

# Detection of Change in Coverage of Land Area for Agricultural use

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**Abstract—** The science and art of obtaining information about an object, area or phenomenon through the analysis of data acquired by a device that is not in contact with the object, area or phenomenon under investigation is known as remote sensing. Remote sensing data are the primary sources extensively used for change detection in recent decades. RS data sensors record the information from different portions of the land surface. In Nanjangud taluk, the agricultural land area is being rapidly urbanized towards the developed land. So it is necessary to find the accurate coverage of area been used for the agricultural land and that area being urbanized from 2015-2018. The land image data is obtained from the LIS3 satellite sensors. Post classification approach helps in cross tabulation of the various aspects of changes in the land area. The MLC classifiers make use of this image to study the landscape changes on the earth's surface left for the agricultural land usage. The change detection of the land area coverage is done by using the post classification techniques and MLC methodology.

**Keywords-**MLC, Change detection, remote sensors.

## I. INTRODUCTION

### A. Overview

In an urban environment natural and human-induced environmental changes are of concern today because of deterioration of environment and human health. [1]

The science and art of obtaining information about an object, area, or phenomenon through the analysis of data acquired by a device that is not in contact with the object, area, or phenomenon under investigation is known as Remote sensing.[2] Actually remote sensing means observing something from a distance. Satellites in space observe the Earth from a distance and help scientists study large tracts of land and how that land changes over time. [3]Image is a combination of red, green and blue color pixel values.

Traditional methods for gathering demographic data, censuses, and analysis of environmental samples are not adequate for multi complex environmental studies, since many problems often presented in environmental issues and great complexity of handling the multidisciplinary data set; we require new technologies like satellite remote sensing and Geographical Information Systems (GISs).[4]

Recent development in the use of satellite data is to take advantage of increasing amounts of geographical data available in conjunction with GIS to assist in interpretation. GIS is an integrated system of computer hardware and software capable of capturing, storing, retrieving, manipulating, analyzing, and displaying geographically referenced (spatial) information for the purpose of aiding development-oriented management and decision-making processes. [7]

Remote Sensing (RS) and Geographic Information System (GIS) are now providing new tools for advanced ecosystem management. The collection of remotely sensed data facilitates the synoptic analyses of Earth - system function, patterning, and change at local, regional and global scales over time; such data also provide an important link between intensive, localized ecological research and regional, national and international conservation and management of biological diversity. [5]

The Nanjangud Taluk is taken as the study area as it has rapidly being urbanized from recent times. It is bounded between North latitude 11 o 5' 30" and 12 o 12'30" East longitude 76 o 22'30" to 76 o 56'30" Top sheets Numbers are 57 D/12, 57D/16,58A/5,58A/9,58A/13.[6]The figure 1 provides the physiographic coverage of the study area.

The post-classification comparison approach used by many researchers employed post classification to detect land change detection techniques based on Maximum Likelihood Supervised use/land cover change detection and concluded that it has achieved high overall accuracy for a variety of data.

A Maximum Likelihood Classification and Post-classification Change Detection Techniques can be applied to Land sat images for mapping and monitoring land cover and land use changes.[8] Recently, post-classification has been employed in different areas around the world based on the use of the new classification algorithms for different purposes so as to quantify land cover change, improve spectral classification, reduce the classification error propagation and improve the land use and land cover change classification accuracy.

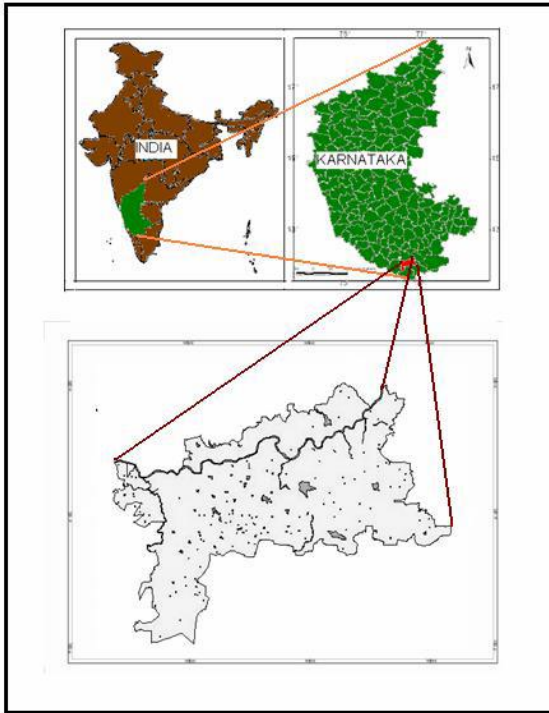


Fig. 1. The geographical map of the study area.

