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Satellite Image Segmenation and Classification for Environmental Analysis

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Abstract: ***Image segmentation is a difficult task in computer vision. This process includes the classification of visual input to segments to simplify image analysis. There are many types of method for the image segmentation some of the common methods are edge detection-based method region-based methods, clustering-based method, partial differential equation-based, watershed-based method, and neural network-based method. This research work is mainly focused on image segmentation. Satellite images are given as the input of the proposed system. Machine learning techniques plan an important role in various domains. Here the remotely sensed data can be segmented by using the K-Means clustering method. Compared with other traditional methods this clustering technique yields better results. This system can be implemented by using the MATLAB software tool. Machine learning concepts drastically decrease the time needed to arrange an exact map.***
Keywords: K-Nearest Neighbour (KNN) and support vector machine (SVM) for classification in terms of accuracy.

I. INTRODUCTION

In remote sensing images, lot of predictions can be made without any intervention of the human being. Remotely sensed image is digital representations of the Earth, by using this, places which cannot be accessed is viewed by the remote sensing images, this will encourage the process of those interior parts. In a remotely sensed image data, each pixel represents an area of the Earth at a specific location. If a pixel satisfies a certain set of criteria, then that pixel is assigned to the class that corresponds to those criteria. This process is referred as image classification. Presently, image classification method can be grouped into two main categories depending on the image primitive i.e., pixel depending on the image primitive i.e., pixel based and object-based method. Pixel based methods classify individual pixels without taking into account any neighbourhood or spatial information of the pixel. Object/ Region based methods are also able to handle high resolution imagery which aggravates the classification process for most pixel-based methods. Depending on the type of information extracted from the original data, classes will be identified with the known features on the ground. An example of a classified image is a land cover map, showing vegetation, bare land, pasture, urban, etc. In remote sensing imagery, a pixel might represent a mixture of class covers, within-class variability, or other complex surface cover patterns that cannot be properly described by one class. Finding about vegetation indices level is very important to know about the used lands and agricultural levels in the particular region. To achieve this, the remote sensing image has to be taken for processing, in this work LANDSAT image is taken and it is processed to identify the used land. In the processing initially LANDSAT image is checked for noise freeness. Using this image, the required features are extracted. For this feature extraction the different features like vegetation indices, used land, forest and unused land are considered. After extracting the features from the image, classification algorithms are applied to get the different classification groups, in this KNN, SVM, Fuzzy algorithms are applied to get the classified image. These results were compared with the MOKNN and MOSVM. Modified algorithms which gives the better result comparing with the existing algorithms. To predict the overall accuracy of the algorithms, different metrics are used like user's accuracy, producer's accuracy, omission error and commission error. Satellite remote sensing programs have produced an archive of images of the earth that are becoming an increasingly valuable source of data for the study of land cover and land use change. The foremost example is the Landsat program, which has been in operation since 1972. The entire Landsat archive has become freely available, allowing public access to time-series data for most parts of the world. Interpretation of these images, however, remains a challenge. Conventional supervised image classification relies on training data land that coincide temporally with the images used. Training data and the multi-spectral satellite data for the same sites are used in multivariate statistical algorithms to create a predictive model, referred to as "spectral signatures", that is used to classify the satellite image into land cover classes. Training data, however, are usually not available for the majority of images in a time series, and can, in many cases, no longer be easily obtained for older images. One approach to overcome this problem of missing training data is using visual interpretation, but this is difficult, time-consuming, and possibly very subjective. An alternative approach is to use a signature derived from training data and a matching image from another period and apply this to the images for which no training data are available.

Such has been used to classify images by applying signatures obtained from a different domain, whether location, time period, or sensor. Studies that date back to the 1970s have explored signature extension for Landsat Multi-Spectral Scanner (MSS) images. More recently, this approach has been re-examined in response to advances in atmospheric correction and the need to monitor large areas efficiently. The accuracy of spatial signature extension, which uses signatures derived from training sites from one region to classify images from another region, has been found to deteriorate with distance between the regions. In one study, a distance of 1500 to 2000 km between the signature source and the image to be classified reduced the accuracy by half compared with a distance of 500 km. That study also reported poorer accuracy in signature extension in the north–south than in the east–west direction due to the larger change in vegetation in the north–south direction. Temporal signature extension has yielded better results than spatial signature extension, particularly when variation across years is reduced with radiometric normalization (or rectification, but the general validity of the conventional approach to signature extension has not been investigated much, and alternative approaches, such as combining data from several images, have not been considered.

