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Urbanisation Analysis Using Spatial Support and Improved Random Forest Decision Tree Approach

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ABSTRACT: *Urbanization is the major strategy that leads to the loss of the various biodiversity and the homogenization of geological habitat. But due to the heterogeneity of these their spatial extent, is difficult to quantify and monitor. Since vegetation in urban areas delivers crucial ecological services as a support to human well-being and to the urban population in general, its monitoring is a major issue for urban planners. It is necessary to study and analyse the drastic changes occurred due to global urbanization periodically. Monitoring the changes in urban green spaces are their functions such as the management of air, climate and water quality, the reduction of noise, the protection of species and the development of recreational activities The periodical assessment of urbanization gives raise to the development of various techniques and rules from several researchers. This paper is also a part of development over the urban-land cover analysis. It introduces an improved Budget based node calculation in Decision tree approach that preserves the statistical features and object boundaries and help in improving the classification accuracy. The system implements a spectral bands segmentation method, which differentiates the remote sensory images as Land Cover (LC) and Land Use (LU). The proposed RF algorithm of decision trees attempts to provide an improved efficiency over the other existing methods that is obtained from the experimental verification of the earlier algorithms with the proposed. The comparison report shows the performance of the algorithm from 2007 to 2013 respectively*.

KEYWORDS: *Urbanization Analysis, Problems in urbanization, Remote sensing and Geographic Information System*

I. INTRODUCTION

The population increase and migration of people from rural areas is the reason for drastic change in land cover areas and water surfaces that leads to urban development. The Urban development has been motivated in high rate by the growth of infrastructures, buildings, real estates and housing, sanitaries, utility grids and transport systems [1] [2]. It is necessary to study and analyse the changes occurred due to the rapid development in a country or a state, which is made possible by adopting a remote sensing method Urban-rural land use change is a very important phenomenon, which characterizes the urban and sub-urban areas surrounding the cities and oasis in the desert and arid zones, due mainly to urbanization activities, resulting from demographic and industrial development and also from immigration. Urbanization is considered to be an important issue and its impact on the agricultural lands surrounding urban areas has to be studied. [3] [4]

A. URBANIZATION ANALYSIS

Urbanization processes are pervasive, given that, nowadays, more than half of the world population lives in cities. According to studies performed by United Nations, this proportion might increase to over 72% by 2050. The increasing consumption of land has therefore become an unstoppable phenomenon affecting virtually all the contemporary metropolis worldwide. Policy makers face therefore unprecedented challenges with regard to governance, urban planning, and land use management because of the prevailing high dynamic growth. Performing comparative studies of dynamic environments, such as in the case of a megacity, is not a trivial job, due to the fact that this involves plenty of parameters highly variable over time: shape, dispersion, compactness, density, texture, connectivity, and so on [5]. Among these, density is the parameter commonly used to describe a type of urban environment relatively to its evolution, namely a recorded history of its growth, stagnation or decline. The urban growth process is accompanied by the modification or reduction of various portions of the city being part of a pre-existing landscape; therefore, fragmentation is the most obvious symptom of a time series that eventually leads to disorganization of an urban area. The construction of a road can be seen, at an embryonic stage, as an insignificant process: however, over the years, this may affect the land cover as well as paving the way for new urban settlements, resulting in geographic fragmentation and new structural patches spread over the area of interest. In Italy, cities continue to enlarge their boundaries, even if their growth is in general accompanied by environmental degradation, drastic reduction of agricultural crops, pastures, green areas and loss of biodiversity. According to data from the Italian Institute of Statistics, it is possible to point out the continuing loss of the "free surface" parameter, term here used to describe fields, grasslands, forests or areas not occupied by human artifacts such as buildings, factories, urban infrastructure, etc. Urbanization is inevitable, when pressure on land is high, agriculture incomes are low and population increases are excessive, as is the case in most of the developing countries of the world.

Urbanization has become not only of the principal manifestation but also an engine of change, and the 21th century which has become the centre of urban transition for human society [5]. In a way urbanization is desirable for human development On the other hand, uninhibited urbanization has been in authority for many of the difficulties, our cities experiences today, resultant in insufficient living environment, acute harms of drinking water, noise and air pollution, disposal of waste, traffic congestion etc. To develop these environmental humiliations in and around the cities, the technical development in relevant fields have to cracked these problems instigated by rapid urbanization, only then the results of development will spread most of the depressed ones. The recent technology of remote sensing which contains both aerial as well as satellite based systems, allow us to gather lot of physical data rather simply, with speed and on tedious basis, and organized with GIS assists us to examine the data spatially, offering prospects of producing various options, thereby enhancing the whole scheduling process.

B. CAUSES OF URBANISATION

The main causes of urbanization in India are:

- Expansion in government services, as a result of Second World War.
- Migration of people from Pakistan after partition of India.
- The Industrial Revolution
- Eleventh five year plan that aimed at urbanization for the economic development of India
- Economic opportunities are just one reason people move into cities
- Infrastructure facilities in the urban area
- Growth of private sector after 1990

C. PROBLEMS IN URBANIZATION

There are many problems are in effect due to the modern way of urbanization. Lack of civic amenities is yet another problem. As per 2001 slum census only 65.4 per cent of the households in the cities and towns had access to drinking water within their locations. Residual households either had the water supply source outside their premises or away from their houses. Some of the major problems in India due to urbanization are explained as follows as,

Urban Straggle: Urban straggle or real extension of the cities, both in population and geographical area, of promptly growing cities is the origin reason of urbancomplications. In most cities the economic base is incompetent of dealing with the problems created by their excessive size. Enormous settlement from rural areas as well as from small towns into big cities has taken place almost dependably; thereby adding to the size of cities.

Overpopulation: Overpopulation is a condition in which too many people live in too little space. It is a logical significance of over-population in urban areas. It is obviously predictable that cities having a large size of population clutched in a small space must suffer from overcrowding. This is well demonstrated by almost all the big cities of India.

The other major problems are unemployment, Accommodation storage, urban crimes, urban pollution etc.

