest fires require accurate interpretation of voluminous data, making manual approach literally inadequate. Effectiveness of image based decision strategies has been limited due to the difficulties in modeling contextual knowledge as well as shape of features. We have used inverse mapping of Celluar Automata for accurately modelling feature shapes and contexts. Adaptive kernel strategy along with SVRF has been used for exploiting the n-dimensional classifier concept for achieving an unsupervised strategy. Main obstruct in the modelling of features using CNN approach was increased computational complexity, which has been tackled using coreset based aproximation. Involvement of public in giving inputs regarding forest fires can bring a thrust to the mission; however lack of skill may be a matter of concern. This has been made good by using a semiautomatic framework where machine and man will work side by side thus integrating the rational nature of man with the acquired skill of machine. Spectral and spatial

information has been dynamically combined using adaptive kernel trick for representing contextual knowledge.

Developed techniques have been compared with contemporary methods with reference to various data sets using different statistical parameters. Investigations over various satellite images and study areas revealed that considerable success has been achieved with the procedure. Methodology also illustrated to be effective in providing intelligent interpolation and interpretation of random features and phenomenon. We have presented a basic frame work which can be further improved using additional parameters.

Keywords: *Cartography & Geospatial Technologies, Prediction, Drought*

Conference: International Congress on Integrated Decentralized Planning: Geospatial Thinking, ICT & Good Governance

AN INTEGRATED FOREST MANAGEMENT APPROACH

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Remote sensing is effectively used as a tool for decision making in various fields, especially in forest management because of its spatial analysis and display capabilities. We have investigated the possibility of an integrated semiautomatic frame work for automation of various analyses related to fire management. Advanced web mining and intelligent techniques namely support vector machine, cellular neural networks, corset etc have been adopted for effective fire spread modeling, feature detection, context modeling and decision support. Spectral and spatial information has been dynamically combined using adaptive kernel trick for representing contextual knowledge. Developed techniques have been compared with contemporary methods with reference to various data sets using different statistical parameters. Investigations over various satellite images and study areas revealed that considerable success has been achieved with the procedure.

Keywords: *forest management, modeling, mining*

Conference: 9thEARSeL Forest Fire Special Interest Group Workshop

A SETI APPROACH TOWARDS EXTRA-TERRESTRIAL REMOTE SENSING

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Astrobiology addresses the possibility of extraterrestrial life and explores measures towards its recognition. Researches in this context are founded upon the premise that indicators of life encountered in space will be recognizable. However, effective recognition can be accomplished through a universal adaptation of life signatures without restricting solely to those attributes that represent local solutions to the challenges of survival. The life indicators should be modelled with reference to temporal and environmental variations specific to each planet and time. In this paper, we investigate a semi-automatic open source frame work for the accurate detection and interpretation of life signatures by facilitating public participation, in a similar way as adopted by SETI@home project. The involvement of public in identifying patterns can bring a thrust to the mission and is implemented using semi automatic framework. Different advanced intelligent methodologies may augment the integration of this human machine analysis. Automatic and manual evaluations along with dynamic learning strategy have been adopted to provide accurate results. The system also helps to provide a deep public understanding about space agency's works and facilitate a mass involvement in the astrobiological studies. It will surely help to motivate young eager minds to pursue a career in this field.

Keywords: *SETI, extra-terrestrial, remote sensing*

Conference: International Astronomical congress 2013

AN OPEN SOURCE STRATEGY TOWARDS THE DEVELOPMENT OF A GEO SPATIAL FRAME WORK IN PUBLIC HEALTH DOMAIN

Arun P.V.

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Remote sensing techniques are turning earth in to new frontier by driving deeper understanding of earth's complex systems in a way that will greatly improve our predictive capability and bring vital societal benefits to people around the globe. The economic feasibility and flexibility of EO data have made it increasingly available to the global community. However these data collected is just a fraction of what could be put to excellent, perhaps lifesaving use in every region of world. The lack of comprehensive integrated approach had led to gaps in scientific understanding and hence affected various applications. An integrated approach towards the use of remote sensing data for decision making is needed in various fields, especially in medical research and health care analyses.