The concept of change detection comes under the area of digital image classification. Image classification in a remote sensing data says that the data which we have obtained is classified based on that which is obtained from satellite.

Images from the satellite itself are digital which makes the given area having different values which is captured from a three different segments/sensors. These sensors will have a digital number. In remote sensing system, a variable assigned to a pixel, usually in the form of a binary integer in the range of 0–255 (i.e. a byte). The range of energies examined in a remote sensing system is broken into 256 bins. A single pixel may have several digital number variables corresponding to different bands recorded as shown in Figure 2 and figure 3.

The DN values present in each picture are the combination of all the 3 sensors. The main aim is depending on the brightness condition and wavelength values. The classes are determining considering the above said conditions. So the given image sector will be in a structure called as a pseudo color.

The images obtained from the satellite will be hence in the form of false color component (FCC) or pseudo color component. For the FCC, the given RGB values will be obtained from the formula  $\{R, G, B\} = \{C, M, Y\} - 1$ .

The below figure shows the DN values and scatter plots of the MS bands.

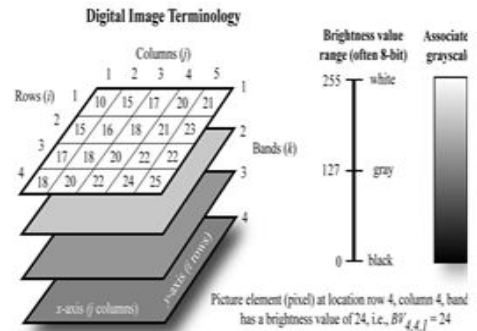


Fig. 2. DN values

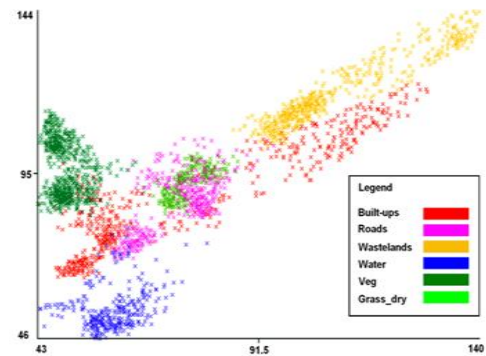


Fig. 3. Scatter plots

In these images the pixel values are standardized from 0-255 where it is divided into black, grey and white. The classes are considered according to the pixel values. The classes are splitted here and there as seen in the figure, hence for the spreading sequence the bandwidths are compared. It can be bandwidth 1 with the band 2, band 2 with the band 3 or band 3 with band 1. For better spectral classification band 1 versus band 3 are considered.

**B. Objectives**

The main aim of this project is to

- Classify the image using Maximum Likelihood Classifier (MLC).
- To analyze the land cover/land area changes in the study area over a period of time 2015-2018 using Post Classification Approach.

**C. Literature survey**

Jayakumar S and D.L.Arockiasamy have attempted to map land use/land cover and change detection in Kolli hill, TN using remote sensing and GIS in the year 2003. About 467 ha increase has been observed in single crop category and about 434ha decrease has been observed in land with or without scrub category.

Selcuk Reis, in the year 2008 have done a journal work on “Analyzing Land Use/Land Cover Changes Using Remote Sensing and GIS in Rize”, at North-East Turkey. This paper aims investigating land use/land cover changes occurred in Rize between 1976 and 2000 using remote sensing and GIS.

The LULC changes were analyzed according to both slope and altitude. The main change observed for the time period of 1976-2000 was that the area of agriculture (mostly green tea) was increased approximately 13700 ha, and forest area was decreased approximately 12100 ha. 60% of total tea production in Turkey was performed in the study area.

