Band Value Based Reflective Image Classification Method to Classify the Satellite Image Environment

KR.Sivabalan [#1], E.Ramaraj [*2]

[#] Ph.D Research scholar, Dept.of Computer Science, Alagappa University, Karaikudi, India
[1] sivabalanalu@gmail.com
[*] Professor and Head, Dept.of Computer Science, Alagappa University, Karaikudi, India
[2] eramaraj@rediffmail.com

***Abstract*—Remote sensing images are the basic assert to find the agricultural assessment, Global change detection and Tsunami prediction. Remote sensing image classification helps to determine the soil moisture, Weather forecasting, spying enemy activities and etc. Several band combination sensors such as Panchromatic, Panchromatic Nadir, TH-01 take the earth images with various properties. The satellite image classification process is done with the avail of sundry methods such as Supervised, Unsupervised and Object predicated image analysis. The above verbally expressed methods come under Automated, Manual and Hybrid relegation respectively. This research paper provides a new method called Band Value Based Reflective (BVBR) image classification method to classify the satellite image environmental. The BVBR method having the quality measures such as confusion matrix, overall accuracy, kappa Coefficient to justify the classification accuracy.**

Keywords-Remote sensing, Classification, Unsupervised, Reflection method, Band Reflection

I. INTRODUCTION

The remote sensing comprises of imagery of earth and planet that are caught by the satellite technology. Around the whole world, the government depends on the satellite technology in the view of business perspective to growth the country. Nowadays the purpose satellite imagery technology is in the increasing mode due to the contraction of manpower. The usage of image classification is to extract the classes of information from the raster image which is having multiband classes. The need of classification is to providing the integrated environment to proceed the further processing on satellite images. The satellite image classification technique is mainly used for grouping the pixels to perform operations on land cover features as agriculture, urban and forest [3]. In remote sensing, there are three different kinds of image classification techniques are used: named as Unsupervised Classification, Supervised Classification, and Object-based image analysis. [2], [6]

In this research paper supervised image classification strategy is used for the most part centred for finds the environment from a multiband imagery. A substantial number of obscure pixels are examined and classified into the land cover class based on the band reflective value. Supervised classification technique is used for more and more to classify the satellite image among the remote sensing objects with the help of environmental signature file.

II. RELATED WORK

D. Simonetti, E. Simonetti, Z. Szantoi, A. Lupi, and H. D. Eva,[1] designed classification technique for Landsat 8 imagery that was named as Phenology based synthesis classifier. The PBS algorithm to map land cover based on medium spatial resolution satellite data. Web geographic information system interface used there to carry out the accuracy assessments. The PBS classifier operates and applied with corresponding rules to a selection of single date image classifications of the study area over the land cover class.

Cristina Gomez, Joanne C. White , Michael A. Wulder,[2] authors proposed the time series information of optical remotely sensed data for Land cover satellite images by Land cover classification. In that paper, authors validating the time series data of the large area, land cover products and also review the identity of suited methods to incorporating the time series information.

III.DATASET DETAILS

Satellites are observing the earth from various orbits. Satellite imagery properties totally associated with the sensor of the satellite and the orbit of the satellite. Imagery visual relies on upon the orbit elevation and inclination [9]. The most vital parameter for classification purity is imagery selection. Landsat 8 imagery [7], [8] is taken as the input imagery. Part of Tamilnadu[10] is taken as the region of interest.

TABLE I Dataset Details

Property Name	Value
Origin	U.S. Geological Survey
Satellite Name	Landsat 8
Sensor ID	OLI_TIRS
Landsat scene id	LC81420532017100LGN00
Date Acquired	10.04.2017
Reflective Lines	7771
Thermal Lines	7771
Panchromatic Lines	15541

TABLE II STUDY AREA DETAILS

Point Number	Latitude	Longitude
1	10^0 22’18.74” N	79^0 8’16.12”E
2	10^0 22’18.74”N	79^0 22’27.14”E
3	10^0 12’44.68”N	79^0 8’17.52”E
4	10^0 12’47.28” N	79^0 22’30”E

Table I shows the Landsat 8 imagery properties. OLI and TRIS sensors take the earth imagery from the Landsat 8 satellite. OLI and TRIS companied images are used in the BVBR classification method. The above Table II shows the region points of the study area. These four points are taken as the rectangle points. That rectangle covered area is taken to classification.

