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Deforestation Identification Model using RBC-Region Based Clustering

B. Tamil Selvi[1*], M.Parvathy[2], PL.Prabha[3], C.H.Sumalakshmi[4]

[1*]Computer Science and Engineering, K.L.N College of Information Technology, Madurai, India
[2]Computer Science and Engineering, K.L.N College of Information Technology, Madurai, India
[3]Computer Science and Engineering, K.L.N College of Information Technology, Madurai, India
[4]Computer Science and Engineering, K.L.N College of Information Technology, Madurai, India

[*]*Corresponding Author: tamil.sabitha@gmail.com, Tel.: 9790228707*

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***Abstract*—** Deforestation is the permanent ruin of forests in order to make the land available for other uses. Deforestation activities come in many ways including forest fire, logging, and mining. There is a need to detect deforestation to protect available resources. Satellites remote sensing provides fundamental information for accessing deforestation effect. In this paper, we proposed two method to detect deforestation 1.Extraction based RGB bands - with the help of clustering pixels combined with RGB color bands. Vegetation coverage estimated by scheming of RGB pixels .Region clustering were demonstrated to be more suitable for identifying the waste, sand, cultivated region. Classification accuracy of the features of interest varied from 80 to 95 percent.2.Decorrelation stretching- technique to improve the visual distinction of an image and representing the deforestation effect which understood by human through image. Finally, Histogram of an RGB bands was proposed to estimate the distribution of each pixel in an image which could give the clarity of vegetation coverage and make forest detection more efficient. The sample forest area around Madurai district was taken through the satellite and selected as a test site.

***Keywords*—** Satellite remote sensing, Vegetation coverage , Region clustering, Decorrelation stretching, Histogram

I. INTRODUCTION

Most of the land area is covered by forest. Humans and the natural world depend on forest resources. However, deforestation has been overwhelming our forests. Deforestation brings about a lot of unpredicted effects on the earth and results in many negative consequences. Deforestation is a process of clearance and altering the main function of the forest. During the enormous activities on deforestation, it has been one of the major natural damage on earth. Deforestation happens for many reasons, such as logging, agriculture, natural disasters, urbanization and mining. There are several ways to clear forest burning and clear-cutting the land are two methods. Deforestation is troubling our environment and the way our earth appears. At least eighty percent of our forests have been ruined. Our rain forests are vanishing. It has been estimated that around 728 km of forest have been wiped out clearing most of the cases. In spite of a forest fire significantly affects soil properties because organic matter located near the soil surface is rapidly ruined. The alterations of Organic Matters due to fire, in turn, could affect several chemical, physical, and microbiological properties of the underlying soil [10]. In order to present deep facts about deforestation, it is more necessary to analyze the effect of deforestation in the environmental change. Common methods of deforestation are burning trees and clear cutting [8]. These activities causing many harmful effects like leave land completely barren. Clear cutting—process of cutting most of the trees all at once. Burning trees—Process to clear the forest by using fire as a tool. It is a common activity to the farmer because it can run in short period of time. The ash came from burned trees has fertilized the soil in short time. These two activities are generally found as the causes of deforestation in many tropical forest nations. The long-term effect of deforestation on the soil condition can be dangerous. The most research on estimated effect regarding soil properties caused by burning there is a increase in pH value and nutrient availability in short-term after the burning happens, but after several months pH will be changing drastically [11]. In contrast, the pH value seems to be decreased, and nutrients capacities are lesser than the natural range in the case of clear cutting [12]. According to NASA's Earth Observatory, "If the present rate of deforestation continues, the world's rain forests will disappear within 100 years-causing unknown effects on global climate and eliminating the majority of plant and animal species on the planet."

Our work is to utilize satellite image data to identify different region based on RGB channels. Green Band is used to discover vegetation coverage in an image. The development

strategies for clusters facilitate more effective outcome and more feasible to address the complication in that image. Such information can used to identify the changes in particular region. It also creates awareness for people to preserve available resources. Furthermore, it may give the possibility of economic scale. By comparing existing methodology our method Extraction based RGB band is proficient to extract features from an input and test the result with RGB bands. The extraction of green band pixels states that changes over land cover and vegetation areas.

Rest of the paper organized as follows, Section I contains introduction of current work and main issues and causes of deforestation, Section II has related survey regarding our application, and Section III contains deals with detection of deforestation and also explains clustering methodologies for detecting various cluster of images, Section IV concludes our aim is to create awareness regarding this issue then only we can prevent available resources for future generation.