D. REMOTE SENSING IMAGE CLASSIFICATION

It aims at distinguishing different categories or thematic land-cover classes using different features. Remote sensing images are normally in the form of digital images. In order to extract useful information from the images, image processing techniques may be employed to enhance the image to help visual interpretation, and to correct or restore the image if the image has been subjected to geometric distortion, blurring or degradation by other factors. The collected data information from the sensor is processed, mapped and analysed by GIS and further helps in managing location-based information. Remote sensing is the art and science of making measurements of the earth using sensors on airplanes or satellites. These sensors collect data in the form of images and provide specialized capabilities for manipulating their features. [6] In the past decades, remote sensing has been widely used in various applications, such as urban structure extraction, urbanization monitoring, change detection, and so on. With the development and modernizations in data, technologies, and concepts in the wider arena of earth statement, urban remote sensing has promptly increased popularity among a wide range of societies from many features such as Land Use/Land Cover mapping, Urban Heat Islands exploration, impermeable surface area appraisal and urban environmental security valuation handle difficult problems of possessions allocation and decision making. It includes the use of collective intelligence and anticipation to chart direction, order coordination and make growth in public activity concerning to human environment and common welfare. In order to offer more operative and meaningful direction for best planning and improvement essential to support the organization has become crucial. Hence the requirement for appropriate information system is progressively being felt in all planning and developmental accomplishments, whether these are for urban or rural areas. Urban areas of today are more precisely defined as straggling regions that become interrelated in a dendritic fashion. The progressive aspects of urbanization have often been surpassed by weakening in the physical environment and quality of life caused by the broadening gaps between supply and demand for essential services and infrastructure.

E. GEOGRAPHIC INFORMATION SYSTEMS (GIS)

GIS provides the most important informative contribution to the remote sensing applications and geological analysis. The biological invasions like species extinction and global changes caused in the ecosystem are identified by the application of remote sensing and GIS. In order to efficiently extract more reliable feature information from the satellite data, suitable classification algorithm is very essential to be selected. These information systems also propose elucidation of physical data with other socio-economic data, and thus providing a significant relation in the total planning process and making it more effective and meaningful. Modern technological progresses made in domain of spatial technology cause significant influence in planning activities. This domain of planning is of primary significance for a country like India with varied geographic patterns, cultural activities etc [7]. The determination of using GIS is that, maps offer an added dimension to data analysis which fetches us one step closer to imagine the complex patterns and associations that describe real-world planning and policy problems. Visualization of spatial patterns also supports variation exploration, which is essential in observing of social indicators. The intentions of this paper are to describe remote sensing and GIS applications in various stages of planning, implementation and monitoring of the urban area.

There are many image analysis techniques available and the methods used depend on the requirements of the specific problem concerned. In many cases, image segmentation and classification algorithms are used to delineate different areas in an image into thematic classes. The resulting product is a thematic map of the study area. This thematic map can be combined with other databases of the test area for further analysis and utilization. In the classification process, each image pixel or area is assigned into one of the several thematic categories. An important trend in remote sensing image classification is to incorporate spatial features (e.g., texture or morphology) to improve the classification results that can be obtained using the original image data alone. The incorporation of spatial information is mainly performed as a spatial pre-processing or post-processing. In addition, some methods, like discriminative random fields, conditional random fields and relaxation methods, take the spatial information into account during the classification process [8]. On the one hand, spatial pre-processing aims at extracting spatial features. Among the techniques based on this strategy, we can highlight the use of morphological profiles, morphological attribute profiles, morphological component analysis (MCA), morphological neighborhood filter-based techniques, empirical mode decomposition (EMD), wavelet filters and others. On the other hand, post processing based approaches generally perform spatial regularization after classification. For instance, techniques based on partitional clustering, watershed transformations, relearning algorithms, graph-based classification, or super pixel approaches have been used for this purpose.

II. LITERATURE REVIEW

A remote sensing device records response which is based on many characteristics of the land surface, including natural and artificial cover. An interpreter uses the element of tone, texture, pattern, shape, size, shadow, site and association to derive information about land cover.

The generation of remotely sensed data/images by various types of sensor flown aboard different platforms at varying heights above the terrain and at different times of the day and the year does not lead to a simple classification system. It is often believed that no single classification could be used with all types of imagery and all scales. To date, the most successful attempt in developing a general purpose classification scheme compatible with remote sensing data has been taken.

J. R.Otukei and T. Blaschke, [14] analyzed the potential of DTs as one technique for data mining for the analysis of the 1986 and 2001 Landsat TM and ETM+ datasets, respectively. The results were compared with those obtained using SVMs, and MLC. Overall, acceptable accuracies of over 85% were obtained in all the cases. In general, the DTs performed better than both MLC and SVMs.

S. Moustakidis et al. [15] proposed a novel fuzzy decision tree (the FDT-support vector machine (SVM) classifier), where the node discriminations were implemented via binary SVMs. The tree structure was determined via a class-grouping algorithm, which formed the groups of classes to be separated at each internal node, based on the degree of fuzzy confusion between the classes. In addition, effective feature selection was incorporated within the tree building process, selecting suitable feature subsets required for the node discriminations individually. FDT-SVM exhibited a number of attractive merits, for example, enhanced classification accuracy, interpretable hierarchy, and low model complexity. Furthermore, it provided hierarchical image segmentation and had reasonably low computational and data storage demands. Their approach was tested on two different tasks: natural forest classification using a Quick Bird multispectral image and urban classification using hyper spectral data. Exhaustive experimental investigation demonstrated that FDT-SVM was favourably compared with six existing methods, including traditional multiclass SVMs and SVM-based binary hierarchical trees. Comparative analysis was carried out in terms of testing rates, architecture complexity, and computational times required for the operative phase.

K. L. Bakos and P. Gamba [16] introduced a novel methodology to build a multistage hierarchical data processing approach that was able to combine the advantages of different processing chains, which may be best suited for specific classes, or simply already available to the data interpreters. The combination process was carried out using a hierarchical hybrid decision tree architecture where, at each node, the most useful input information source, i.e., the processing chain was used. The structure of the tree was created by using the predicted accuracy level of the whole structure estimated on a validation set. The final maps were achieved by applying the designed framework to the whole data set. The usefulness of the procedure was proved by two instances of a specific application, i.e., vegetation mapping, in mountainous and plain areas.

