Extraction of Various Features from Satellite Image Data using Supervised and Unsupervised Classification Techniques and Threat Alerts Generations for Emergency Management

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Abstract

Andrapradesh is the one of the most important state in India and most of the area covered with coastal line of 974 km (605 mi) with jurisdiction over nearly 15,000 km2 territorial water and this state is the one of the state is the eighth largest state in India covering an area of 162,970 km2(62,920 sq mi). The satellite image data is very large size that means Terabytes of information stored, it includes various patterns and also includes various features like mangrove, water bodies and mining lands, agriculture lands, aquaculture lands were delineated using various classification techniques. In this context, various land use and various features disable threats can be classified and also providing alert services for the emergency management for the future generations using various supervised and unsupervised classification algorithms with various threshold values, we can classifying the data with various visual interpretation techniques and also providing good accuracy and compare the current technique accuracy with previous classification technique accuracy .In the previous classification for satellite data using various supervised classification techniques got accuracies of 78.53% respectively. In the present classification method will proposing the combination of both supervised and unsupervised classification with the good accuracy of 95% with Kmeans and c4.5 with parametric and non parametric regression techniques with Land Use and Land Cover Methods(LULC) with good Data Processing technique with scalable Result

Keywords: SatelliteImage,C4.5,LULC,VisualInterpretation,Regression

1. Introduction

Satellite image data producing terabytes of information .This terabytes of information includes various formats like images,textdata and also includes different dimensionalities. This is called the Big data challenging issue. Feature selection is a process that selects a subset of original features. In view of these difficulties, the more consolidated research in Image Analysis performs two basic steps which are: detections of features that result both in the features of interest and the false positives that arise from protrusions in the images such as holes that can be caused by shadows and / or cars on the roads and boats or misclassification in the case of rivers; the second step is the refinement of the results that occurs based on a priori knowledge of the feature of interest, this knowledge is spatial and / or spectral (SAMUEL et al., 2012).

The data processing and classification is very big problem. In the computer world this type of data processing and classification depends up on various techniques. the data classification mainly concentrating on various machine learning algorithms. By using these algorithms we can classify the data and we can provide accurate results in a scalable mannaer.The classification mainly depends up on two types those are supervised and unsupervised techniques. by using these techniques we can extract various features from the given data. Some of the features are visible features and some of the features are invisible features both can be categorized and clustered by using various cluster techniques. The decision tree will classifying the features very perfectly and also determines the impact of those features. Some times some of the features are very important to the nature otherwise more damage will occur to the nature .If any feature is reducing due to the reduction more erosion will occur.

2. Study Area

In Andrapradesh mangrove forests spread in 27,661 hectares in Krishna delta but most of the are is under threat because fisher man community living in the coastal areas. Most of the areas costal lines having farm hoses and restaurants . The above all can be possible only at destruction of mangrove forests. Due to destruction the climate conditions will change and automatically temperature will increase during summer period nearer to coastal line people. If any situation , feature destruction will comes those alert services can provide by using classification algorithms.

3. Data Analysis by using Learning Algorithms

Classification is a Machine learning technique. The objective of this technique is building a perfect class models for the given data sets and generating accurate and scalable results in a timely manner. with reference of predictive attributes feature selection

can be classifies and categorized by using [1]. supervised, semi-supervised, and unsupervised machine learning techniques. For the classification feature relevance is also very important then only we can learn the data very accurately. In this we are predicting Feature subsets.
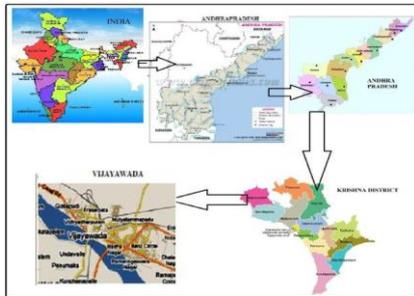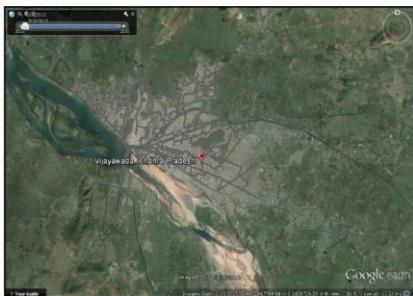

Fig II.1: Study Area

Fig II.2: Andrapradesh Google Map from Google Earth

3.1 Supervised Learning Selection

In this technique class labels are allowed by using class   labels data can be classified that means Known features we can extract. for example water bodies those labels marked by using Gain and Gini Index ratios by using C4.5 Decision Tree algorithm[12].