II. BACKGROUND SURVEY

Deforestation is one of the consequences we are facing still now. Various methodologies to detect deforestation from satellite images had been proposed by many researchers. J.R.G Townshend [1] used wall-to-wall covered technique to estimate deforestation rate by with sampling image data from Landsat Image. S. R. V. Martins [2] proposed a new methodology called STARS to detect deforestation by using Modis Satellite, by distinguishing the spectra value to detect deforestation area. Spectra value used to classify the different area. Philipp Geyer[3] used various clustering methodologies like hierarchical clustering and portioning clustering. Based on these two clustering technique, able to group a pixels that is cluster a given image. Another researcher has implemented remote sensing analysis, Yelwa S.A [5] use NDVI threshold classification to compute the satellite images digital number value. They employ NDVI to detect the vegetation cover then scrutinize the classification result in temporal time. Curtis A. Colling [7] presents a multi-temporal analysis of Landsat data, by using vegetation indices to determine Forest Age. Deforestation can be identified using existing approaches. To detect the deforestation from real time data set and that data must be sampled, in that case collecting the satellite data (SAR Data –Satellite Radar Aperture)quite straightforward previously inferred. The Results of feature extraction of green band are found to be more informative and robust compared to the spectra value calculation. Our methodology uses RGB channels from that band we can able to discriminate soil and rock surfaces from vegetation and provides increased penetration of water bodies, assessing vegetation coverage, to detect vegetation slope like road blue, green and red band respectively.

III. PROPOSED WORK

Our proposed idea consists of four stages

- Data preprocessing
- Region clustering.
- Extraction based RGB Band
- Deforestation detection

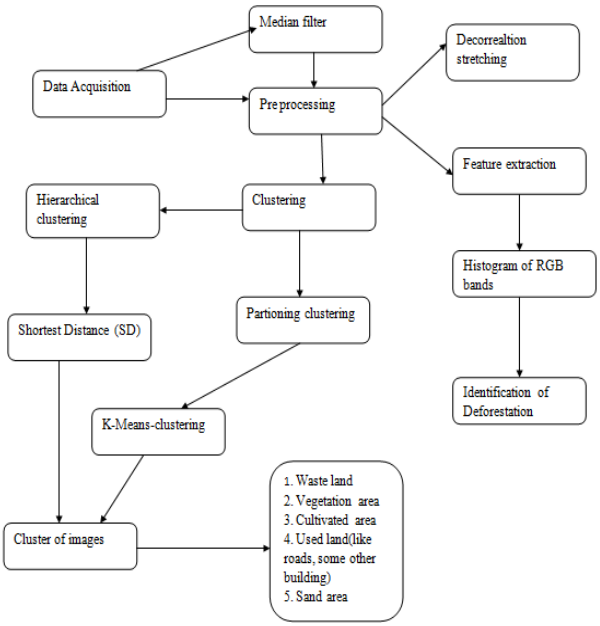

Figure.1 Proposed method including data acquire, Extraction and Clustering, Deforestation identification

A. Data Preprocessing

Preprocessing is an enhancement of image data that removes unwanted distortions or improve some image features importance for further processing.

- Data Acquisition-The aim of the data preparation is to collect image that includes all parameters that are required to estimate the effect of deforestation measures. Important parameters include the vegetation region, waste region, cultivated region. Moreover, the existing system used the parameter as forest fire and soil moisture and temperature. Finally, the setup of a feature extraction model was a helpful means in the project for interpreting results for proposing district networks
- Pre-processing-After data collection, pre-processing is done by median filter. Median filter is applied to the input image using the function wiener2. The median filter is an effective of removing noise without blurring sharp edges. Such noise removal is a usual pre-processing step to improve the results of further processing. The median filter replaces a pixel by the median of all pixels in the neighbour.

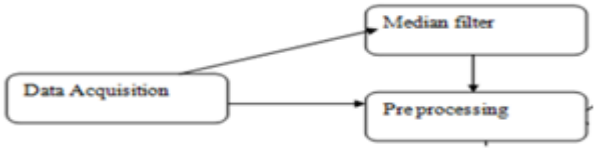

Figure.2 Data pre-processing

B. Region Clustering

Region clustering is applied to the images in the feature space. A clustering method is to identify groups of pixels closely located to each other in the feature space, which leads to groups of pixels reacting similarly. The next section characterizes and examines methods for this purpose. After clustering, cluster of images shows that different clusters includes vegetation, used, waste land etc. The main tool for this purpose is histogram of RGB bands that shows the location of pixels in the feature space.

