International Journal on Applications in Engineering and Technology
Volume 5: Issue 2 : December 2019, pp 13 – 15 www.aetsjournal.com ISSN (Online) : 2455 - 0523

SATELLITE IMAGERY IN LAND CLASSIFICATION USING MATLAB

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Abstract— This research paper is Land classification is a process through which fractal nature of terrain and its biophysical processes are quantified or attributed into thematic layers. The synthesis of thematic layers results different terrain units or land suitability class which is important for planning, land-use and land management. This research attempts to carry out terrain analysis and land suitability classification of the Satellite image. The Land use characteristics are generated into physical, morphological, hydrological and other remote sensing based thematic layers. The Mu-Matrix software module is used to standardize and weigh the data.

Keywords*:* satellite images; image enhancement; image classification.

I. INTRODUCTION

Land use and land cover change has become a central component in current strategies for managing natural resources and monitoring environmental changes. The advancement in the concept of vegetation mapping has greatly increased research on land use land cover change thus providing an accurate evaluation of the spread and health of the world's forest, grassland, and agricultural resources has become an important priority.

Viewing the Earth from space is now crucial to the understanding of the influence of man's activities on his natural resource base over time. In situations of rapid and often unrecorded land use change, observations of the earth from space provide objective information of human utilization of the landscape. Over the past years, data from Earth sensing satellites has become vital in mapping the Earth's features and infrastructures, managing natural resources and studying environmental change.

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1) Objective of the study

The aim of this study is to produce a land use land cover map of Ilorin at different epochs to detect the changes that have taken place particularly in the built-up land and subsequently predict likely changes that might take place in the same over a given period.

The following specific objectives will be pursued to achieve the aim above.

- To create a land use land cover classification scheme
- To determine the trend, nature, rate, location, and magnitude of land use land cover change.
- To forecast the future pattern of land use land cover in the area.
- To generate data on land consumption rate and land absorption coefficient since more emphasis is placed on built-up land.
- To evaluate the socio – economic implications of predicted change.

II. RELATED WORKS

Short, N. M. 2010. In this study Sensors acquire data at four resolutions are spatial, spectral, temporal, and radiometric. There are several definitions of spatial resolution but typically it refers to the smallest feature that can be detected in an image or to the pixel size of an image. It is a function of the altitude of the sensor and the areal extent of Earth's surface which can be seen by a sensor at a given moment Hyper spectral resolution refers to detection of hundreds of very narrow spectral bands.

Jensen, J. R. 2005In this study remote sensing refers to the collection, production, and analysis of information about the Earth and earth phenomena typically using Sensors have the advantages that they are non-biased, can reach inaccessible and remote locations, and collect data on a systematic basis. Sensors can be active or passive, sub-orbital or satellite. Active sensors send out signals (sonar, laser, radio signals etc.) which contact earth phenomena, then record the backscatter of those signals. Passive sensors record electromagnetic radiation from sunlight that has been reflected or emitted from earth.

Jensen (2005) recommends 10 × the number of bands in the image stack per class. Data may be collected in the field and/or from high spatial resolution imagery. Principal Components Analysis (PCA) reduces or eliminates redundancy which commonly exists in multiple Land sat bands. It converts a set of highly correlated data into a smaller set of uncorrelated data which still contains most of the information from the original data set (Jensen 2005).

Bhagat R.M., eat all (2009). In this study remote sensing has been shown to be a useful tool for assessing dry land issues such as drought. There are some problems, however, that can cause inaccuracies in land cover information derived from remotely sensed imagery of dry lands. These are due to spectral and spatial characteristics of rangeland soils, vegetation, and characteristics of urban surfaces. At moderate resolution, urban surfaces can have a wide range of spectral profiles because they are composed of a mixture of materials. These characteristics make remote sensing of dry lands challenging; however, unique combinations of classifiers and features may help overcome some of these challenges. An evaluation of different combinations of classifiers and features is the focus of this investigation.

III. Methodology

The procedure adopted in this research work forms the basis for deriving statistics of land use dynamics and subsequently in the overall, the findings. The study was conducted in Tamil Nadu India.

The study applied current techniques namely remote sensing and GIS to assess the land use and land cover changes in the study area. Furthermore, interviews using a checklist, semi-structured questionnaire and focus group discussion were conducted to get perceptions on the changes in the catchment over a period. In addition, secondary information in soft and hardcopy from different sources were consulted.