For the above problem, Data processing taking   Landsat images of TM and ETM+ of Andrapradesh data collected from USGS Earth Explorer web site[5].Before going to classification first preprocessing the data ,this can be applied to classification techniques by using supervised and unsupervised learning methods. Humans are living on the earth. But changes on the earth land use and land cover is the very crucial factor. If any feature will change lot of problems faced by the humans and the eco observations of land that includes, plants and water land soil all are satisfies the vegetation Indexes and fulfill the human needs. In the present days so many land changes are there due to heavy garbage and polluting the entire earth. By using satellite image data classifying all these problems and proving threat alert services to the future generations.

In the proposed research K-nearest neighbors with c4.5 algorithm used for the data classification. In the previous research Land cover classified by modified K nearest neighbors technique in[3]. Using Bayesian, support vector machines, k-nearest neighbor techniques classified the data and compared accuracy parameter and they got 93% accuracy. Various methods used for Extraction of coastal area for sea shoreline in the Andrapradesh. region segmentation technique and thresholding methods are used for Coastline extraction in[4].Edge detection technique is also a very classified data model [6].

3.2 Unsupervised Learning Selection

Kmeans   clustering is the one of the unsupervised learning method. It grouping the similar items in to one group .If any group Cluster is missed depends up on centroid calculation . ISODATA clustering algorithm[16] which is built in the ERDAS Imagine

will classify according the number of classes required and the digital number of the pixels available.

4. Proposed Methodology

Combination of supervised and unsupervised with visual interpretation techniques with land cover and use methodology proposing .effective classification for the feature extraction and reduction threat alert services can automatically generate. Mangrove trees disappearance is a very serious climate change conditions and increasing humidity factor. New Architecture generating alert services in an effective manner. Basic theme of this research was to evaluate satellite imagery as a tool for monitoring changes in features like mangrove forests in Krishna delta Andrapradesh and the secondary objective was to evaluate training sample size on classification accuracy. Both Maximum Likelihood Classifier (MLC) and Support Vector Machine (SVM) with C4.5 classification techniques were employed to classify features like mangroves and other land cover types in IM using time series Landsat Thematic Mapper (TM) from Earth Science(2017. Changes in the features and the impact of land cover over a period of years (1989–2017). Studies of feature reduction is one of the important factor for development of a Krishna delta coastline and implementation of future plan for the feature reduction and   conserving mangrove resources in Andrapradesh for Krishna delta.
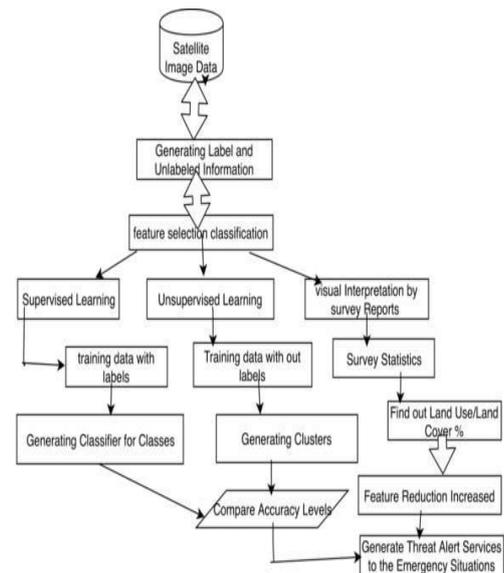

Fig IV.1: Flow Chart For Proposed Architectur

5. Data used for Feature Extraction and LU/LC

According to Land Use Land cover changes Andrapradesh state is the very popular one, it includes costal   lines and urbanization ,vegetation lands, mining lands and some land belongs to wet lands. Usage of Land is very high because of human luxurious point of view some features are reducing like mangrove forests, increasing Aqua Lands due to all temperature and humidity factor automatically increasing. Continuously monitor Land Use and Land Cover Changes by using various methods[1].In the proposed research monitor these changes and if change factor is high provides alert services for the emergency management for the future generations.Landuse and land cover   identify the environmental changes and future predections.Depends up on various parameters C4.5 Classification can classifies the data and some of the classes classified effectively by the MLC,SVM classification methods. More classes can be classified and

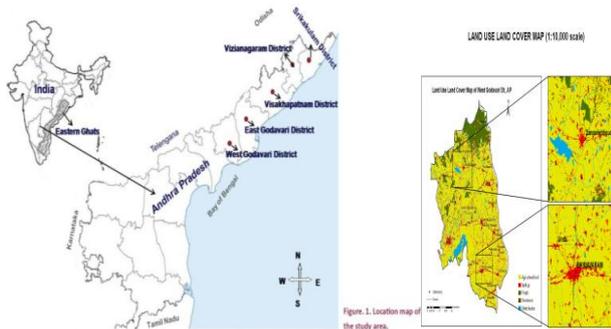combining other techniques will get accurate results all these results compare with Kappa coefficients [11].

