Detection of Vegetation Areas From Satellite Images

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Abstract- *Image processing has been proved to be efficient tools for investigation in different fields and applications. Significance of agriculture acts as an important task in economies of countries. Remote sensing technology is playing an important role in investigation of the earth for detection of vegetation area. The estimation of vegetation is important to everyone and classifying vegetation in a gainful approach is the aim of all farmers and an agricultural organization. Vegetation area identification from remotely sensed images is essential due to use of remote sensing images as an input for agricultural and economic planning by government and private agencies. The methodology for this work is selection of satellite image, detection of vegetation area using suitable classification method. This paper includes supervised classification methods like minimum distance classification and maximum likelihood classification. This paper presents a summary of how these classification methods can be used to identify vegetation area using image processing. The general process is implemented in Scilab.*

Keywords- agriculture, supervised classification, image processing, remote sensing, satellite images, vegetation area

I. INTRODUCTION

Assessing and monitoring the state of the earth surface is of key importance. Vegetation mapping is an important technical task for managing natural resources as vegetation provides a base for all living beings and plays an essential role in affecting global climate change [1]. Vegetation mapping also provides valuable information for understanding the area under vegetation cover and its changes inferred as a result of monitoring for a continuous period.Vegetation cover plays a key role in terrestrial biophysical process and is related to a number of ways to the dynamics of global climate. Tracking of changes in the vegetation activity and crop phenology seasonally over wide areas is essential for many applications, such as estimation of net primary production, deciding time boundary conditions for crop yield modeling and supporting decisions about water supply.

The previous method followed for the detection of vegetation areas or for classification of images is Normalized difference vegetation index method.This method is typically based on differential absorption, transmittance and reflectance of energy by the vegetation in the red and near infrared regions of the electro-magnetic spectrum.

The modern approach we have usedfor detection of vegetation cover through satellite images involves supervised learning algorithm for classification using two methodologies namely minimum distance classification and maximum likelihood classification.

Satellite image is the input and the output is an image highlighting the vegetation cover.

II. RELATED WORK

In recent years a large amount of research work is being done in satellite image processing. Sayali Jog et. Al. [2] proposed the classification methods of satellite images and accuracy assessment of each technique. It stated various classification techniques like minimum distance classification, maximum likelihood classification, parallelepiped classification and also showed the accuracy of the classification obtained by using each of the classification techniques. It also proposed accuracy assessment method by the computation of error matrix and calculation of overall accuracy and kappa coefficient. Omar S. Solimon et. Al. [3] proposed a system for remote sensing classification. It stated how satellite images can be useful in extracting various information for a desired application. Sunita Abburu et. Al. [4] proposed supervised learning method for training the computer for classification. Superiority of supervised learning method over unsupervised learning was proved. Supervised algorithm involved training the computer brain by the user for correct classification of pixels into various classes. As a result, supervised classification yielded better classification results compared to unsupervised classification.

Arpita Pandya et. Al. [5] did classification of vegetation area from satellite images using image processing techniques. Reading an image, converting it into various forms, filtering, thresholding were some image preprocessing techniques described.Meera Gandhi et. Al. [6] proposed an enhanced method for change detection in analysis of satellite image based on normalized difference vegetation index. The normalized difference vegetation index is calculated as a ratio

difference between measured canopy reflectance in the red and near infrared bands respectively. In this method detection of vegetation cover is employed on the basis of wavelengths corresponding to various bands of an image.

III. DETECTION OF VEGETATION AREAS FROM SATELLITE IMAGES

The methodology of proposed system is as follows

1. Input satellite image.
2. Read satellite image.
3. Supervised learning for classification.
4. Image preprocessing.
5. Image classification.
6. Output image showing vegetation cover.

Computer classification of remotely sensed images involves the process of learning the relationship between the data and the information classes. There are two learning methodologies- supervised learning and unsupervised learning. We have used supervised learning for training our computer.

Supervised learning

Learning process designed to form a mapping from one set of variables(data) to another set of variables(information classes).
A teacher is involved in the learning process.

After the computer has learned from the training samples, classification takes place.

Supervised classification

Supervised classification methods require input from an analyst. The input from analyst is known as training set. Training sample is the most important factor in the supervised satellite image classification methods. Accuracy of the methods highly depends on the samples taken for training.