A. Baraldi et al. [17] provided a quantitative assessment of ISRC accuracy and robustness to changes in the input data set consisting of 14 multisource space borne images of agricultural landscapes selected across the European Union. The collected experimental results showed that, first, in a dichotomous vegetation/non-vegetation classification of four synthesized VHR images at regional scale, ISRC, in comparison with LSRC, provided a vegetation detection accuracy ranging from 76% to 97%, rising to about 99% if pixels featuring a low leaf area index were not considered in the comparison. Second, in the generation of a binary vegetation mask from ten panchromatic-sharpened QuickBird-2 and IKONOS-2 images, the operational performance measurement of ISRC was superior to that of an ordinary normalized difference vegetation index thresholding technique. Finally, the second-stage automatic stratified texture-based separation of low-texture annual cropland or herbaceous range land (land cover class AC/HR) from high-texture forest or woodland (land cover class F/W) was performed in the discrete, finite, and symbolic ISRC map domain in place of the ordinary continuous varying, sub-symbolic, and multichannel texture feature domain. In addition, they demonstrated that the automatic ISRC was eligible for use in operational VHR satellite-based measurement systems such as those envisaged under the ongoing Global Earth Observation System of Systems (GEOSS) and Global Monitoring for the Environment and Security (GMES) international programs.

V. E. G. Millán et al. [18] investigated the best season (wet or dry season) and angle of observation to map tropical dry forest succession in Brazil. Nonparametric decision trees were used to build up classification maps based on principal component analysis (PCA) inputs. The results indicated that the use of off-nadir data improved the map accuracy of successional stages of tropical dry forests and riparian forests. Particularly, extreme and negative angles of observation generated higher map accuracies, suggesting that tree shadows were enhancing spectral differences between the studied vegetation classes. Images from the dry season provided better total and classes map accuracies for late and intermediate stages of tropical dry forests. On the other hand, some classes, such as riparian forests and early stage of tropical forests needed the use of off-nadir angles of observation to reach a minimum accuracy and best scores were reached using wet season's images.

R. B. Kheir et al. [19] discussed about the use of Geographic Information Systems (GIS), remote sensing, and, more specifically, structural classification techniques and decision-tree modeling to map erosion risks and design priority management planning over a representative region of Lebanon. The structural classification organization and analysis of spatial structures (OASIS) of Landsat TM satellite imagery (30 m) was used to define landscapes that prevail in this area and their boundaries, depending on their spectral appearance. The landscape map produced was overlaid sequentially with thematic erosion factorial maps (i.e., slope gradient, drainage density, rainfall quantity, vegetal cover, soil infiltration, soil erodibility, rock infiltration and rock movement). The overlay was visual and conditional using three visual interpretation rules (dominance, unimodality and scarcity conservation), and landscape properties were produced. Rills and gullies were measured in the field, and a decision-tree regression model was developed on the landscapes to statistically explain gully occurrence. This model explained 88% of the variability in field gully measurements. The erosion risk map produced corresponds well to field observations (accuracy of 82%). The landscapes were prioritized according to anti-erosive remedial measures: preventive (Pre), protective (Pro), and restorative (Res). This approach was useful in Lebanon.

Ashish Kumar Bhandari et al. [20] have used two successful swarm-intelligence-based global optimization algorithms, cuckoo search (CS) algorithm and wind driven optimization (WDO) for multilevel thresholding using Kapur’s entropy has been employed for image segmentation. Best solution as fitness function has been achieved through CS and WDO algorithm by using Kapur’s entropy for optimal multilevel thresholding. A new approach of CS and WDO algorithm has been used for selection of optimal threshold value. This algorithm used to get the best solution or best fitness value from the initial random threshold values, and to evaluate the quality of a solution, correlation function is used. The experimental outcomes have been examined on standard set of satellite images using various numbers of thresholds. The results based on Kapur’s entropy revealed that CS, ELR-CS and WDO method can be accurately and efficiently used in multilevel thresholding problem.

III. METHODOLOGIES AND RESULTS

The methodology employed in this research focus on the measurement of area that is differentiated as LU and LC regions. The LU/LC pattern of a region is an outcome of natural and socio-economic factors and their utilization by man in time and space. Land is becoming a scarce resource due to immense agricultural and demographic pressure. Hence, information and possibilities for their optimal use is essential for the selection, planning and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population. LU/LC 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.

A. Proposed System for Spectral Image Classification

In this section, we describe the proposed Budget based Random forest approach in DT image separation scheme.