Earth science application to public health varies from infectious disease mapping to emergency preparedness and response planning. Epidemiologists, public health professionals and medical geographers have traditionally used maps, when analyzing associations between location, environment, and diseases. GIS is particularly well suited for studying these associations because of its spatial analysis and display capabilities.Different geospatial parameters such as land cover, NDVI, drainage, settlement, environmental parameters, land cover etc. have been used for various health related analysis. The globally available EO data should be integrated and transformed to useful information that can be accessed by physicians across the world, thus enabling them to use it as a tool for effective medication. The web mining technology along with the recent intelligent techniques can be effectively used to build an automatic frame work in public health domain, thus integrating different sources of EO data to derive useful information.

In this paper we propose an open source geospatial frame work for supporting various analyses in public health domain using data mining, web GIS and artificial intelligence techniques. Methodology exploits the automatic analysis of different earth observation data available online so as to provide relevant information to the public health professionals. A web based interface is developed which can be readily accessed by the physicians around the globe and the system automatically uses openly available geospatial data (say from USGS) for extracting the required information. The open source web GIS techniques are well exploited to provide a proper geo visualization of the data. The system has been tested over sample patient data available from NIMHANS and proved to facilitate the representation of various analyses in addition to diagnostic as well as predictive support.

Keywords: *SETI, extra-terrestrial, remote sensing*

Conference: International Astronomical congress 2013

GRAPH BASED APPROACH FOR EFFECTIVE SEGMENTATION IN DZONGKHA

Arun P.V&ParsuramDhungyel

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

In this paper we show how linguistic knowledge can be incorporated during graph based parsing. We use MSTParser and show that the use of a constraint graph, instead of a complete graph, to extract a spanning tree improves parsing accuracy. A constraint graph is formed by using linguistic knowledge of a constraint based parsing system. Through a series of experiments we formulate the optimal constraint graph that gives us the best accuracy. These experiments show that some of the previous MSTParser errors can be corrected consistently. It also shows the limitations of the proposed approach.

Keywords: *NLP, segmentation, Dzongkha*

Journal:ACM transactions on Asian languages

DEPENDENCY APPROACH FOR RESOLVING ISSUES IN PARSING OF DZONGKHA

Arun P.V&Tshering

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

In this paper, we present our approach towards dependency parsing of Dzongkha language using mapping segments to English. Our approach includes the effect of using different settings available in Malt Parser following the two-step parsing strategy i.e. splitting the data into inter-Chunks and intra-Chunks to obtain the best possible LAS1 UAS2 and LA3 accuracy. Our system achieved best LAS of 91.33% for Gold Standard track and second best LAS of 87.23% for automated data.

Keywords: *NLP, image translation*

Journal:IEEE Expert

SPATIAL ANALYSIS IN PUBLIC HEALTH DOMAIN: AN NLP APPROACH

Arun P.V&Tshering

Department of Information Technology, College of Science and Technology, Royal University of Bhutan, Phuentsholing, Bhutan.

arunpv@cst.edu.bt

ABSTRACT

Remote sensing products are effectively used as a tool for decision making in various fields, especially in medical research and health care analyses. GIS is particularly well suited in this context because of its spatial analysis and display capabilities. The integration of RS techniques in public health has been categorised as continuous and discrete strategies where latter is preferred. We have investigated the integration of these approaches through linguistic interpretation of images. In this paper, we propose a framework for direct natural language interpretation of satellite images using probabilistic grammar rules in conjunction with evolutionary computing techniques. Spectral and spatial information has been dynamically combined using adaptive kernel strategy for effective representation of the contextual knowledge. The developed methodology has been evaluated in different querying contexts and investigations revealed that considerable success has been achieved with the procedure. The methodology has also demonstrated to be effective in intelligent interpolation, automatic interpretation as well as attribute, topology, proximity, and semantic analyses.