Two classification techniques used are-

1. Minimum distance classification

The minimum distance classifier [7] is used to classify the image data into classes whose Euclidian distance between the image pixel and the class in the multi-feature space is minimum. The distance is defined as an index of similarity between the image data and classes, so that minimum distance is identical to the maximum similarity.
Euclidian distance is defined as:

$$d^2= (X-\mu)^T(X-\mu)$$

2. Maximum likelihood classification

In maximum likelihood classification the pixel with the maximum likelihood is classified into the corresponding class. The likelihood L_k is defined as the posterior probability of a pixel belonging to class k.

$$L_k=P(k|X)=P(k)*P(X|k)/\sum P(i)*P(X|i)$$

where P(k): prior probability of class k
P(X|k): conditional probability to observe X from class k.

IV. PERFORMANCE AND EXPERIMENTS

The experimental setup requires Scilab installed in the PC.

Also scilab image video processing(SIVP) toolbox must be installed for processing of images.

Procedure followed for performing experiment:

- Input and read a satellite image
- Provide training coordinates to the machine for supervised learning.
- Use a suitable classification technique out of the two (minimum distance and maximum likelihood) for classification and detection of vegetation cover.
- Output is an image highlighting the area covered by vegetation.

Accuracy assessment is performed to check the accuracy of classification [8].

V. RESULTS

Let us provide an input satellite image to the computer for classification.

Fig 1: Satellite image taken as input

We provide training data to the computer to classify different regions with vegetation being our area of concern.

The image below shows the mapping of regions corresponding to various classes. These regions are provided as training samples for classification.

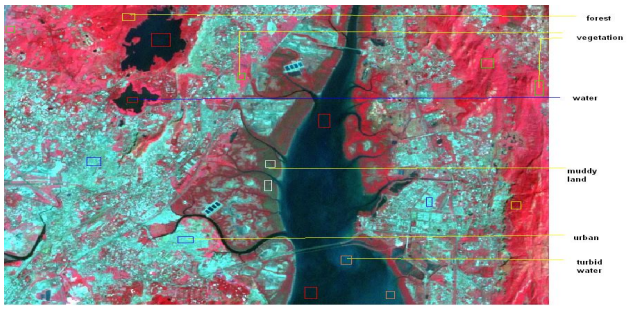

Fig 2: Satellite image highlighting various regions for classification

After providing the training samples the machine will automatically classify the whole images into various classes. The output of the two classification techniques used is shown below.

1. Minimum distance classification

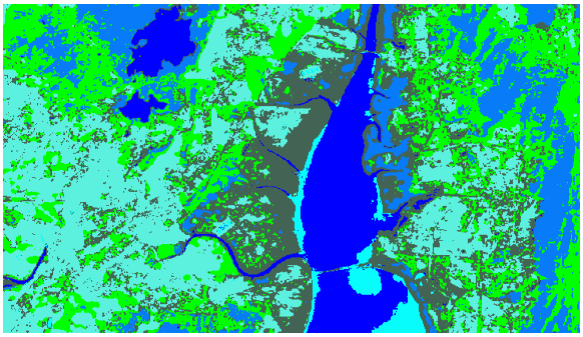

Fig 3: Minimum distance classified image

2. Maximum likelihood classification

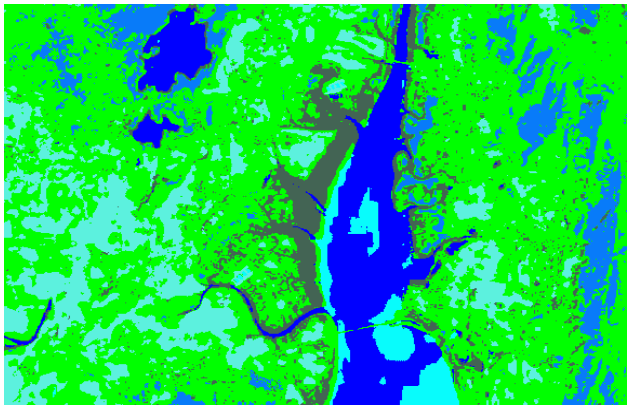

Fig 4: Maximum likelihood classified image

In the above output images, the green colored area denotes the presence of vegetation.

Accuracy assessment performed on theclassification techniques yield an overall accuracy of >88% for maximum likelihood classification and >78% for minimum distance classification.

VI. RESULT ANALYSIS

The results inferred after performing classification could successfully indicate the vegetation cover.

Computationally minimum distance classification is faster as compared to maximum likelihood classification since it is less complex.

Maximum likelihood classification output is much accurate compared to minimum distance classification.
Hence we were successful in showing the area under vegetation and this information can be used for further study.

VII. CONCLUSION

Satellite images perform as good source for classify or identify area related to vegetation monitoring and mapping in region. Image processing is having its precious significance in the agricultural applications.

This project can be used for various applications by government like providing information to farmers regarding the arable land. It can also provide statistics about the total vegetation cover available and its monitoring over a continuous period.

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