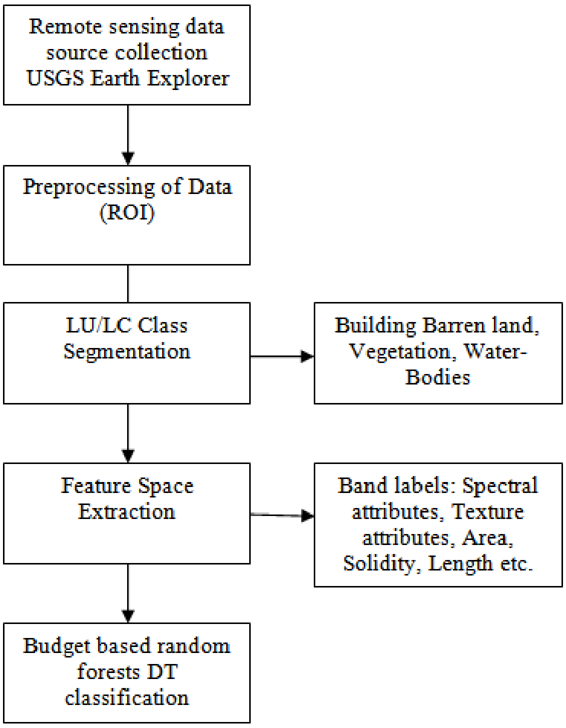
B. Study Area and Site Description

e Urban areas have been recognized as “engines of inclusive economic growth”. Of the 121 crores Indians, 83.3 crores live in rural areas while 37.7 crores stay in urban areas i.e. approximately0 32% of the population due to globalization. It is because the better opportunities that cities provide for individual development and that there are very few occupational choices available in the villages. Cities are the better equipped habitat to provide livelihood opportunities. Satisfying people’s day today needs is still a challenging task in metro cities, that too in and around South India. We can say that, people will have a tendency of migrating to cities as long as cities provide better lifestyle and employment opportunities. Hyderabad is the one of the fastest growing city in southern India. Hyderabad is one of the major metropolitan cities visibly developed a lot. In 1869, Hyderabad Municipal Corporation was introduced by British Government so as monitor population growth in Hyderabad due to the urban development. Hyderabad is the capital city of Telangana and its geographical coordinates are from 17.3850° north to 78.4867° east. The city is divided into 4 major sub-urban regions and each sub-urban regions are divided into five division for official use. Many investigations were performed as a case study on Hyderabad region.

C. Data collection and Class selection

The rapid inflows of rural population to urban places give rise to housing problem and the development of slums in these places. The increase in population of urban places pressurizes the demand of water and sanitation facilities, which results in environmental pollution, health hazards etc. So the urbanisation in metro cities should be regularised. This Research mainly concentrate on classes such as vegetation, water, urban area and barren land cover in Hyderabad. Water class includes rivers, lakes, pools and streams etc., in which the rivers and streams may sometimes referred as barren areas because it may not have flowing water throughout the year. In addition, the classes such as Forest regions, Small and Medium Parks are consider as vegetative lands. However during summer and spring season, forest areas may also consider as barren lands abruptly. Cloud free Landsat satellite data of two different years and month taken from USGS Earth Explorer website.

Based on U.S Geological Survey of Earth Resources observation and Science (USGS EROS), Month of July has minimum cloud cover of 4% and the vegetation peak for pasture, which period is suitable to get high spectral signals in vegetation. Different size of samples are require to find urbanisation in metro cities as 30m, 40m, and 50m respectively, where 30 m resolution is suitable for mapping in regional scales. High resolution sensors are impractical to apply to the total study area due to their high cost and this process requires a longer period to analysis than the medium spectral images.



IV. EXPERIMENTAL RESULT AND DISCUSSION

The analysis process of urbanization using the proposed Improved Random Forest DT algorithm provides increased accuracy of identifying the LC and LU regions than the all other approaches developed earlier. The spectral and texture attributes are calculated for further differentiating the band levels found in the image sample.

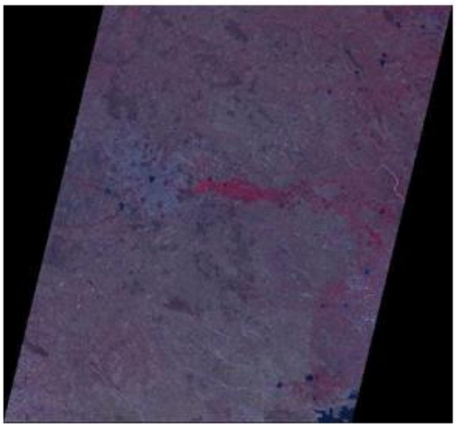
A. Experimental data collection

In this research, an experiment is made on two images containing all the attributes required to classify, which consist of two random years 2007 and 2013 from the database USGS Earth Explorer website respectively shown in Fig.1, 2. The USGS Earth explorer containing the spectral view of Cloud Free Landsat satellite data of Hyderabad region is considered

S. No.	Image taken on	Satellite/ sensor	Reference system/path/Row
1	February 2007	Landsat5 /TM	WRS-2/144/48
2	February 2013	Landsat7 /ETM+	WRS-2/144/48

Table.1. Details of Landsat data collected

The below two images Fig 1 and 2 shows the spectral view of the selected two random years 2007 and 2013



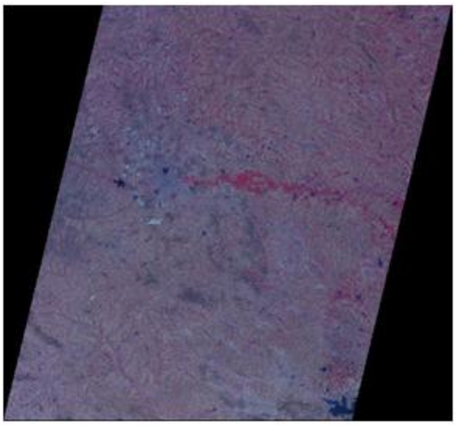


Fig 1 & 2.Ariel view of 2007 satellite image

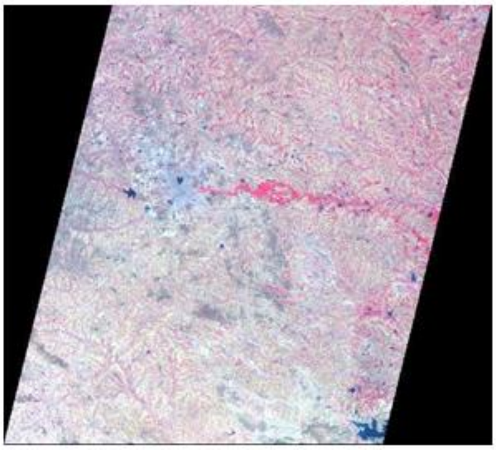
The spectral training images Fig. 1, 2 are passed into a series of process such as pre-processing of training and test data, Identification of classes, Segmentation of the data, and classification results, which are all performed for finding the accuracy of detecting the LC and LU data.

B. Class selection

In this experiment, Land cover regions are denoted by the Built up area and Barren land, whereas the Land use regions are denoted by the Vegetation and Water bodies that is applicable for both the 2007 and 2013 satellite images.

