Digital Classification of Land Use/ Land Cover by Using Remote Sensing Techniques

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Abstract-The landuse/landcover pattern of a region is an outcome of natural and socio-economic factors and their utilization by man in time and space. The terms "land use" and "land cover" are often used simultaneously to describe maps that provide information about the types of features found on the earth's surface is called as land cover and the human activity that is associate with them.

The social and economic development of our country is interlaced with our natural resources, and the manner in which they are managed and exploited. The finite land, minerals, water are currently under tremendous pressure in the context of highly competing, and often conflicting demands of an increasing population. So there is an urgent need to improve the productivity and the environment to meet the basic requirements of our growing population and to improve the quality of life.

The input data used in this work is satellite Image Resource Sat 2 with LISS 4 Sensor of 5m resolution, and SOI toposheet. The methodology adopted for this thesis is total enumerated through digital analysis which was carried out with the help of Erdas Imagine and GIS software.

Key words- LU/LC, satellite image, Erdas Imagine, GIS, SOI.

I. INTRODUCTION

One of the main purposes of satellite remote sensing is to interpret the observed data and classify features. In addition to the approach of photointerpretation, quantitative analysis, which uses computer to label each pixel to particular spectral classes (called classification), is commonly used. Quantitative analysis can perform true multispectral analysis, make use of all the available brightness levels and obtain high quantitative accuracy.

There are two broads of classification procedures: supervised classification unsupervised classification. The supervised classification is the essential tool used for extracting quantitative information from remotely sensed image data [Richards, 1993, p85]. Using this method, the analyst has available sufficient known pixels to generate representative parameters for each class of interest. This step is called training. Once trained, the classifier is then used to attach labels to all the image pixels according to the trained parameters. The most commonly used supervised classification is maximum likelihood classification (MLC), which assumes that each spectral class can be described by a multivariate normal distribution. Therefore, MCL takes advantage of both the mean vectors and the multivariate spreads of each class, and can identify those elongated classes. However, the effectiveness of maximum likelihood classification depends on reasonably accurate estimation of the mean vector m and the covariance matrix for each spectral class data [Richards, 1993, p189].

II. OBJECTIVE OF THE PROJECT

The main objective of the project is to

i) Geo referencing of toposheet

ii) Landuse / land cover classification

iii) Accuracy Assessment / Field verification

A. *Study Area*
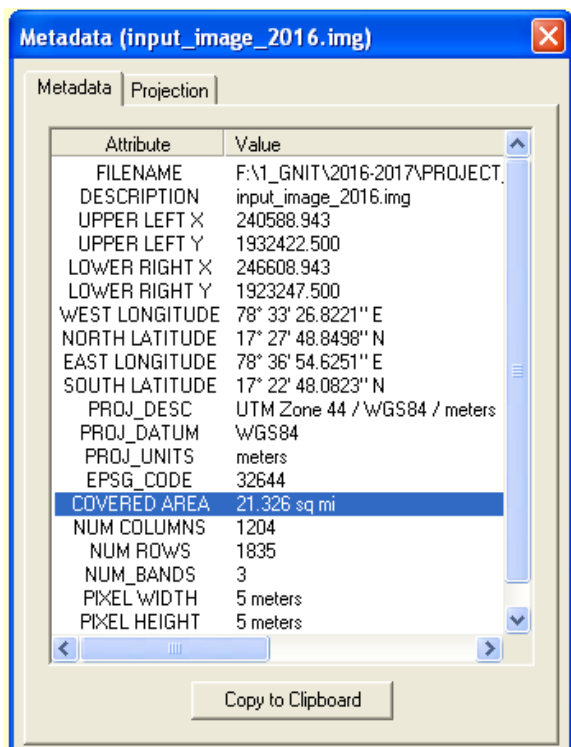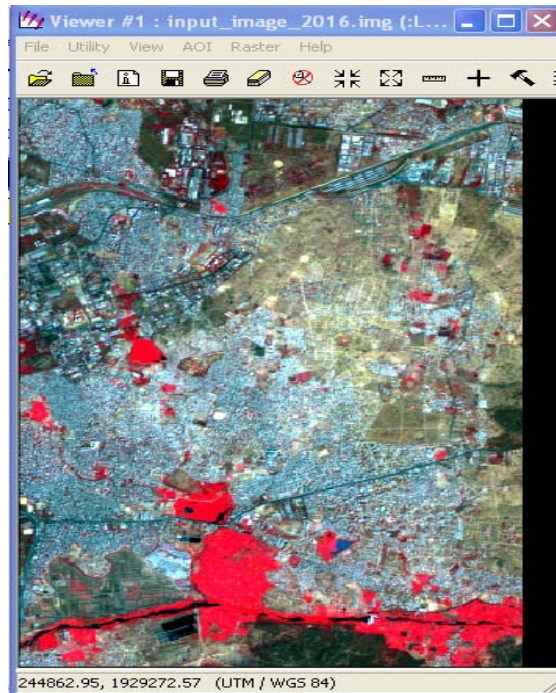
The study area is located in Cherlapally, Hyderabad