IV.BVBR APPROACH

BVBR method is generally used to classify the medium spectral satellite imagery. The following Fig. 1(a) shows the overall process of BVBR. Dataset procurement, ROI selection, Region Image enhancement and classification are the step by step process.

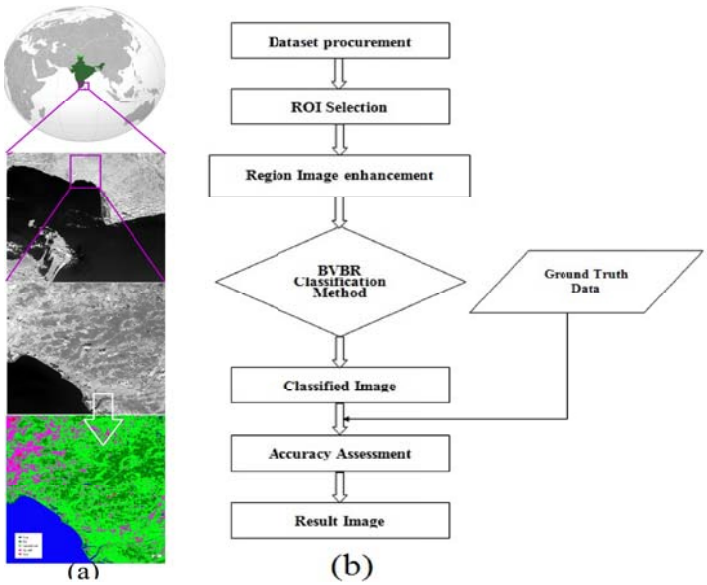

Fig.1 (a) Overall process flow (b) Architecture of BVBR

Fig.1 (b) demonstrates the well-ordered procedure of BVBR classification approach. Each progression is handled successively on the satellite imagery. This stream of process prompts classifying the earth environment with high exactness.

A. Dataset Procurement

Dataset procurement is only the way toward gathering the reasonable imagery from the imagery warehouse. Many number of satellites bringing the earth imagery with their individual properties. From the imagery distribution centre, medium spectral satellite imagery is best to handle. Thus, the Landsat 8 (OLI + TRIS) imagery is taken to classification. This procurement is done with the assistance of Earth Explore [8].

B. ROI Selection

ROI is the process of cropping the study area from the entire imagery. Part of the India is taken as the review region. Needed imagery set is selected from the previous process. The study area is clipped using this ROI selection process. This is done because to classify the environment with high accuracy. Area selection is done with the help of latitude and longitude factor. Vector file and shape methods are used to crop the exact review region [5].

C. Region Image enhancement

Image region enhancement is the process of band combination and spectral band mixing. This is used to get a better visual from the selected imagery.

D. BVBR Method:

Band Value Based Reflective image classification technique is produced to takes a shot at the passive sensor satellite images. BVBR strategy is totally in view of the four bands from the Landsat 8 imagery. Coastal, Near Infrared, SWIR 1, SWIR 2 are the four bands. These bands are having it own reflective value. This esteem completely based on the earth surface.

TABLE III BVBR Bands and Usage

Band Name	Band Use	Sample Image
Coastal/Aerosol	Observe the sediment in the water, analyse the water depth. Map the coral reefs.	
Near Infra Red (NIR)	Accentuate biomass content	
Shortwave Infrared (SWIR 1)	Measure surface temperature.	
Shortwave Infrared (SWIR 2)	Vegetation moisture.	

TABLE IV BVBR Variable Limitations

Variable	Maximum Reflection Value
Coastal	45522
Near Infrared	60887
SWIR 1	65535
SWIR 2	65535

$$BVBR = \frac{(Coastal+SWIR\ 1+SWIR\ 2)}{3} * NIR \text{ -------- (1)}$$

The above table III describes the list of bands and uses of the bands which are taken for BVBR method and the Table IV shows the maximum reflection value for the various type of bands used in the BVBR formula(1) to classify the earth environment. Five classes are computed in the BVBR method. The classes are Water, Trees, Vegetated, Dry Land and Rocks. These classes are having its own maximum and the minimum threshold value.