Journal:IEEE JSTARS

Keywords: *NLP, image translation*

DUST ACOUSTIC SHOCK WAVES WITH NON-THERMAL IONS IN A 3-DIMENTIONAL DUSTY PLASMA

Apul Narayan Dev[1,*] and Jnanjyoti Sarma[2]

[1]*Department of Science and Humanities, College of Science and Technology, RUB, Bhutan.*
[2]*Department of Mathematics, R. G. Baruah College, Guwahati-781025, Assam.*
apul@cst.edu.bt

ABSTRACT

The propagation of dust acoustic waves in magnetized dusty plasma system containing non-thermal ions and Maxwellian electrons with positive and negative charge dust grains have emerged as an active topic of research in the nonlinear plasma physics area through out the last decades due to its potential application in space and astrophysical plasma as well as in laboratory. Many researchers have studied the Korteweg-de-Vries-Burgers (KdV-Burgers) equation using a set of generalized hydrodynamic (GH) equations by reductive perturbation method and thereby reported the properties of the solitons and shock waves for strongly coupled magnetized dusty plasmas. However, in this article the salient features of nonlinear propagation of solitary waves in warm dusty plasmas without viscosity effect for positive and negative dust charge fluctuation have been studied by deriving Korteweg-de Vries-Burgers (KdV-Burgers) equation. The analytical solution of KdV-Burgers equation is numerically analyzed and DA shock waves propagation is reported, which could be relevant in case of different space and astrophysical plasmas including Saturn's spokes, F-ring, etc. It is shown and theoretically discussed about the critical dust density n_{dc} in Saturn's F-ring and laboratory values for both positive and negative dust charge fluctuation. The effect caused by dispersive and dissipation are also discussed. It is found that the solution of KdV equation represent a rarefactive (compressive) solitary waves if $n_d < n_{dc}$ ($n_d > n_{dc}$), where n_d is the dust density and the strength of dispersion term, the Burgers equation represent a negative (positive) shock waves when $n_d < n_{dc}$ ($n_d > n_{dc}$) but with the combination of dispersion and dissipation term, the KdV-Burgers equation represent a positive (negative) shock waves when $n_d < n_{dc}$ ($n_d > n_{dc}$). The effects of some important parameters for Saturn's F-ring such as $T_e = 10^4$ KV, $T_i = 2 \times 10^3$ KV, $z_d = 10$ and typical laboratory plasma [4], $T_e = 9 \times 10^3$ KV, $T_i = 3 \times 10^2$ KV, $z_d = 3 \times 10^3$ to the shock wave solution are illustrated from the wave evaluation for both dust positive and negative dust charge fluctuation.

Keywords: *plasma, charge dust, hydrodynamic*

Accepted for poster presentation at 28th National Symposium on Plasma Science & Technology (PLASMA 2013), 3-6 December, 2013, 3-6 December 2013. KITT University, Bhubaneshwar (Odisha)

ANALYSIS AND EVALUATION OF MASS TRANSIT IN PHUENTSHOLING

Yadu Prasad Acharya[1,2], Bikash Sharma[1,3], Karuna Chhetri[1,4], Tshering Lhendup[1,5], Sangey Pasang[1,6]

Department of civil engineering, College of Science and Technology, Royal University of Bhutan, Phuenstholing, Bhutan[1]

yaduprasad467@gmail.com[2], bekay_sharma@yahoo.com[3], karuna.chhetri@gmail.com[4], tsheringlhendup@yahoo.com[5], sangey@cst.edu.bt[6]

ABSTRACT

This paper aims to study the existing mass transit system serving Pasakha, and proposes a new bus mass transit in the areas of the city which previously did not have access to mass transit. A general observational study is carried out to understand the structure of current mass transit system followed by customer satisfaction survey and boarding and alighting count to assess the current system. The market research survey was conducted to prominent commuters such as students, office goers and hospital goers to find the willingness to shift from current mode of transport system to mass transit. The scope for mass transit in the city has been analyzed with the help of questionnaires and by studying the travel characteristics of the target group. The results of the studies reveal that the current mass transit is far from adequate, the service coverage is very low and users are dissatisfied with the overall performance of the current system. There is also a great deal of potential for mass transit in the city core and its vicinity. In this context, it can be concluded that installing bus mass transit in the city can be regarded as a step towards a sustainable transport system with less environmental impact compared to private vehicles. Bus schedule and route maps have been developed based on the surveys conducted which also incorporates the current system. As an additional measure, it is recommended to bring forward better policy measures that can reduce private vehicle ownership and attract more people towards mass transit.

Keywords: *Mass Transit, Boarding, Alighting, Trip, Schedule.*

Published and Presented in *6th ATRANS Symposium- Young Researcher's Forum* on 23rd August 2013 at Bangkok Thailand. Paper identification number: YRF13-035