Methods for clustering:

There are two methods for classifying image with the help of clustering. ''Clustering is the process of grouping together objects that are similar". The basic function of clustering therefore is to assign those pixels to one cluster or groups that are close in the feature space. Therefore, the measure of the distance is the basis for clustering. Hierarchical clustering is optimal due to its simplicity and deterministic. Partitioning k-means clustering was also considered for comparison purpose

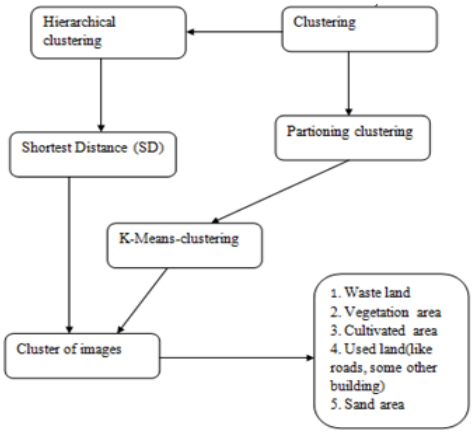

Figure.3 clustering methodology

The methodology we used,

- Hierarchical clustering
- Partitioning clustering

Hierarchical clustering

According to Xu and Wunsch [20] the following steps are involved in hierarchical clustering.

1. Assign each object of features to one individual cluster. All clusters have one exact similar group of pixels.
2. Calculate the proximity matrix of the clusters.
3. Merge the two closest clusters.
4. Repeat the steps 1–3 until all clusters have been merged or the desired number of clusters is reached

Furthermore, the calculation of proximity matrix differs in the way of method we used. Our project uses the implementation of the Statistical Toolbox of MATLAB.

- Shortest Distance (SD) - This method uses the closest members from two clusters to determine the distance.

$d(r,s)=\min(\text{dist}(X_{i,j},X_{s,j}))$ with $i \in (1,2,\ldots nr)$, $j \in (1,2,\ldots ns)$ (1)

Partitioning clustering

In contrast to hierarchical clustering, this partitioning method won't merge the clusters with others. Instead of this, similar pixels are assigned to clusters considering object criterion.

- K-Means Method- The method uses grouping of pixels by partitioning that is minimization of inner squared distance sum of clusters as criterion.

$$\text{Minimize } D = \sum_{i=1}^{n_c} \sum_{x \in k_i} (x-\bar{x}_i)^2 \quad (2)$$

Because of simplicity and effectiveness k-means method extensively used ones among the multiple available clustering method as described in Xu and Wunsch.

Clustering Results

After applying both the clustering methodology, we get the cluster of images. These clusters includes grouping of pixels which is similar to each other. These cluster images includes the area which may be the vegetation, used, waste, cultivated area.

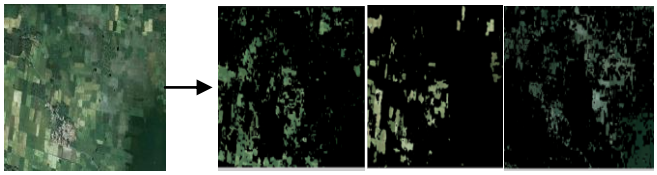

Figure.4 Original image clustered into 3 types of cluster

We may cluster into 5 or 6 clusters based on your need. The cluster comes under the portion of greenery areas, cultivated area, sand or some other waste area which may include roads etc.

C. Extraction based RGB Band(Spectral Feature Extraction)

Feature extraction reduces the amount of resources required. Feature extraction techniques are used in various image processing applications e.g. character recognition. As features may be define the behavior of an image, efficiency in terms of classification and obviously in time consumption also.

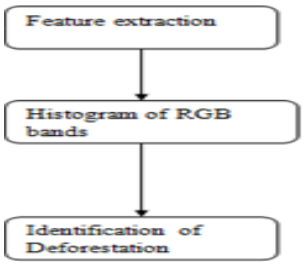

Figure.5 Deforestation detection

Histogram of RGB bands

The histogram of a image can be displayed using data.usinggimhist (I) or imhist (I) where I represents the given input image. The number of bins in the histogram is specified by the image type. If a I is a gray scale image, the function imhist () uses default value of 256 bins. In case of binary image imhist () function uses only two bins.