A. Motivation

Environmental threat is very high in present situation due to the concept globalization and over population. Daily many trees have been cut and number of buildings and water bodies encroachment is getting higher day by day. Government does not have any correct data in numbers in their hand. To get the details also is not possible as it needs more time with lot of man power still then we will get only cooked up data. To live a better life in this world our environment has to be maintained well.

B. Objective

Satellite image processing has proven to be a powerful tool for the monitoring of the earth's surface to improve our perception of our surroundings has led to unprecedented developments in sensor and information technologies. However, technologies for effective use of the data and for extracting useful information from the data of satellite image processing are still very limited since no single sensor combines the optimal spectral, spatial and temporal resolution. The conclusion of this, according to literature, the remote sensing still lacks of software tools for effective information extraction from Satellite image processing data. For many parts of the world, medium to high resolution remote sensing satellites will only acquire data after the satellite has been programmed to do so. In these circumstances, coverage of the affected area is likely to be delayed and possibly missed. However, when major disasters unfold, most satellite operators will schedule imagery collection, even without confirmed programming requests, either on humanitarian grounds or in the hope of data sales. These all the satellite image processing drawback effects the whole disaster mitigation process, so we are processing the novel techniques to integrate the system by various combination of algorithm to amalgamate the geological boundary data with geohydrology data and lithosphere data like HI climb mountains, terrain, sedimentary basin, rifts etc. The proposed method will focus on flood rescue and mitigation mainly. The objectives of proposed method is to present an advanced method for combination of multi-spectrum RGB images for multi- spectrum image fusion. The proposed method can be used to analyse the maxima features in a particular image.

C. Existing System

KNN algorithm stores all the available data and classifies a new data point based on the similarity. This means when new data is appeared then it can be easily classified into a well suite category by using KNN algorithm. K-nearest neighbor algorithm used vastly in the classification of images. An improved KNN for high resolution remote sensed data is used and it permits to combine the locality using the maximum margin classification.

D. Proposed System

Support Vector Machine Support Vector Machine is a new approach to supervised pattern classification which has been successfully applied to a wide range of pattern recognition problems and it is also a training algorithm for learning classification and regression rules from data. SVM is most suitable for working accurately and efficiently with high dimensionality feature spaces in addition to that SVM is based on strong mathematical foundations and results in simple way and very powerful algorithms.

II. LITERATURE SURVEY

Literature survey is a scholarly source (such as books, journal articles, and theses) related to a specific topic or research question. It is often written as part of a thesis, dissertation, or research paper, in order to situate your work in relation to existing knowledge. Before building the system, the above consideration are taken into account for developing the proposed system.

A. Survey On Classification Technique Used In Remote Sensing for Satellite Images: Rahul Naware, Amreen Khan

This paper gives classification technique used to find the land cover classes in satellite images. In the paper mostly used classification ion technique is studied that is supervised classification unsupervised classification and object-oriented classification. And this survey the implementation is done by naïve bayes technique is used which gives less accuracy..

B. Performance Evaluation of Lossless Compression Techniques: Uthayakumar, T Vengattaraman

This paper gives the existing image compression techniques such as Lempel Ziv Markov chain Algorithm (LZMA), Burrows Wheeler Transform (BWT), Lempel Ziv Welch(LZW) coding, Deflate and LZ77 are compared to one another. And the compression technique is used which may results in less accuracy as over lapping of images will be high.

C. Super pixel Partitioning of Very High-Resolution Satellite Images for Large-Scales Classification Perspective with Deep Convolutional Neural Networks: T. Postadjian, A. Le Bris, C. Mallet, H. Sahbi

This paper develops the strategy for the use of deep networks to label very high-resolution satellite images, with the perspective of mapping regions at country scale. Therefore, a super pixel-based method is introduced. And the implementation is done by random forest method with neural network so accuracy will be less.

D. Multiscale image segmentation using normalized cuts in image recognition on satellite images: Alexander V. Akinina, Michael B. Nikiforov , Alexander V. Savin

This paper gives the normalized cuts, supplemented with the super pixel algorithm. Thus, multiscale segmentation is used, which significantly improves further classification. In these only edges are been detected so all the places cannot be segmented property.

E. Cloud Cover Assessment in Satellite Images Via Deep Ordinal Classification: Chaomin Shen, Chenxiao Zhao, Mixue Yu, Yaxin Peng

This paper proposes a deep learning approach for cloud cover assessment in quick look satellite images. The quick look images from centre for Remote Imaging, Sensing and processing (CRISP) are used for demonstration.