Fig V.1: Study Area Map for feature Extraction Fig V.2 Land Use /Land Cover

Andrapradesh satellite image data used with resolution of 31m with 242 bands .Image was Processed of 6 bands. Training samples are collected for all classes from the image and classified with various classification methods.
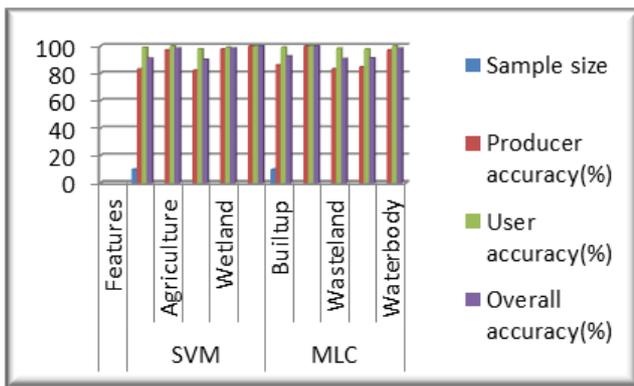
Classification Accuracies Comparisons

Fig V.3: Classification Accuracy Comparison Chart

Table 1. Comparison of Classification Accuracies

Classification Technique	L1 Classes Features	Producer accuracy(%)	User accuracy(%)	Overall accuracy(%)
SVM	Builtup	83.15401	98.99646	91.07524
	Agriculture	96.92348	99.91343	98.41845
	Wasteland	82.25342	97.89243	90.07293
	Wetland	97.78345	99.12987	98.45666
	Waterbody	100	99.91325	99.95662
				95.51593
MLC	Builtup	86.23456	99.19234	92.71345
	Agriculture	99.9923	99.92351	99.95791
	Wasteland	83.24562	98.3421	90.79386
	Wetland	84.62135	97.84321	91.23228
	Waterbody	96.92345	100	98.46173
				95.58759

6. Conclusion

In this study various features extracted and land use land cover impact can be assessed through Supervised and unsupervised classification techniques with reference of previous Research Methodologies. Land Use land cover factor is high because of population increment and technology growth. All factors considered through this assessment if any feature reduction is there those alert services developing in the future work depends up on Coastal Vulnerability Indexing[18]. The Techniques of SVM,MLC are the efficient classifiers including all some univarient and multivariate tests conducted through R language .Test accuracy compared with Kappa statistics coefficient.

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References

[1] K.Sundara kumar,(2011), "Assessment of Urban Noise Pollution in Vijayawada City, A.P, India", International Journal of Earth Scienceand Engineering, 4(6): 459-463

[2] K. C. Seto, C. E. Woodcock, C. Song, X. Huang, J. Lu And R. K. Kaufmann,(2002), Monitoring land-use change in the Pearl River Delta using Landsat TM, Int. J. Remote Sensing, Vol. 23, No. 10, 1985–2004.

[3] Luis Samaniego 1 and Karsten Schulz2 "Supervised Classification of Agricultural Land Cover Using a Modified k-NN Technique (MNN) and Landsat Remote Sensing Imagery" in Remote Sens. 2009, 1, 875-895;doi:10.3390/rs1040875

[4] V. Paravolidakis a, K. Moirogiorgou a, L. Ragia b, *, M. Zervakis a, C. Synolakis b," COASTLINE EXTRACTION FROM AERIAL IMAGES BASED ON EDGE DETECTION" in ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume III-8, 2016 XXIII ISPRS Congress, 12–19 July 2016, Prague, Czech Republic

[5] Dellepiane, S., De Laurentiis, R. and Giordano, F., 2004. Coastline extraction from SAR images and a method for the evaluation of the coastline precision. Pattern Recognition Letters, 25(13), pp. 1461-1470.

[6] Liu, H. and Jezek, K., C., 2004. Automated extraction of coastline from satellite imagery by integrating Canny edge detection and locally adaptive thresholding methods. International Journal of Remote Sensing 25(5), pp. 937–958.

[7] Kasturi Devi Kanniah 1,*, Afsaneh Sheikhi 1, Arthur P. Cracknell 2, Hong Ching Goh 3, Kian Pang Tan 1, Chin Siong Ho 4 and Fateen Nabilla Rasli 1" Satellite Images for Monitoring Mangrove Cover Changes in a Fast Growing Economic Region in Southern Peninsular Malaysia" in Remote Sens. 2015, 7, 14360-14385; doi:10.3390/rs71114360

[8] Lillesand, T. M., Kiefer, R. W. and Chipman, J. W. (2008). Remote sensing and image interpretation 6th edition (New York:John Wiley & Sons Ltd). John Wiley & Sons Ltd.