E. Accuracy Assessment:

Accuracy assessment is the process of evaluating the classified image. It is used to find the purity of classification and justifies the quality of classification. This process is done with the help of external ground truth data

V. RESULT

BVBR formula works based on the reflection values of Coastal, NIR, SWIR 1, SWIR 2 bands from Landsat 8 Imagery. BVBR formula returns the numerical value. Based on the numerical value pixels are grouped as a surface class. Based on the environment, detected surface classes are visualized with various colors.

TABLE V Confusion Matrix

Class	Water	Trees	Vegetated	Dry Land	Rocks	Total
Water	85455	0	0	0	1	85456
Trees	53	5818	22	0	0	5893
Vegetated	40	417	4535	110	57	5159
Dry Land	1	2	37	1966	283	2289
Rocks	0	0	0	11	496	507
Total	85549	6237	4594	2087	837	99304

TABLE VI BVBR Accuracy

Class	User Accuracy (%)	Producer Accuracy (%)
Dry Land	94.2	85.89
Vegetated	98.72	87.9
Rocks	59.26	97.83
Trees	93.28	98.73
Water	99.9	100

Table V shows the Confusion Matrix of BVBR method. BVBR classification user and Producer Accuracy values are tabulated in Table VI. The overall accuracy is calculated by using the formula (2) and it returns the Kappa coefficient value for the Overall Accuracy value.

$$\text{Overall Accuracy (OA)} = \frac{Number\ of\ Correctly\ Classified\ Pixels}{Total\ Number\ of\ Pixels} * 100 \quad \text{---------- (2)}$$

$$OA = \frac{98270}{99304} = 98.96\ \%$$ Kappa Coefficient for the Overall Accuracy is 0.958

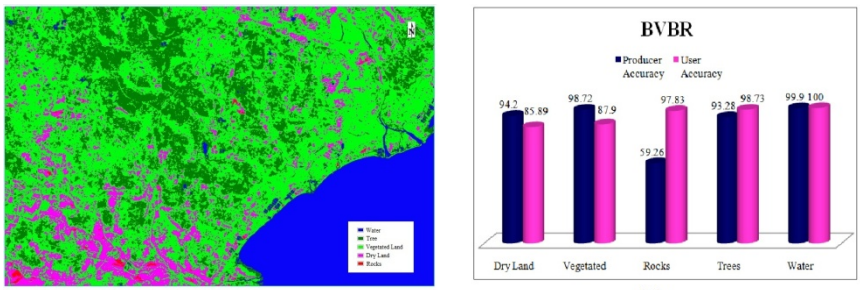

Fig. 2 (a) BVBR Classified image (b) BVBR accuracy details

Fig. 2(a) shows the environment classified image. Fig. 2(b) demonstrates the graphical representation of User and Producer accuracy of BVBR method.

VI. COMPARATIVE ANALYSIS

Same Landsat 8 dataset is classified using Normalized Difference Vegetation Index (NDVI) and Enhanced Vegetation Index (EVI) [4] for the same five classes that were used in the classification process.

A. Classification using NDVI and EVI

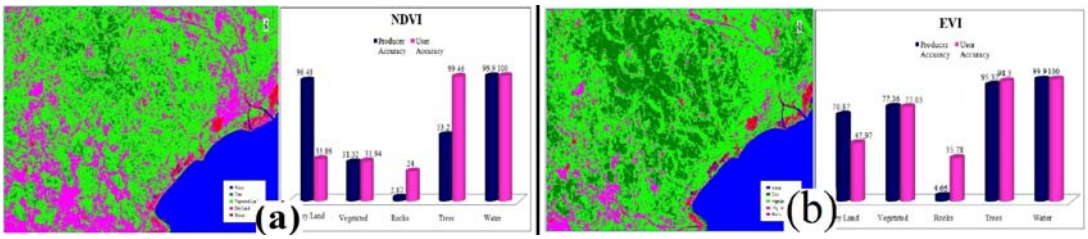

Fig. 3 (a) NDVI classification (b) EVI classified image

Fig. 3 (a) shows the environment classified image using NDVI and Accuracy graphical representation. Fig. 3 (b) demonstrates the EVI classified image and accuracy chart respectively.