C. Pre-processing of training and test data

The intensity values are detected from the Fig. 1, 2 based on the RGB value calculation method, which are used for adjusting the pixels of the attributes present in the image. The enhanced image is provided with a legible quality of RGB existence and a noise free data. In fig 3, the improved spectral view of 2007 year is represented, likewise the enhancement is performed for Fig. 2 of 2013 spectral image.



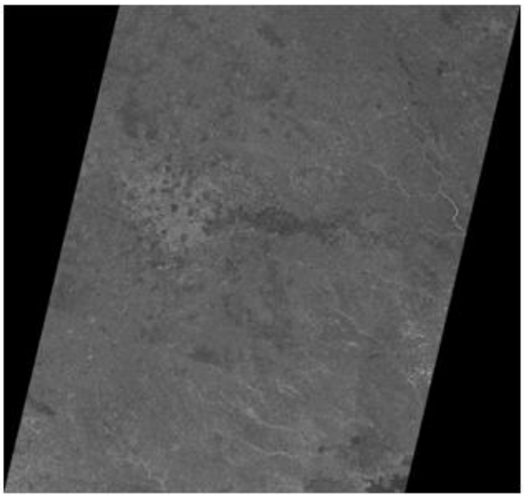


Fig 3. Enhanced spectral image of 2007

D. Segmentation results

The attributes classes are segmented into four bands denoting the spectral intensities of the RGB values such as Near Infra-red (Near IR), Short IR1, Short IR2, and Thermal IR shown in Fig. 4, 5, 6, 7, 8, 9. From these four spectral bands, two bands may not be considered by our proposed method. The short IR1 and short IR2 from 2007 and 2013 is considered less, whereas the other bands are analyzed to follow up classification. **Fig 4. Near IR representation of 2007**