[9] Luis Samaniego 1 and Karsten Schulz 2Supervised Classification of Agricultural Land Cover Using a Modified k-NN Technique (MNN) and Landsat Remote Sensing Imagery in Remote Sens. 2009, 1, 875-895; doi:10.3390/rs1040875

[10] Milap Punia a, P.K. Joshi b,⇑, M.C. Porwal c Decision tree classification of land use land cover for Delhi, India using IRS-P6 AWiFS data in journal homepage: www.elsevier.com/locate/eswa

[11] Haile K. Tadesse ,Allan Falconer LAND COVER CLASSIFICATION AND ANALYSIS USING RADAR AND LANDSAT DATA IN NORTH CENTRAL ETHIOPIA in https:// www. researchgate .net /publication /319766913

[12] Liangxiao Jiang1, Chaoqun Li2, Jia Wu1, and Jian Zhu1 A Combined Classification Algorithm Based on C4.5 and NB in Third International Symposium, ISICA 2008 Wuhan, China, December 19-21, 2008 Proceedings.

[13] Cunhe Li, Lina Zhu, and Kangwei Liu A New Approach of Feature Selection for Chinese Web Page Categorization in Third International Symposium, ISICA 2008 Wuhan, China, December 19-21, 2008 Proceedings.

[14] Chien-Liang Liu and Chia-Hoang Lee Simplify Multi-valued Decision Trees in Third International Symposium, ISICA 2008 Wuhan, China, December 19-21, 2008 Proceedings

[15] K. SUNDARAKUMAR1, M. HARIKA2, SK. ASPIYA BEGUM2,S.YAMINI2,K.BALAKRISHNA2 LAND USE AND LAND COVER CHANGE DETECTION AND URBAN SPRAWL ANALYSIS OF VIJAYAWADA CITY USING MULTITEMPORAL LANDSAT DATA in January 2012 Journal of Engineering Science and Technology Vol. 4 No.01(1):166-174

[16] 1Manoj Pandya, 1Astha Baxi, 1M.B. Potdar, 1M.H. Kalubarme, 2Bijendra Agarwal   Comparison of Various Classification Techniques for Satellite Data in International Journal Of Scientific & Engineering Research, Volume 4, Issue 1, January-2013 1 ISSN 2229-5518

[17] Richa Sharma, Aniruddha Ghosh and P K Joshi   Decision tree approach for classification of remotely sensed satellite data using open source support in J. Earth Syst. Sci. 122, No. 5, October 2013, pp. 1237–1247 @Indian Academy of Sciences

[18] K. Nageswara Rao & P. Subraelu &T. Venkateswara Rao & B. Hema Malini & R. Ratheesh &   S.Bhattacharya & A. S. Rajawat & Ajai   Sea-level rise and coastal vulnerability: an assessment of Andhra Pradesh coast, India through remote sensing and GIS in J Coast Conserv (2008) 12:195–207 DOI 10.1007/s11852-009-0042-2

[19] Samuel H. Huang Supervised feature selection: A tutorial in www.sciedu.ca/air Artificial Intelligence Research 2015, Vol. 4, No. 2, URL: http://dx.doi.org/10.5430/air.v4n2p22.

[20] D. LU* and Q. WENG A survey of image classification methods and techniques for improving classification performance in International Journal of Remote Sensing Vol. 28, No. 5, 10 March 2007, 823–870

[21] Feras Al-Obeidata,d,*, Ahmad T. Al-Taanib, Nabil Belacelc, Leo Feltrind, Neil Banerjeed A Fuzzy Decision Tree for Processing Satellite Images and Landsat Data in The 2nd International Workshop on Machine Learning and Data Mining for Sensor Networks,MLDM-SN 2015 Procedia Computer Science 52 (2015) 1192 – 1197 Available online at www.sciencedirect.

[22] Thapa R.B., Murayama Y. (2011) Accuracy of LandUse and Land Cover Mapping Methods. In: Murayama Y.,Thapa R. (eds) Spatial Analysis and Modeling in Geographical Transformation Process. GeoJournal Library, vol 100. Springer, Dordrech

[23] Nabi A, Brahmaji Rao P, Rama Prasad AV (2012) Analysis of mangrove vegetation of Diviseema region, Krishna district, Andhra Pradesh. Int J Animal Environ Sci 2:99–108Google Scholar.

[24] Satyanarayana B, Raman AV, Dehairs F, Kalavati C, Chandramohan P (2002) Mangrove floristics and zonation pattern of Coringa, Kakinada Bay, East coast of India. Wetl Ecol Manag 10:25–39CrossRefGoogle Scholar

[25] Vidyasagaran K, Madhusoodanan VK (2014) Distribution and plant diversity of mangroves in the west coast of Kerala, India. J Biodiv Environ Sci 4:38–45Google Scholar