A. Remotely sensed data, processing and change detection

1) Image selection and acquisition

The target was images acquired during the dry season with minimum cloud cover. Nevertheless, the required images for the entire catchment were not readily available. As a consequence, images acquired during the wet season had to be used.

2) Image pre-processing

The methods for the images analysis combined both visual and digital image processing. The processing involved image rectification /geo referencing and co-registration and image enhancement. Prior to image processing, images layers / bands were imported and layer stacked to full scene. All image processing and subsequent image analysis were carried out using Matlab.

3) Image rectification

Image rectification was carried to correct for distortions or degradation resulting from the image acquisition process. To ensure accurate identification of temporal changes and geometric compatibility with other sources of information, the image were coded to the co-ordinate and mapping system of the national topographic maps. Since the available satellite images had been already corrected for radiometric distortions and had no apparent noise, the created sub-scene was only subjected to geometric correction.

The geometric correction allows to compensate for various distortion introduced by several factors including earth rotation effects, panoramic distortion (with field of view of some sensor), curvature of the earth, atmospheric refraction, relief displacement, variations in platform altitude, attitude and velocity and panoramic effects related to the imaging geometry.

Volume 5: Issue 2 : December 2019, pp 13 – 15 www.aetsjournal.com ISSN (Online) : 2455 - 0523

4) Image enhancement

Enhancement usually reinforces the visual interpretation of the images are prepared and its contrast was stretched using Gaussian distribution function. The 3 x 3 high pass filters was applied to the colour composite to further enhance visual interpretation of linear features, e.g. rivers and vegetation features

5) Ground truthing

Ground truthing was done in order to verify and modify land covers described in the preliminary image interpretation. GPS was used to locate sampled land cover observations while digital camera recorded photos on physical features about the areas. All sampled GPS points were booked as way points on a booking paper and photograph numbered. Key informants were also involved to give some information on land cover and land use particularly for the past years. The exercise was done during the dry season to make easy access of impassable areas.

6) Image classification

Supervised classification, using Maximum Likelihood Classifier (MLC), was utilized. Supervised classification process involved selection of training sites on the image, which represent specific land classes to be mapped. They are pixels that represent what is recognized as a discernable pattern, or potential land cover class. The training sites were generated by on-screen digitizing of selected areas for each land cover class delivered from colour composite.

IV. Result and discussion

The results are presented inform of maps, charts and statistical tables. They include the static, change and projected land use land cover of each class.

The original Satellite images, of size 640 x 640, are divided into 64x64 patches, each corresponding to a map area of roughly 20m x 20m.

Figure 4.1 Input gray scale Image

Each patch has a label, which is just the correct class of its central pixel. The correct class is determined according to the color of the corresponding pixel in the map image of the same area. Each 64 x 64-pixel patch was fed as training data to the classification network as shown in figure 4.1.

Figure 4.2 after noise removed Resolution change

Figure 4.3 Segmented Images

Filters can be used to enhance the appearance of an image as shown in figure 4.2. The filter can be viewed as a matrix that is moved over the image. Each value in the filter is multiplied by the value in the image underneath it, and then the sum replaces the value at the center of the filter as shown in figure 4.3.

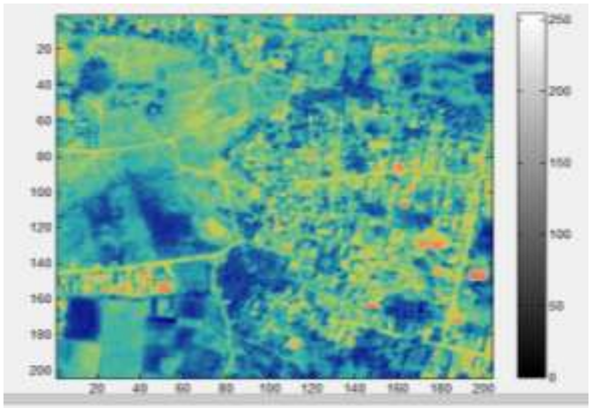

Figure 4.4 Gray scale color range

As shown in the figure 4.4 the Smooth image Values in the filter must be integers; the final result will be divided by the sum of the values in the filter to insure that the average value of the image will not change in the 3D shape distribution figure 4.5.