District with Latitude:17°23.043′N, Longitude: 78°27.38′ E

➢   AOI: - 21.32 Sq mi.

The coordinates of the study area are as follows as shown in meta data

Figure 1 Satellite data

B.   *Data used:*

The input data used in this work is

Satellite Image ie (Resource Sat 2) with LISS 4 Sensor,

SOI toposheet No 56K/11

   Hand GPS Instrument (Garmin Etrex)

III. METHODOLOGY

A.   SUPERVISED CLASSIFICATION

The following are the important aspects of supervised classification which is considered

- ✓   An appropriate classification scheme is adopted.
- ✓   Representative training sets is selected, including an appreciation for signature extension factors, if possible.
- ✓   Statistics is extracted from the training sets spectral data
- ✓   The statistic are analyzed to select the appropriate features to be used in the classification process.
- ✓   Selected the appropriate classification algorithm
- ✓   Classify the imagery into m classes based on the Visual interpretation.   Figure 2 Meta data
- ✓   Statistically evaluate the classification accuracy.
- ✓   Among the above aspects representing training sites are important
- ✓   Once a set of reliable signatures has been created, the next step is to perform classification of data. Each pixel is analyzed independently. The measurement vector for each pixel is compared to each signature, according to a decision rule are then assigned to the class for that signature.

B.   MAXIMUM LIKEHOOD

 The maximum likelihood decision rule is based on the probability that a pixel belongs to a particular class. The basic equation assumes that these probabilities are equal for all classes, and that the input bands have normal distribution.

 D= [-0.5 log {det (Vc)}] – [0.5(X-Mc) T (Vc)-1 (X-Mc)]

Vc= covariance matrix of class 'c'

X= measurement vector of a pixel.

Mc= mean vector of class 'c '