Sathees Kumar P and Nisha Radhakrishnan have studied Remote sensing and Gis in land use planning in the year 2010. The different land use categories and their spatial and temporal variability in Tiruchirapally city has been studied over a period of 8 years (1998 -2006), from the analysis of topographical map, IRS ID and IRS P6 for the year 1973, 1998, 2002 and 2006 using Arc GIS and ERDAS Imagine 9.1.

Prakasam C in the year 2010 has analyzed a case study on the “land use and land cover change detection through remote sensing approach” of Kodaikanal taluk, Tamil nadu. The present paper is to analyse the nature and extent land use/land cover changes in Kodaikanal Taluk and to identify the main forces behind the changes. The multi temporal satellite data set observed by LANDSAT 5, Thematic Mapper (TM), LANDSAT 4, and Multi Spectral Scanner (MSS) and Survey of India Taluk map drawn on 1:63360 scale were used for the analysis.

Praveen Kumar Mallupattu and Jayarama Reddy Sreenivasula Reddy in the year 2013 have done the research work on “Analysis of Land Use/Land Cover Changes Using Remote Sensing Data and GIS at an Urban Area” at Tirupati, India. The main objective of this paper is to detect and quantify the LU/LC in an urban area, from 1976 to 2003 using satellite imagery and topographic map. A supervised signature extraction with the maximum likelihood algorithm was employed to classify the digital data of IRS 1D georeferenced and merged LISS III and PAN for land use/land cover mapping for the year 2003.

Andy Bhermana , Bambang Hendro Sunarminto , Sri Nuryani Hidayah Utami and Totok Gunawan in the year 2013 have done a case study on “The combination of land resource evaluation approach and GIS application to determine prime commodities for agricultural land use planning at developed area” at the central Kalimantan province, Indonesia. This region consists primarily of arable land considered as agricultural developed areas and non-arable land with total area of 9,571,231 hectares (61.94%) and 5,880,056 hectares (38.06%) respectively. The potency of land availability for agriculture then indicates that land geographically has an opportunity to be developed.

N. Vijayakumar, B.Gurugnanam, K.Arulbalaji in the year 2015 have proposed a journal on “Land Use And Land Cover Change Detection “in Thirumanimuttar Sub Basin, Cauvery River, Tamilnadu. In this journal the Land Use/ Land Cover map was prepared by processing the imageries in ERDAS image processing software. The images were classified by using NRSC and supervised classification methods

## II. METHODOLOGY

The maximum likelihood detection and the post classification algorithm are used for the detection of change in coverage of land area for agricultural use.

The proposed block diagram is shown in the Fig 3.1. and 3.2.

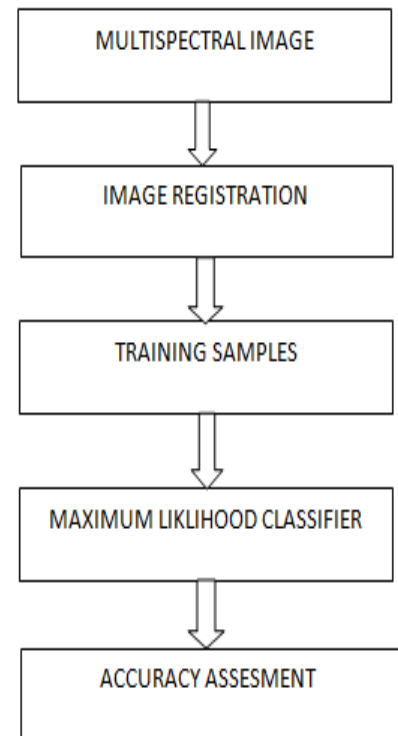


Fig. 4. MLC

### A. Multispectral Image

- A multispectral image is one that captures image data within specific wavelength ranges across the electromagnetic (EM) spectrum.
- Spectral imaging can allow extraction of additional information the human eye fails to capture with its receptors for red, green and blue.
- Multispectral imaging measures light in a small number of spectral bands.

