INTERNATIONAL JOURNAL OF RESEARCHES IN BIOSCIENCES, AGRICULTURE AND TECHNOLOGY

ANALYSIS OF GREENNESS IN RULER'S VILLAGES USING SUPERVISED AND UNSUPERVISED CLASSIFICATION

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ABSTRACT:

With a view of accomplishing the needs for further analysis on image, a remotely sensed image is at first pre-processed in order to remove anomalies from it, thus resulting in clear and informative image. The importance of the accuracy in processing of a remotely sensed image cannot be over emphasized as without it the quality of output produced would be of lesser value to the end user. Remote sensing image classification involves supervised and unsupervised techniques. Both the techniques give different outputs and levels of accuracy. This paper describes the analysis that was carried out to perform supervised and unsupervised techniques on remote sensing data for land cover classification and to evaluate greenness in terms of area over a period of time. Both the methods are used for object classification and detection. The input images were enhanced using histogram equalization technique and then segmented using supervised and unsupervised classification with the help of ERDAS software which equips user with a dynamic set of tools for executing numerous task like geo correction and its analysis, data visualization, and mapping of outputs. After segmentation or image classification results were analyzed to give exact measure of greenness in terms of area in hectares and square kilometers calculated over a span of years.

Keywords:- Image processing, Histogram equalization, Unsupervised Classification, Supervised Classification, Greenness analysis.

INTRODUCTION :

The importance of preserving and maintain green spaces in urban environment is widely acknowledged. Green space in cities are considered a crucial factor for realizing environment quality goals. ruler's green space is known to provide ample benefits to human beings. As urban growth is placing pressure on green areas within and around the Villages'. As Many countries all around the world desire to be updated with the latest geographical information and activities of their area, this kind of data helps the respective authority in the Bureaucracy to plan the development of a particular place geographically [1]. Peijun Du et. al. reported the urgency of hybrid approaches of environment analysis of different aspects as Land Use/Land Cover (LULC), rulers vegetation

and water monitoring, change detection and implemented integrated system of Rulers Environment Analysis System (UEAS). For the confirmation of effectiveness of this system author demonstrated case studies [1].

Conghong Huang et.al. described health benefits to rulers residents by analysis of ru green spaces in 28 megacities worldwide between 2005 and 2015. Mapped land covers of Landsat images and running random forest classifier on Google Earth Engine[b]. Health benefits increased as increased availability and accessibility of urban green spaces in megacities[2].

Theodomir Mugiranez et. al. [3] demonstrated support vector machines (SVM) and rule based methods for object based multi stage classification. The input of WorldView-2 spectral bands, gray level co-occurrence matrix (GLCM)

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texture measures, spectral indices and a digital terrain model (DTM) are used to define 12 land cover classes. The classification accuracy improved by geometric ruleset, greenness density indices and urban density indices.

Researcher [4-6] reported survey on different enhancement techniques for more suitable outputs for further analysis. Author described Exact Histogram Equalization, Adaptive Histogram Equalization, Contrast Limited Adaptive Histogram Equalization (CLAHE) and many more. The outcome of these methods may be under contrast or over contrast; every technique has their pros and cons.

Andre Jalobenu et. al. [7] discussed adaptive Gaussian model automatic algorithm for image enhancement. The algorithm gives good results on high resolution satellite images. Maximum Likelihood Estimator (MLE) is used to estimate measuring parameters. Author proposed wavelet-based and adaptive de- convolution based hybrid approach to enhance the outcomes.

Omprakash Patel et. al. [8] described that recursively separated and weighted histogram equalization (RSWHE) method. This method preserves scalable brightness due to its recursive nature. The different histogram equalization based methods compared through experimental study and error estimation parameters.

Jiří Šastný and Martin Minarík [9] described different filtering preprocessing methods for object detection. Author reported that the speed and accuracy are opposing requirements for edge detection. The object momenta give good results with 74% rate of objects recognition.

The research work [10], [11] presented a compressive analysis of different image classification techniques. The classification methods are categories into automatic, manual and hybrid approach. Most of the methods are developed using automatic category.

This work presents analysis of change in greenness of rulers village's for different years. The setup of the paper is as follows:- Section II: describes image data used for evaluation and about ERDAS software is used for analysis. Section III: briefly describes the Preprocessing method for image enhancement and supervised and unsupervised methods for further classification. Section IV: gives the analysis of classification results. Finally section V: ends with the conclusion.

MATERIAL AND SOFTWARE:

In this paper, the sampled input images are collected from Google earth of Size 1280 X 784 of Location near Virli Bu. Area, as shown in Figure 1. ERDAS IMAGINE software is used [12, 13] for geospatial data processing. This software package is used to analyze different imagery, geospatial imaging and vector data. It is the best software for vast amount of information extraction and also supports spatial modeling system.

METHODOLOGY:

Figure 2. shows that the flow diagram for satellite image classification. On input image we applied pre-processing method that is enhancement. The quality and visual information is upgraded using enhancement techniques for further processing. Histogram Equalization is used to tabulate the intensity values thus making uniform distribution of pixels to get an enhanced image see Figure 3. Thus, Histogram equalization technique is used to grow the dynamic range of pixels for better visualization of an input image

Supervised Classification

By using supervised classification method as shown in Figure 4, users are required a training sample for each class that is, a collection of data points known to have come from class of interest. Once the signature files are created the pixels of image are sorted into classes by using method maximum likelihood. It assumes that

the statistics for each class in each band are normally distributed and calculates the probability that a given pixel belongs to a specific class. The highest probability decides the class of each pixel in the image.