C.   GEOREFERENCING

 is the process of assigning real-world coordinates to each pixel of the raster. Many times these coordinates are obtained by doing field surveys - collecting coordinates with a GPS device for few easily identifiable features in the image or map
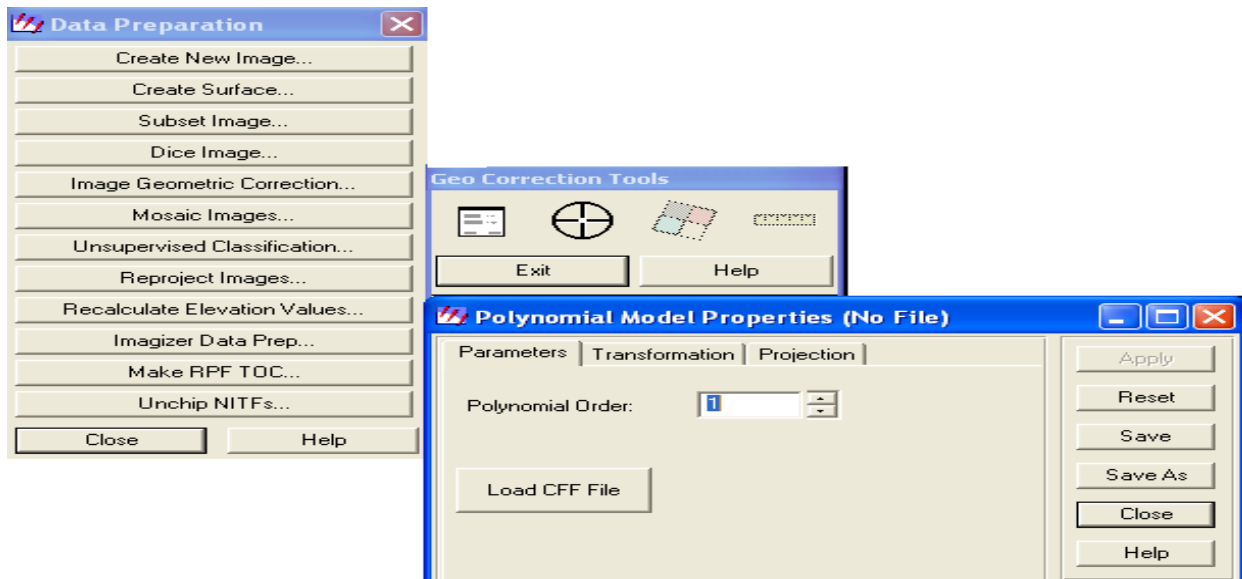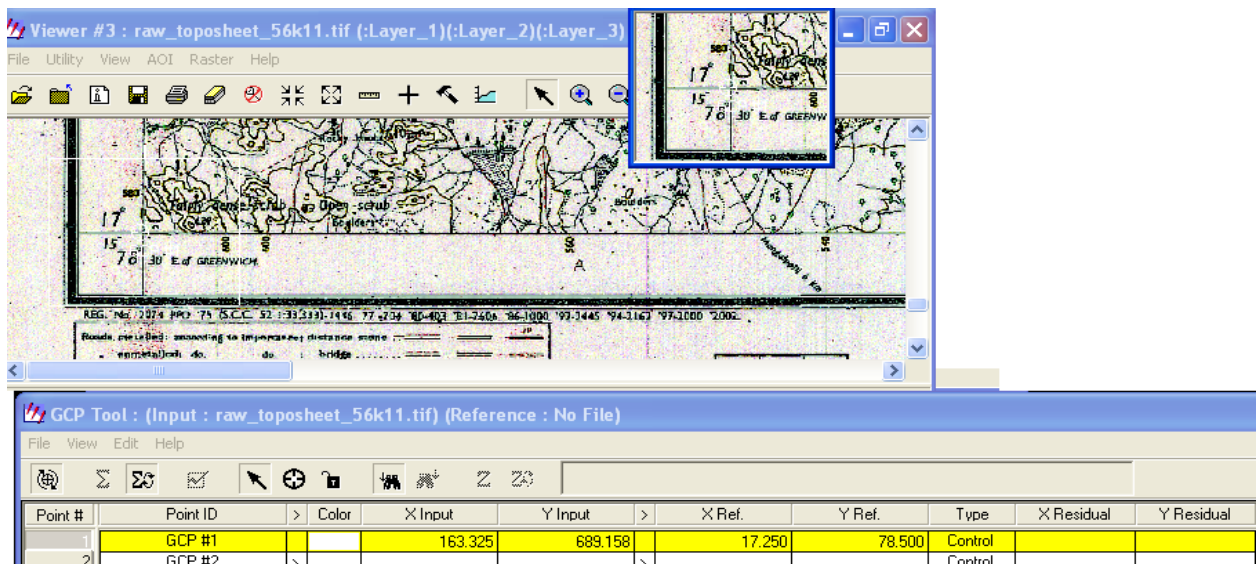
Figure 3 Image Geometric Correction