### B. Image Registration

- Image registration is the process of transforming different set of data into one co ordinate system.
- This involves spatially transforming the moving images to align with the target image.
- The reference frame in the target image is stationery while the other data sets are transformed to match to the target.

### C. Training Samples

- Training samples are areas on the ground for which there is ground truth, i.e. what is there is known. These are the reference samples used. The numbers of training samples are taken. The training

D. Maximum Likelihood Detection

- Maximum likelihood principles calculate the probability of a pixel belonging to a class and allocate the pixel to its most probable class. It involves 3 stages :
  - Training stage
  - Classification stage
  - Output stage

E. Training Stage

- Collect numerical data from training areas on spectral response patterns of land cover categories.

F. Classification Stage

- Compare unknown pixel to spectral patterns, assign to most similar category.

G. Output Stage

- MLC is performed according to the following steps:
  - Display the 3 band overlay composite image .There will be 3 channels associated with RGB respectively. Taking into account the features of the image then determines the set of classes into which the image is segmented.
  - Using the box cursor to choose representative training samples for each of the desired classes from the color composite image. This image forms the training data.
  - These training data samples are used to estimate the mean vectors and co variance matrices for MLC classification.

H. Accuracy Assessment

- It compares the classified image to another data source that is considered to be accurate or ground truth.
- The most common way to assess the accuracy of a classified map is to create a set of random points from the ground truth data and compare that to the classified data in a matrix.

III. APPLICATIONS

- Rate of deforestation, habitat fragmentation, coastal change, urban sprawl and cumulative change through spatial and temporal analysis technique.
- Similar information can be developed for other regions

IV. ADVANTAGES

- The system uses supervised classification which is user aided.
- The signatures can be selected by the user and not by the system.GUI provides a user friendly interface which is easy to access even for a laymen.
- The system database is created using ERDAS imagine software which takes less computational time.

V. SOFTWARE SPECIFICATION

The software requirements of the project are as follows.

- Operating system : Windows 8.1
- Tool : ERDAS IMAGINE

VI. IMPLEMENTATION

This chapter gives information about the implementation of the proposed system..

- Change detection is defined as a process used to identify the change that occurred in a specific area over a span of time.
- By observing the same area at different time intervals using satellites ,the user can identify the change of land use and land cover in that area.
- Basically there are two categories of change detection methods:
  - Pre classification method analyses the change without classifying the image value.
  - Post classification evaluates the change in land cover based on detail categorized classification of land cover.
- Since high classification accuracy analysis can be made with the help of the post classification approach we make use of this type of technique.
- The post-classification comparison has been proven to be the most popular approach in change detection analysis.

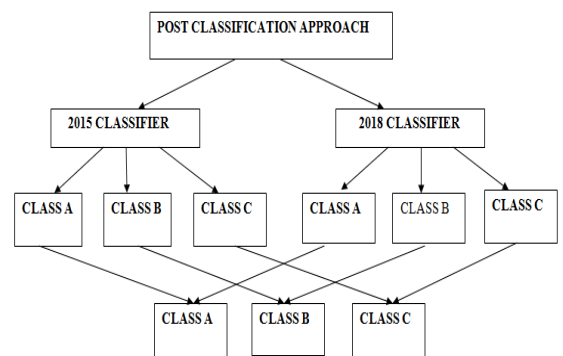


Fig. 5. Post Classification Approach

VII. RESULTS AND DISCUSSIONS

This chapter gives the overall results and conclusion of the proposed system. The images fig 6 and 7 shows the area of interest. The images in the figure 8 and 9 shows the supervised classification. The images in the figure 10 and 11 shows the unsupervised classification of the respective images of fig 12 and 13

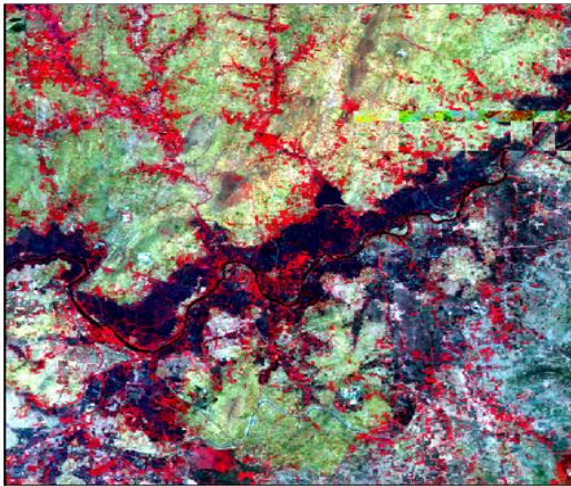


Fig. 6. shows the input image of the region of interest.