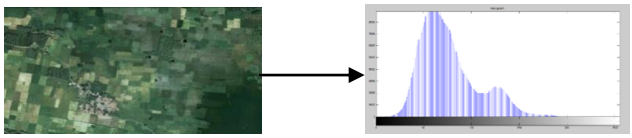

Figure.6 Histogram of green band

This histogram indicates how the green pixel equally distributed over given image. The values in horizontal line vary from 0 to 255. Red would be (255, 0, 0), Green (0, 255, 0), and Blue (0, 0, 255), so on for all the color combinations.

Based on RGB bands-The plotted histogram bands for each bands that is RGB bands. In that Histogram of green, red and blue band shows the amount green pixels there in the original image which is help to discover vegetation coverage, to detect vegetation slope like road, to discriminate soil and rock surfaces from vegetation and provides increased penetration of water bodies. If there is any improvement which reflects the vegetation cover in the image also increases otherwise decreases gradually during the period we taken the image. The number of Red, Green, Blue pixels calculated by using this formula,

```
R=Img( :,:,1);
G=Img( :,:,2);
B=Img( :,:,3);

Img → Original input image
```

(3)

The ratio of green pixel distributed over an image with respect to red and blue calculated by,

```
Ration of G= (∑R ∑G ∑B)*100/∑G
∑R  Summarization of Red pixels
∑G  Summarization of Green pixels
∑B  Summarization of Blue pixels
```

(4)

D. Decorrelation Stretching

This is the method used to improve the visual interpretation of a given image. It enhances the color separation of an image with significant band to Band correlation. The exaggerated colors improve visualization and also make feature discrimination easier. This achieved with the help of de-corrstretch () function. The original color values of the image are mapped to new set of color values with wider range. The color intensity of each pixel are mapped to color Eigen space of NBANDS by NBANDS covariance or correlation matrix, stretched to equalize the band variances, and then transformed back to original color bands. To define RGB band wise statistics, we can use entire original image or subset of it.

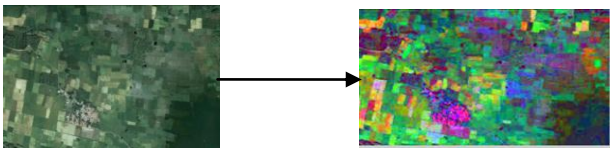

Figure.7 De correlation stretching

Any changes in vegetation cover it indicates due to over population around area or other causes like cutting trees, timber extraction whatever it may be. There is a change in human activity which directly proportional to the population

IV. CONCLUSION AND FUTURE SCOPE

The objective of the work was to prevent available resources in order to prevent further devastation. It provides a inclusive study on detection of deforestation. The identification of similarities based on the clustering has a potential to support deforestation identification process. To our knowledge, there exists no such a simplest methodology focused on this problem. To reflect the problem of this field, simple and extraction based RGB bands and region based clustering has been proposed. Histogram of a band also estimates the distribution of each pixel in an image which could give the clarity of vegetation coverage. The idea of de correlation stretching is utilized to improve the spectral visualization of an image. Future work will be devoted to design a more robust and efficient abundance.

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Authors Profile

Ms.B.Tamil Selvi, pursued master degree in Computer Science and Engineering from K.L.N collge of Information Technology,Madurai, and research interest includes Image processing and medical image processing.

E-mail: tamil.sabitha@gmail.com

Dr.M.Parvathy, Ph.D from Anna University Chennai, Her Research area inclusds Data mining and Image Processing.she has published more papers in various Internationa and National journals.she has more than 15 years of expereince in teaching.Her area of interest includes Datamining and Image processing.

E-mail: parvathydurai2002@gmail.com

Ms.PL.Prabha, Completed M.E in Computer Science and Engineering from Chenduran College of Engineering & Technology,Pudukottai. Area of interest includes Data mining and Image processing.

E-mail: prabha_pl2003@yahoo.co.in

Ms.C.H Sumalakshmi, pursuing Ph.D from Anna University Chennai, Completed M.Tech in Computer Science and Engineering from KMCT College of Engineering,Calicut and Area of interest includes Image processing & Analysis of Algorithms.

E-mail: sumascarlet@gmail.com