Figure 4 Image GCP
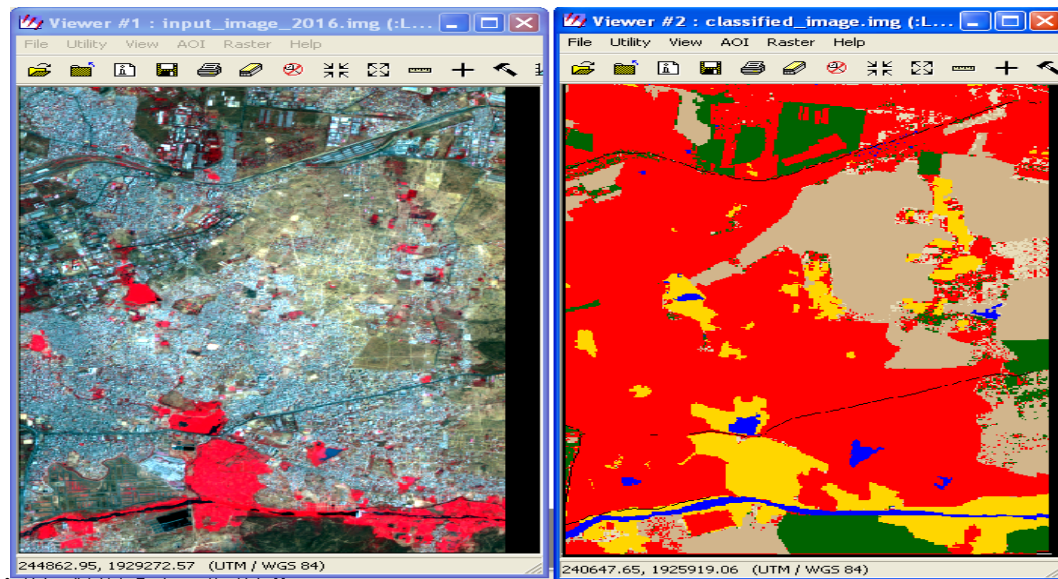
Figure 5: Supervised Classification setup

Figure 6: Original Inmage Vs Supervised Classification setup

D.   RESULT ANALYSIS

Class Names	Histogram	Area _ha	Area- Sqmi
Barren_Land	422137	2607.81	4.0746985
Scrub_Land	43156	266.6022	0.4165654
Built_Up_Land	1271492	7854.82	12.27314
Agriculture_Land	226766	1400.879	2.1888702
Water Bodies	39180	242.0399	0.3781869
Forest Land	177998	1099.608	1.7181346
Transportation	24370	150.5491	0.2352326

Table1: Area calculations
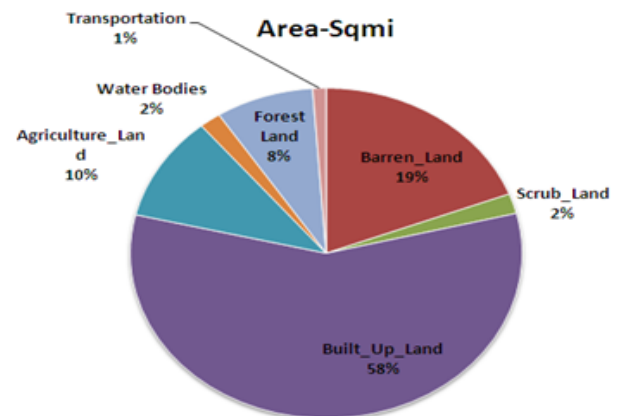
E.   ACCURACY ASSESSMENT

Accuracy Report

Every care is taken to avoid overlapping of training sites by generating error matrix and transformed divergence values at each stage of classification