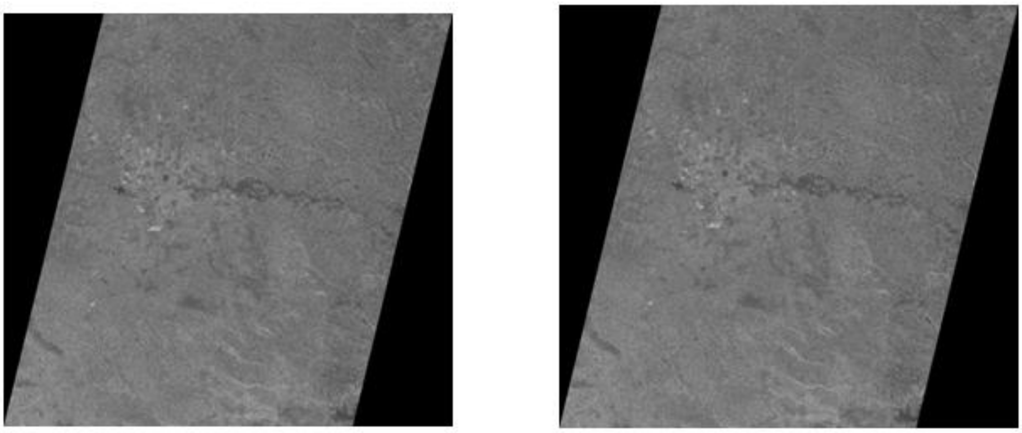


Fig 5. Near IR representation of 2013

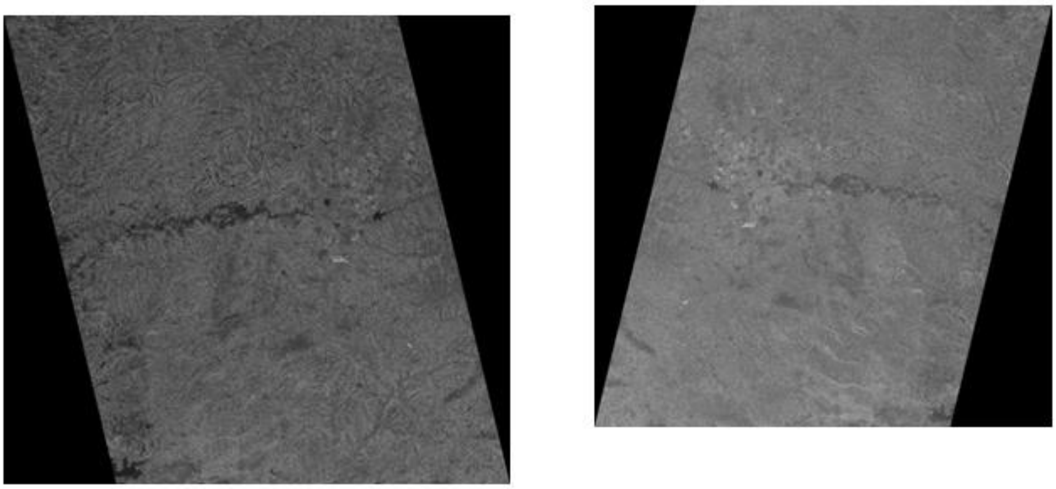


Fig 6. Short IR1 representation of 2007

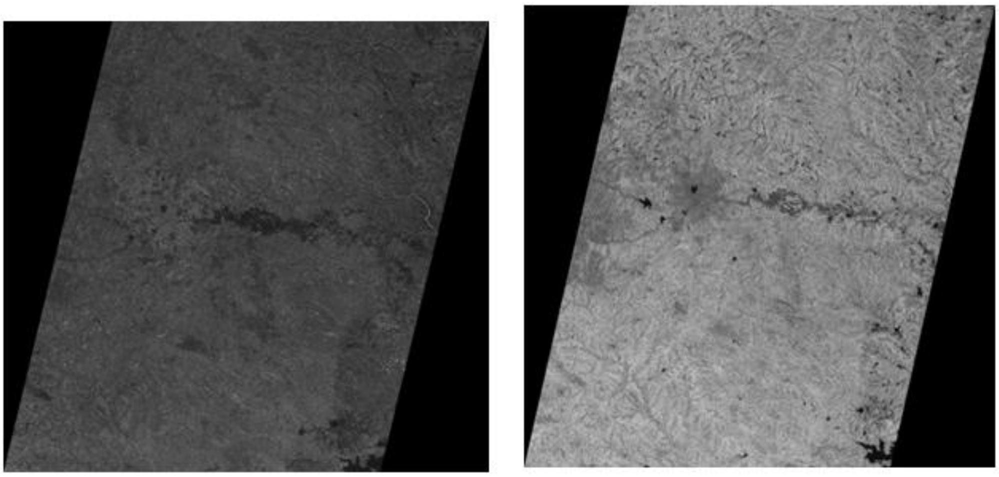


Fig 7. Short IR1 representation of 2013

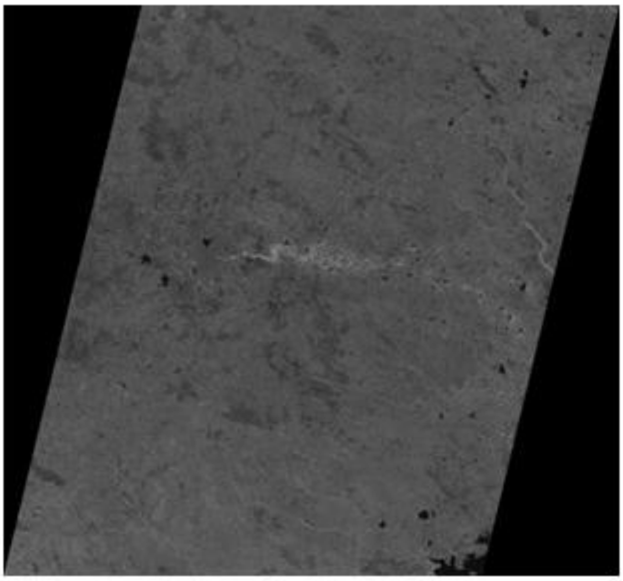


Fig 8. Short IR2 representation of 2007

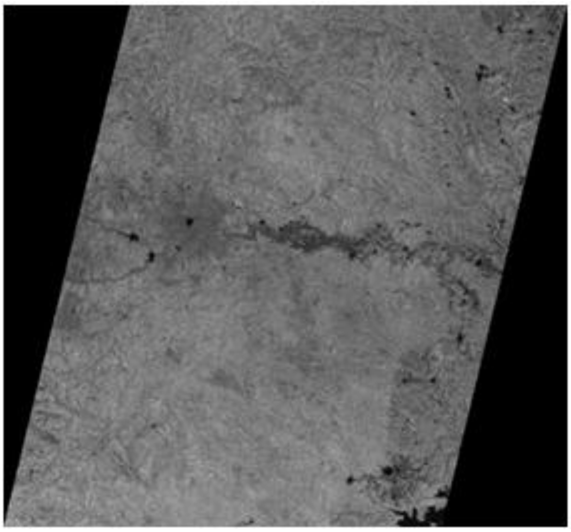


Fig 9. Short IR2 representation of 2013

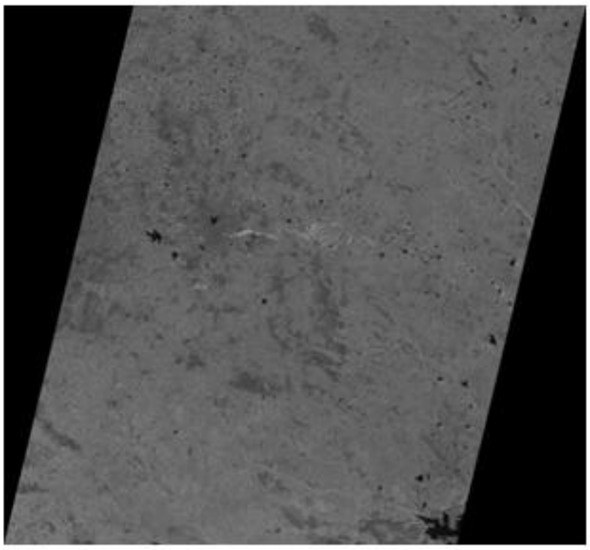


Fig 10. Thermal IR representation of 2007

Fig 11. Thermal IR representation of 2013

As a result, the derived bands were used as the dependent variables whereas the land cover classes were used as the independent variables.

E. Classes

In addition, the spectral band results are identified and the attributes classes are separated from it, showing the waterbodies, forest, urban lands and barelands. The below figs. 8, 9, 10, 11, 12, 13, 14, 15 represents the fine definition of the attributes classes for 2007 and 2013 discussed above