Overall Accuracy for NDVI classification is 92.87 and the Kappa coefficient value for NDVI is 0.71. Overall Accuracy for Enhanced Vegetation Index is 97.14 and Kappa Coefficient for value for EVI is 0.88.

TABLE VII Landsat 8 dataset classification comparison

Class	NDVI		EVI		BVBR	
	Producer Accuracy (%)	User Accuracy (%)	Producer Accuracy (%)	User Accuracy (%)	Producer Accuracy (%)	User Accuracy (%)
Dry Land	96.41	33.89	70.87	47.97	94.2	85.89
Vegetated	31.32	31.94	77.36	77.03	98.72	87.9
Rocks	2.87	24	4.66	35.78	59.26	97.83
Trees	53.2	99.46	95.32	98.3	93.28	98.73
Water	99.9	100	99.9	100	99.9	100
Overall Accuracy	92.86 %		97.14%		98.95%	
Kappa Coefficient	0.71		0.88		0.95	

Table VII illustrate the classification user and Producer Accuracy values in NDVI, EVI, BVBR classification methods.

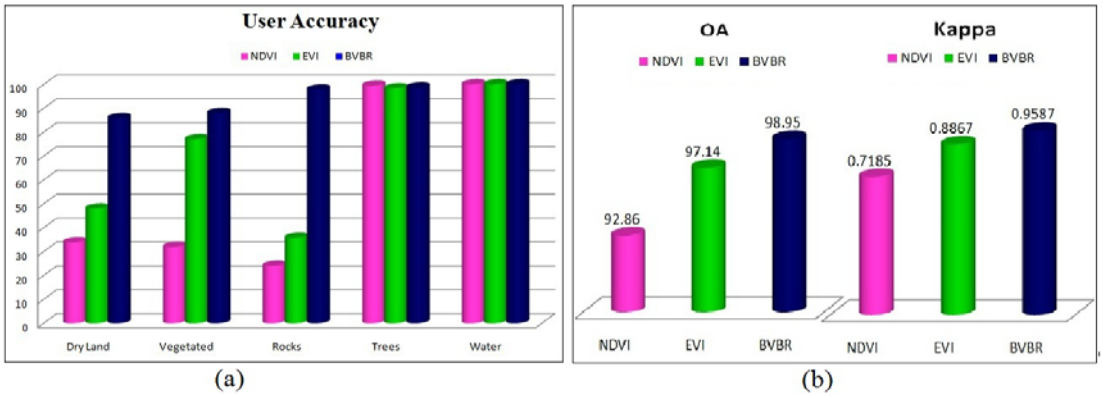

Fig.4 (a) User accuracy value comparison. (b) OA and Kappa coefficient values.

The above Fig. 4 (a) shows the user accuracy comparison details Fig.4 (b) Visualizes the Overall Accuracy and Kappa values for the same Landsat 8 dataset classification. Based on the excremental result, BVBR method produces the efficient result with high accuracy in the study area of Landsat 8 imagery.

VII. CONCLUSION

Remote detecting is the raising field in the digital world. Tremendous of ongoing applications rely on upon the satellite imagery for powerful work. So the classification requires new techniques consistently. This proposed BVBR strategy characterizes environment with high accuracy. BVBR technique is extraordinarily made to prepare the medium resolution satellite imagery which having Coastal, SWIR1, SWIR2 groups. This BVBR technique absolutely depends and works successfully on pixel-based arrangement strategy. Future work can be stretched out to different band combination of high- resolution satellite imagery. In future, the number of surface classes may add to classify the environments using BVBR technique with high precision.

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AUTHOR PROFILE

KR.Sivabalan is currently pursuing the Ph.D degree in Computer Science at Department of Computer Science, Alagappa University, Karaikudi. His research interest includes Remote Sensing Image Processing and Big data Analytics.

Dr.E.Ramaraj is working as the Professor and Head of the Department of Computer Science, Alagappa University, Karaikudi. He has the sound knowledge in many research fields especially in Data Mining, Network Security, Remote Sensing and Big Data & Analytics. He has published more than 100 international journals.