III. SYSTEM MODELS

A. Data Exploration

Under the Data Exploration we are taking the Pretrained datasets. Pretrained means it is a saved network created by someone else and trained on a large dataset to solve a similar problem. It is typically on a large-scale image classification task. For image recognition tasks, using pre-trained models are great. For one, they are easier to use as they give you the architecture.

B. Modules

There are five modules in this project. There are:

1) *Image Acquisition:* Acquisition is the process of collection of images. These images are downloaded from the online dataset provider called Kaggle.com.
2) *Image Pre-processing:* Image pre-processing includes converting RBG images into Grayscale images. An RGB image means the images present with its original colours. Grayscale images have the combination of black and white. Conversion of RGB to grayscale is done for enhancing the dataset available. Converting the images to grayscale helps in improving the accuracy of the result. Grayscale images help to reduce noise and also make the background neutral. It also helps to improve brightness of the image. Data augmentation is a way of creating new data which has benefits like the ability to generate more data from limited data and it prevents over fitting.
3) *Image Segmentation:* Image segmentation breaks the image down into meaningful regions. It divides digital image into multiple segments. The goal is to simplify or change the representation into more meaningful image. It differentiates between the objects we want to inspect further and the other objects or their background. It consists of segmenting the converted grayscale images using K means segmentation.
4) *Feature Extraction:* Feature extraction is extracting or showing of the segmented portion of the image so that classification becomes easy. Features are extracted in order to differentiate between the images. Features extraction is used in almost all machine vision algorithms. The common goal of feature extraction and representation techniques is to convert the segmented objects into representations that better describe their main features and attributes.

5) *Classification:* Here we use the concept of classification method. The last module includes the classification in which Tensor Flow and Machine Learning algorithm will be used. Tensor Flow is a MATLAB-friendly open-source library for numerical computation that makes machine learning faster and easier. Tensor Flow allows developers to create dataflow graphs - structures that describe how data moves through a graph, or a series of processing nodes. Each node in the graph represents a mathematical operation, and each connection or edge between nodes is a multidimensional data array, or tensor.

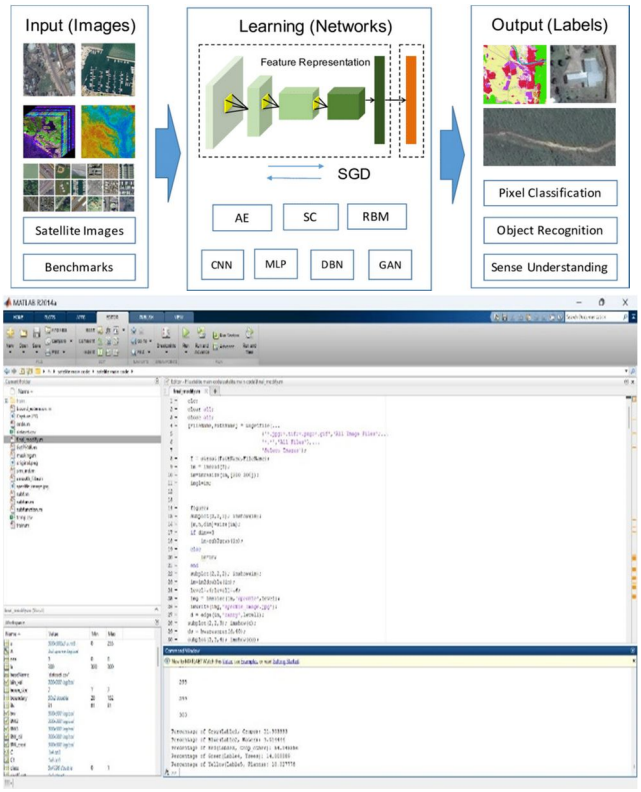
C. Algorithms & Techniques

For image classification purpose we use K-means clustering and Support vector machine in machine learning. K-means clustering is allowing us to cluster the data into different groups and a convenient way to discover the categories of groups in the unlabelled dataset on its own without the need for any training. And Support Vector Machine is used for classification as well as Regression problems. The goal of the SVM algorithm is to create the best line or decision boundary. And we use MATLAB technology it is a matrix-based language.

IV. RESULT & ANALYSIS

All results are calculated in terms of accuracy. From this we are getting less noise ratio and good accuracy so we can state that our proposed system works better than the existing system. And all areas which we needed to be detected and it will help in finding out the land, water and tree areas in percentage classification.