Fig 8. Water bodies representation of 2007

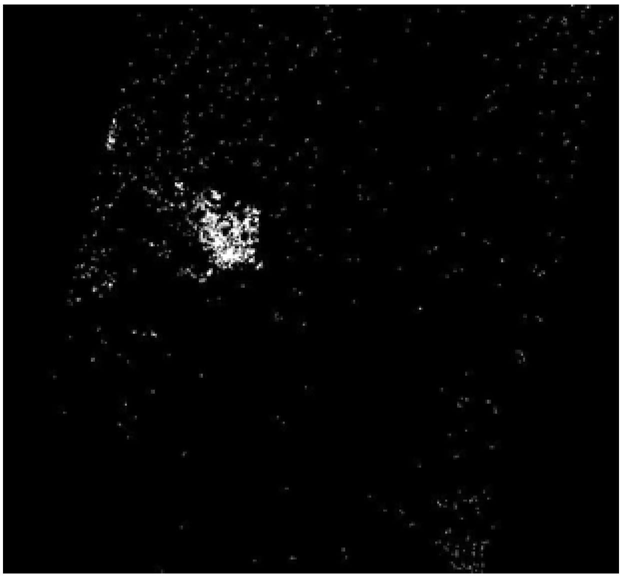


Fig 9. Water bodies representation of 2013

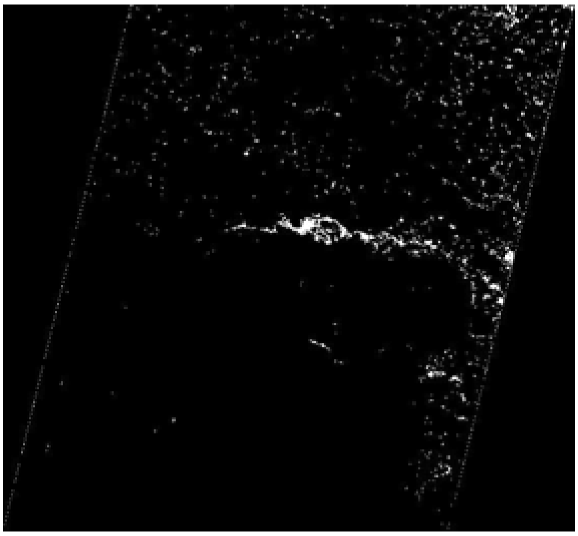


Fig10. Forest representation of 2007

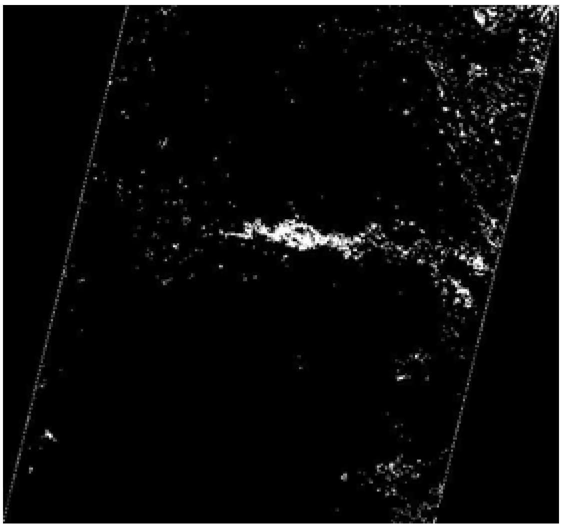


Fig11. Forest representation of 2013

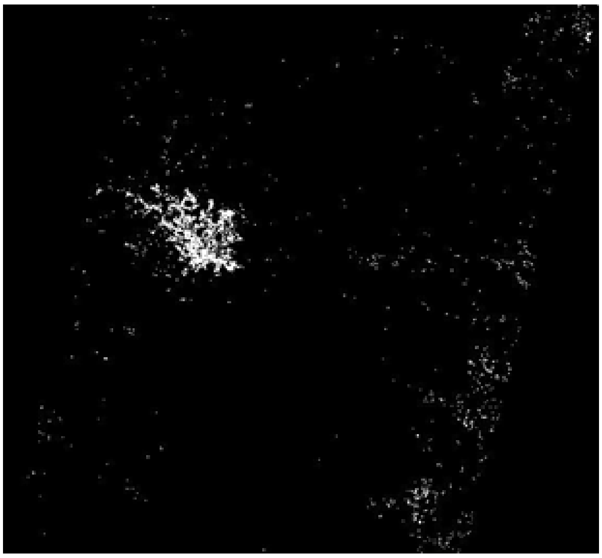


Fig 12. Urban land representation of 2007

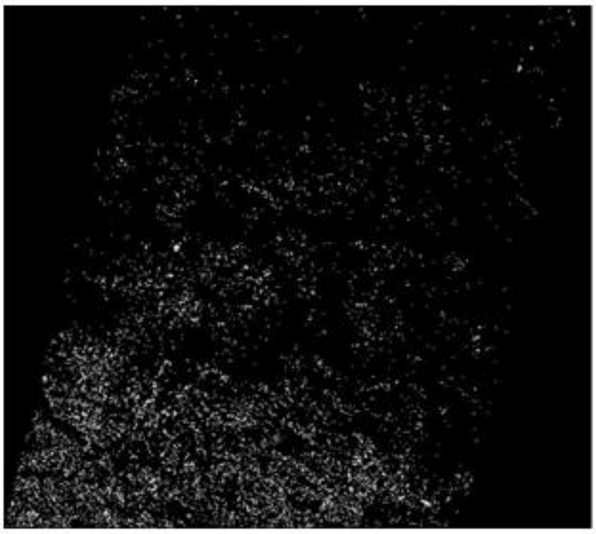


Fig 13. Urban land representation of 2013

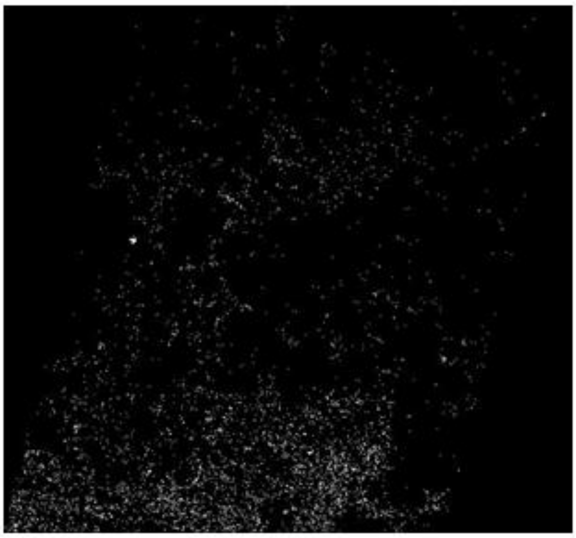


Fig 14. Bare land representation of 2007

Fig 15. Bare land representation of 2013

F. Classification results

The DT based classification is applied in the segmented images to derive the LC and LU region view that is mentioned in the below Figs. 16, 17, 18, 19 of the years 2007 and 2013.