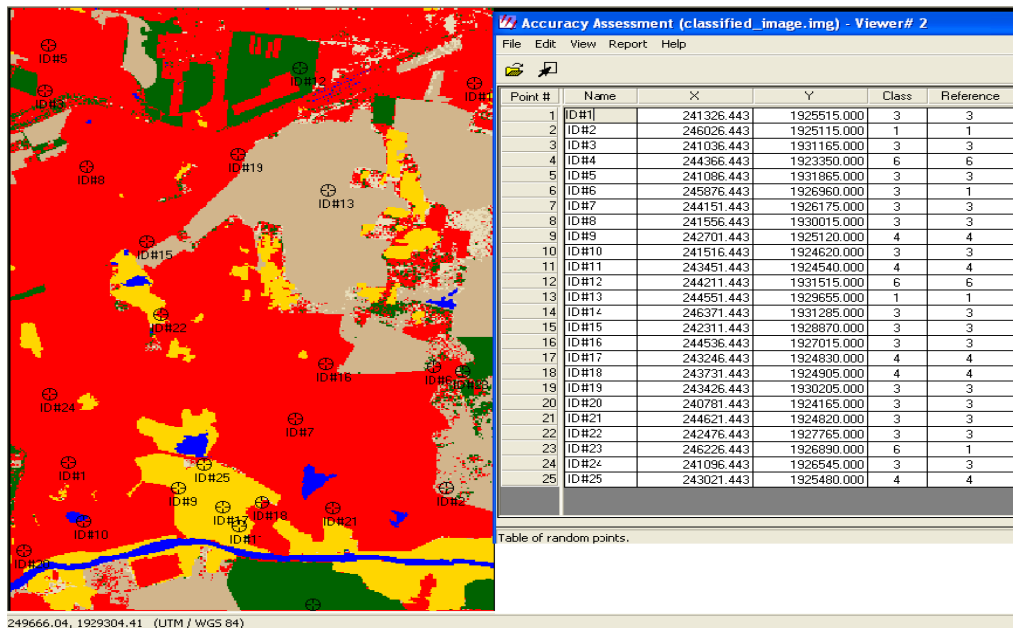The overall classification accuracy of 96.0 % was obtained

Figure7 GCP located on various class values on classified image

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CLASSIFICATION ACCURACY ASSESSMENT REPORT

Image File : f:/2016-2017/project_team/classified_image.img

User Name: admin

Date   : Wed Apr 12 20:53:09 2017

ERROR MATRIX

Reference Data

Classified Data	Unclassified	Barren_Land	Scrub_Land	Built_Up_Land
Unclassified	0	0	0	0
Barren_Land	0	2	0	0
Scrub_Land	0	0	0	0
Built_Up_Land	0	1	0	14
Agriculture_Land	0	0	0	0
Water Bodies	0	0	0	0
Forest Land	0	0	0	0
Transportation	0	0	0	0
Column Total	0	3	0	14

Reference Data

Classified Data	Agriculture	Water Bodies	Forest Land	Transportation
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Unclassified	0	0	0	0
Barren_Land	0	0	0	0
Scrub_Land	0	0	0	0
Built_Up_Land	0	0	0	0
Agriculture_Land	5	0	0	0
Water Bodies	0	0	0	0
Forest Land	0	0	3	0
Transportation	0	0	0	0
Column Total	5	0	3	0

----- End of Error Matrix -----

ACCURACY TOTALS

Class Name	Reference Totals	Classified Totals	Number Correct	Producers Accuracy	Users Accuracy
----------	----------	----------	-------	--------- -----	
Unclassified	0	0	0	---	---
Barren_Land	3	2	2	66.67%	100.00%
Scrub_Land	0	0	0	---	---
Built_Up_Land	14	15	14	100.00%	93.33%
Agriculture_Land	5	5	5	100.00%	100.00%
Water Bodies	0	0	0	---	---
Forest Land	3	3	3	100.00%	100.00%
Transportation	0	0	0	---	---
Totals	25	25	24		

Overall Classification Accuracy =   96.00%

----- End of Accuracy Totals -----

KAPPA (K^) STATISTICS

Overall Kappa Statistics = 0.9333

Conditional Kappa for each Category.

Class Name	Kappa
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Unclassified	0.0000
Barren_Land	1.0000
Scrub_Land	0.0000
Built_Up_Land	0.8485
Agriculture_Land	1.0000
Water Bodies	0.0000
Forest Land	1.0000
Transportation	0.0000

----- End of Kappa Statistics -----

IV. CONCLUSION

- Due to increase in population and forest lands are converted into agriculture lands and over time period these agriculture lands are again converted into built up lands.

- Rapid industrialization, migration of population is more hence the transportation network increases.

- Based on the statistical analysis the area is calculated one can analyze & monitor the need of water, Agriculture, forest, settlement requirement wrt increase in population

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