A. Component Diagram



V. CONCLUSION

This project gives a summary on automated satellite image classification methods and compares several reviews done by various researchers. Automated satellite image classification methods can be classified into 1) supervised 2) unsupervised. Supervised and unsupervised satellite image classification methods differ in the way of grouping pixels into meaningful categories. In the literature, researchers have presented survey on satellite image classification methods and evaluated the performance against different datasets. This project summarizes the various reviews on satellite image classification methods and techniques. The summary helps researchers to select appropriate satellite image classification method or technique based on the requirements.

VI. FUTURE WORK

In future the results obtained from proposed method will be a great measure for predicting and analysing impact of floods. It will help rescue teams to address high alert areas first so, minimum or no loss of life will be achieved. In future, the method can be modified to be used for coastline detection, urbanization, deforestation and earthquakes.

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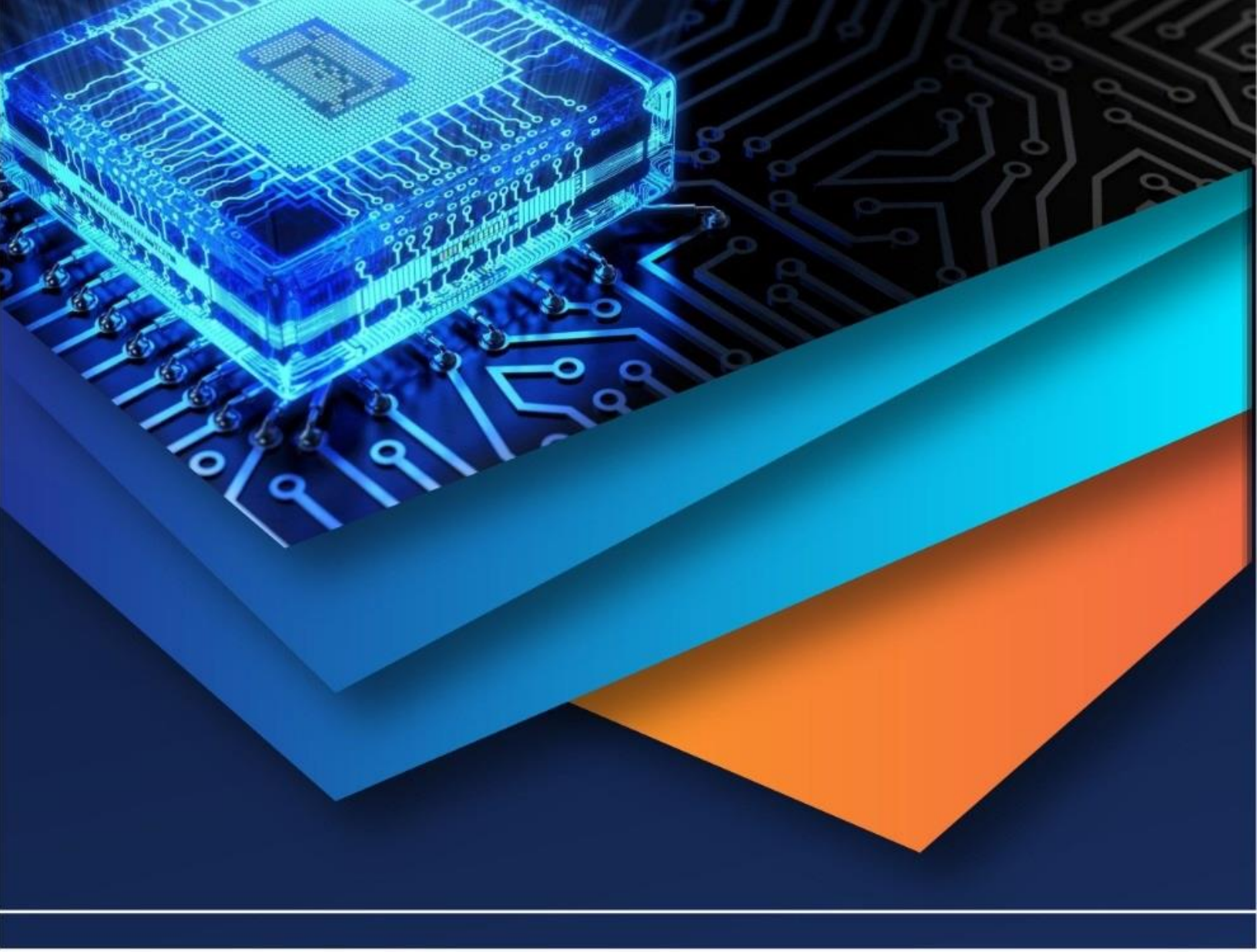

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