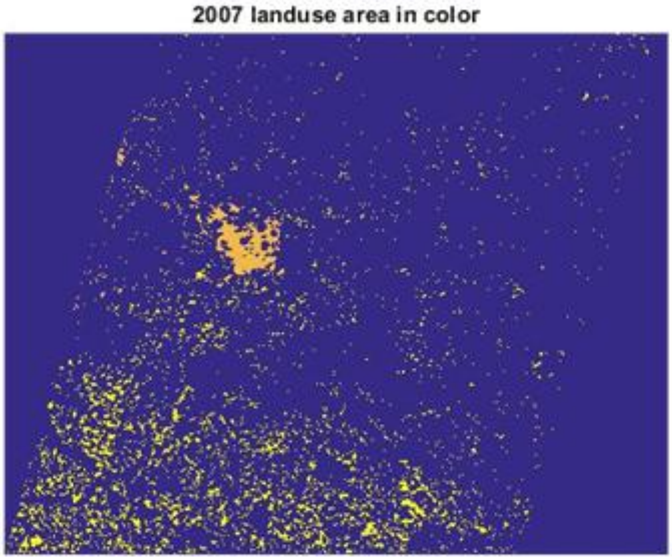


Fig 15. LC representation of 2007 spectral image

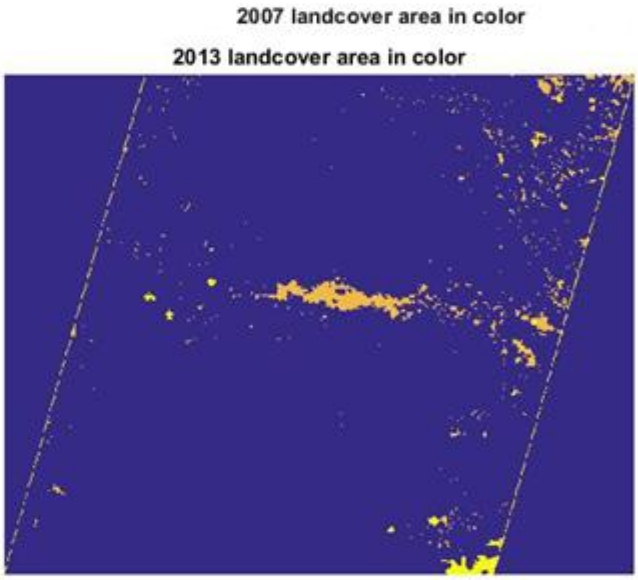


Fig 16. LC representation of 2013 spectral image

The LC and LU is identified by applying this technique with the implementation of Random forest and it provides a good accuracy than the other algorithms.

Fig 17. LU representation of 2007 spectral image

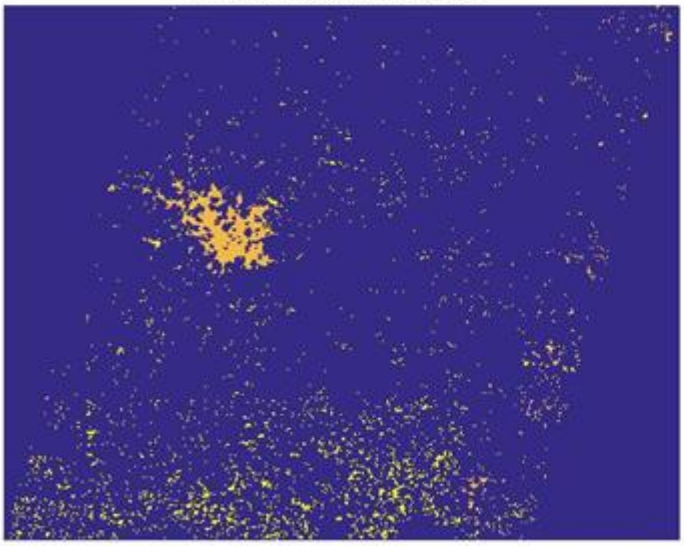


Fig 18. LU representation of 2013 spectral image

The classified images of the two years can be enough to calculate the area of different land cover and land use and also it helps to observe the changes that are taking place in the range of data. The classified images obtained after pre-processing and Random forest DT classification that showing the land use and land cover of the Hyderabad city are given in the following figures Fig. 3, 4and 5, 6.

The below table predicts that the difference between the training and test data found in 2007 and 2013 images in the form of performance accuracy, in which accuracy is divided for existing, proposed and user perspective and the overall accuracy and kappa statistics is also calculated. The accuracy of all the LC and LU classes are improved in our proposed system than the system and improved overall accuracy is also achieved.

G. Analysis report

The distribution of LC &LU classes in the image should not be same all the time rather it will get changed regarding climate and weather condition. Generally, the water bodies region sometimes tend to form as barren land when it is summer and vice versa for rainy season. Likewise the barren land sometimes form as forest area abruptly. The experimental results in our system also tend to change according to such natural phenomena. An assumption of climate is made in this research and a report is generated to denote the pixel occupancy of the classified LC and LU classes of 2007 and 2011, which is measured in hectares shown in table 2.

LC &LU class	**2007*(ha)***	**2013*(ha)***	**2007-2013*(ha)***
Water	5011.2	3323.17	-1688.04
Forest	9622.89	13200.06	+3577.17
Urban	6016.63	86651	+2648.47
Barren land	23272.75	12311.06	-10961.68
Land cover	15964.95	18743.08	+2778.125

Table 2. Analysis report of 2007 & 2013 land cover classes in hectares

The calculation of LC and LU regions are given as LC= Forest + water, LU= Urban + barren land. The above mentioned table and calculation method depicts that, the land cover (LC) is of 85.0% because the water bodies is 66.3% and forest is 72.9%. Likewise the LU region becomes as 51.4% as the urban use is 69.4% and barren land is 52.8%. These generated value is for particular assumption of weather condition considered by us in this research. On the other hand the value of water and forest may become positive if the barren lands are occupied by more water or more forest.

V. Conclusion

The paper is a source that reproduces the Urbanization assessment and analysis data with its improved Decision tree algorithm based on budget based calculation. The spectral and texture attributes are the major components constitutes the spatial feature system, is calculated and the band level differentiation were implemented to provide an improved classification system. The algorithm has been experimented by comparing it with the earlier methods and the reports are tabulated. The classification results of LC and LU regions from the tabulation, shows the rate of urbanization and different attributes of water, forest and barren lands in the years 2007 and 2013 as well. It is concluded by stating that the urbanization in Hyderabad region and its detection accuracy is improved by the proposed technique to a great extent.

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