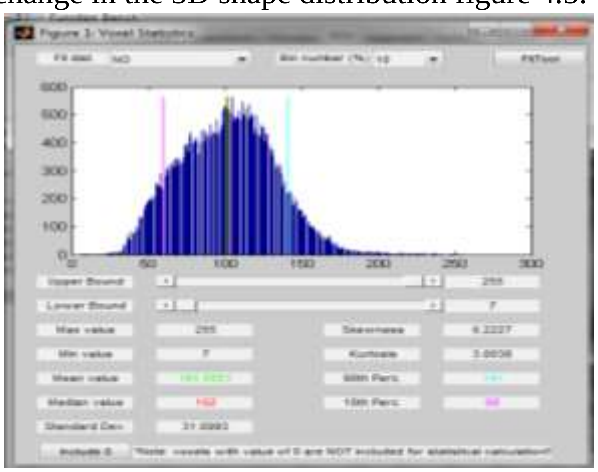

Figure 4.5 Histogram image

In raw imagery, the useful data often populates only a small portion of the available range of digital values (commonly 8 bits or 256 levels). Contrast enhancement involves changing the original values so that more of the available range is used, thereby increasing the contrast between targets and their backgrounds. The key to understanding contrast enhancements is to understand the concept of an image histogram**.** A histogram is a graphical representation of the brightness values that comprise an image as shown in figure 4.5. The brightness values (i.e. 0-255) are displayed along the x-axis of the graph. The frequency of occurrence of each of these values in the image is shown on the y-axis.

These final results overall, producer's and user's accuracy were considered for analysis. The standard division, which is one of the most popular measures in addressing the difference between the actual agreement and change agreement, was also calculated. The Kappa statistics is a discrete multivariate technique used in accuracy assessment. The report derived from the accuracy assessment cell array shows that the classification has resulted in more than 89% total accuracy which is the percentage of intensity, based upon the results of the error matrix. The generated report has also resulted in average intensity of more than 3.66 for each classified image as shown in the figure 4.6. Kappa coefficient expresses the proportionate reduction in error generated by the classification process compared with the error of completely random classification. The overall classification accuracy is expressed as the ratio of the sum of correct classifications (diagonals) and the total randomly generated reference pixels (points) used for the assessment.

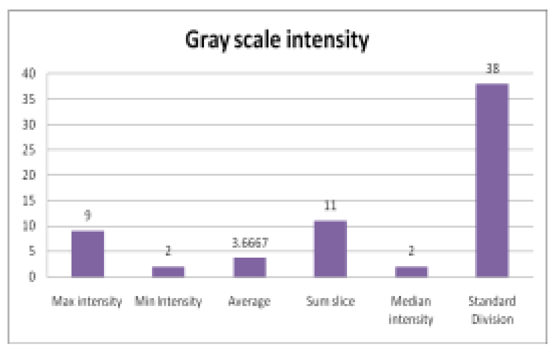

Figure 4.6 Gray Scale Intensity

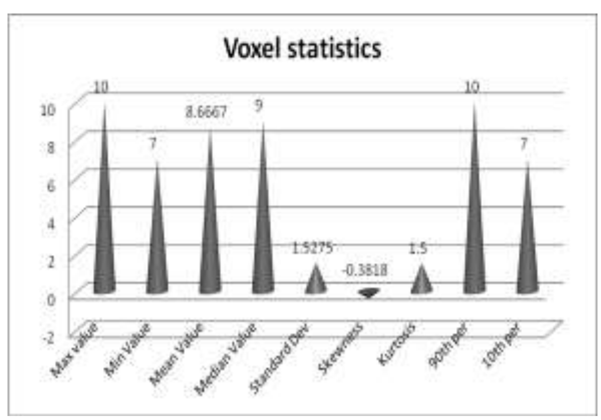

Figure 4.7 Voxel Statistics

The land use land cover percentage and the area coverage of each land category for each study year were derived from the satellite image classification has statistical resulted land uses land cover classes: Agriculture, settlement, Forest, Bare, Bush and water body as shown in the figure 4.7.

V. Conclusion

The land suitability classification based on terrain parameters like Segmentation, Image filter, gray scale intensity and other physical parameters gives satisfactory results. Each land suitability category is expressed in terms of the degree of limitation and potentials of selected parameters for its sustainable application. GIS based terrain characterization and its application for land suitability assessment is a new approach which may serve as effective tool for land use planners and land management bodies. This approach can be extended to a crop based or cultivation-type based suitability assessment and for other land use planning. Determination of the parameters and their weighing is vital because they directly influence the evaluation result.

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