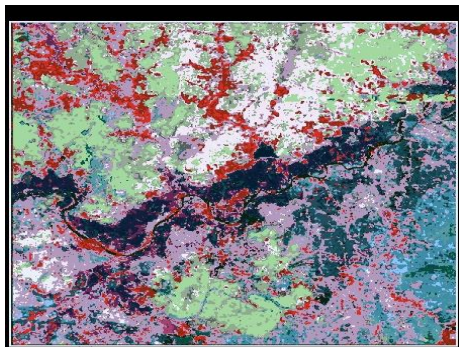


Fig. 7. shows the supervised classification of



Fig. 10. Supervised classification



Fig. 11. Unsupervised classification



Fig. 8. Unsupervised classification

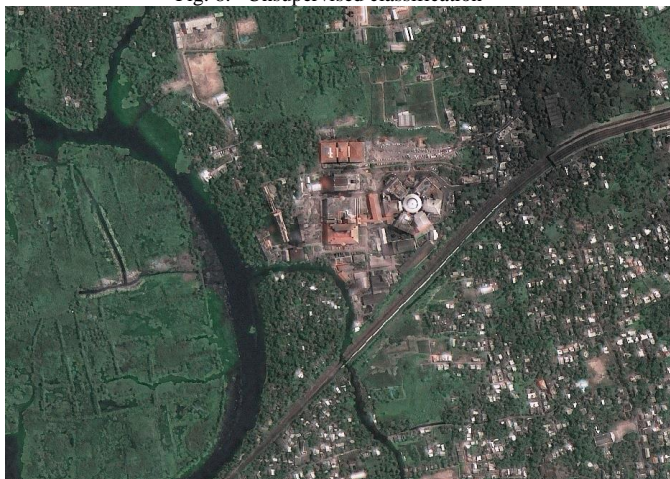


Fig. 9. Area of interest

### VIII. CONCLUSION

The present study shows that satellite RS based on land cover mapping is very effective for detecting land cover changes. The high resolution satellite images such as LIS3 and source for providing accurate information about land cover changes. In terms of techniques used in the study, it was found that the post classification technique was able to produce more accurate results.

### REFERENCES

- [1] Jayakumar S and D.L.Arockiasamy, "Land use and land cover change detection",2003
- [2] Selcuk Reis,in," Analyzing Land Use/Land Cover Changes Using Remote Sensing and GIS in Rize",2008
- [3] Sathees Kumar P and Nisha Radhakrishnan, "Land use change modeling using a Markov model and remote sensing",2010
- [4] Prakasam C,"Land use and land cover change detection through remote sensing approach",2010
- [5] Praveen Kumar Mallupattu and Jayarama Reddy Sreenivasula Reddy, "Analysis of Land Use/Land Cover Changes Using Remote Sensing Data and GIS at an Urban Area",2013
- [6] Andy Bhermana , Bambang Hendro Sunarminto , Sri Nuryani Hidayah Utami1 and Totok Gunawan, "The combination of land resource evaluation approach and GIS application to determine prime

- commodities for agricultural land use planning at developed area”,2013
- [7] N. Vijayakumar, B.Gurugnanam, K.Arulbalaji, “Land Use And Land Cover Change Detection”,2015
- [8] Sharada Singh, “Change detection using remote sensing”,20
- [9] Bedru Sherefa Muzein, “Remote Sensing & GIS for Land Cover/ Land Use Change Detection and Analysis in the Semi-Natural Ecosystems and Agriculture Landscapes”,2006
- [10] Tracking Change Over Time—Understanding Remote Sensing,USGS change for a changing world.
- [11] <https://www.encyclopedia.com/science/dictionaries-thesauruses-pictures-and-press-releases/digital-number>