Signature Files in Supervised Classification:

Firstly, in the signature files data created for different classes, which contains mean and covariance values for each class. Then every pixel of image is assign to a matched class of signatures using maximum likelihood classifier concept. The primary difference between the unsupervised and supervised methods is in the creation of the signature files. In a supervised classification, the analyst selects and digitizes polygons (training areas) and places these polygons in an AOI (Area of Interest) layer from which to create the signature files, rather than using an automated routine to define the most separable classes. Signature files are used for matching purpose in supervised classification, which consumes more time than unsupervised classification, but gives better classification results.

In the ERDAS Imagine software, supervised classification method includes following steps:- The area of interest is defined as individual training site with unique class name as shown in Figure 5. Signatures are generated using training site of pixels, by repeating this process collect several training sites for different classes. Each pixel from image is matched with the one of the signature. So, the system will assign matched signature class to that pixel. This signature is used to draw the area of interest as shown in Figure 6. The green color defines area covers by the vegetation as shown in Figure 7 for different images.

UNSUPERVISED CLASSIFICATION

Unsupervised classification is a pixel based automated classification method. Figure 8 shows the flow of the algorithm. In this method, the user has to define maximum iterations, number of classes and threshold value to stop the classification process. After the classification data has to interpret, label and color code the classes accordingly.

For unsupervised training and classification, ERDAS Imagine employs the Iterative Self-Organizing Data Analysis (ISODATA) clustering technique. The statistical data is used to match the pixel values, and then matched pixels groups into separate classes. To generate the groups, system went through the number of iterations, until it satisfy the threshold condition. These groups are defined in the signature file; it used to generate new class values, which uses the statistics of the data to calculate the similarities or differences of the pixel values then groups the pixels into separate classes. This process takes several passes, or iterations, until it reaches a convergence threshold. The groups are then defined by a signature file, which can be used to create a new raster layer of discrete class values. Imagine uses the ISODATA algorithm to perform an unsupervised classification, or clustering, of the image pixels into spectral clusters. Every cluster has includes a group of similar spectral characteristic pixels. The ISODATA clustering method starts by arbitrarily establishing N cluster means based on the mean and standard deviations of the bands in the input file ("N" is a number specified by the user, this is essentially the number of classes you are trying to classify). A minimum distance criterion is then used to assign each pixel to the "nearest" cluster. In the iteration process again each pixel matched with new cluster characteristics and allocated to the matched cluster.

Unsupervised classification is essentially a computer automated classification. The users specify the number of classes and the spectral classes are created completely on the basis of numerical information in data. The pixels are grouped together on basis of spectral similarity.

The below result is of unsupervised classification where three classes are made which are represented using three different colors. Black color is region of interest detecting the greenness.

RESULTS & DISCUSSION :

From the analysis of experimental results of images year 2003 to 2018, the greenness area is decreasing day by day. The supervised classification gives better results as compare to the unsupervised classification method as demonstrated in the Figures 7 and 9. The input images are taken in the gap of three years for the analysis of change in vegetation. Now a day's this is a concern topic for the betterment of urban cities. As we analyze input images visually in the span of 2003 to 2018 years, green area is decreases faster. From the experimental results, for supervised classification method greenness area is decreasing continuously. As shown in table 1, in 2003 green area in Hectares is 37.7747, after 15 years it reduced to 17.7438 Hectares. For unsupervised classification method gives false results, due to misclassification of the pixel values, as it is fully automatic classification method. Table 2 depicts that the comparative analysis of change in green area between two years.

CONCLUSION:

Supervised classification method more accurate than unsupervised classification; it depends heavily on the training sites, the skill of the individual processing the image, and the spectral distinctness of the classes. Unsupervised classifier generates the different classes on the basis of spectral details, not on visual analysis. Spectral properties of classes can also change over time, so supervised classification can be used for segmentation and further calculations of greenness in terms of area was presented. With the developed algorithm using the software, images are being studied and analyzed on the basis of greenness.

The causes and the effect in increase or decrease of the greenness are then specified. Proper measures can be suggested in order to overcome the problems which where stated during the analysis for the betterment of village's.

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Table 1. Green area calculation from output images for Supervised Classification and Unsupervised Classification Methods.

Sr. No.	Year of image	Supervised Classification		Unsupervised Classification	
		No. of Green Pixels	Area in Hectares	No. of Green Pixels	Area in Hectares
1	2003	377747	**37.7747**	336144	**33.6144**
2	2006	451866	45.1866	359735	35.9735
3	2009	276523	27.6523	396342	39.6342
4	2012	224429	22.4429	337709	33.7709
5	2015	292427	29.2427	325995	32.5995
6	2018	177438	**17.7438**	433748	**43.3748**

Table 2. Green area difference between two years for Supervised Classification and Unsupervised Classification Methods.

Comparison of years	Difference in Areas for Supervised Classification	Difference in Areas Unsupervised Classification
2003 & 2006	**7.4119**	**2.3591**
2006 & 2009	-17.5343	3.6607
2009 & 2012	-5.2094	-5.8633
2012 & 2015	6.7998	-1.1714
2015 & 2018	**-11.4989**	**10.7753**

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(a) Input Image Year 2003	(b) Input Image Year 2006
(c) Input Image Year 2009	(d) Input Image Year 2012
(e) Input Image Year 2015	(f) Input Image Year 2018
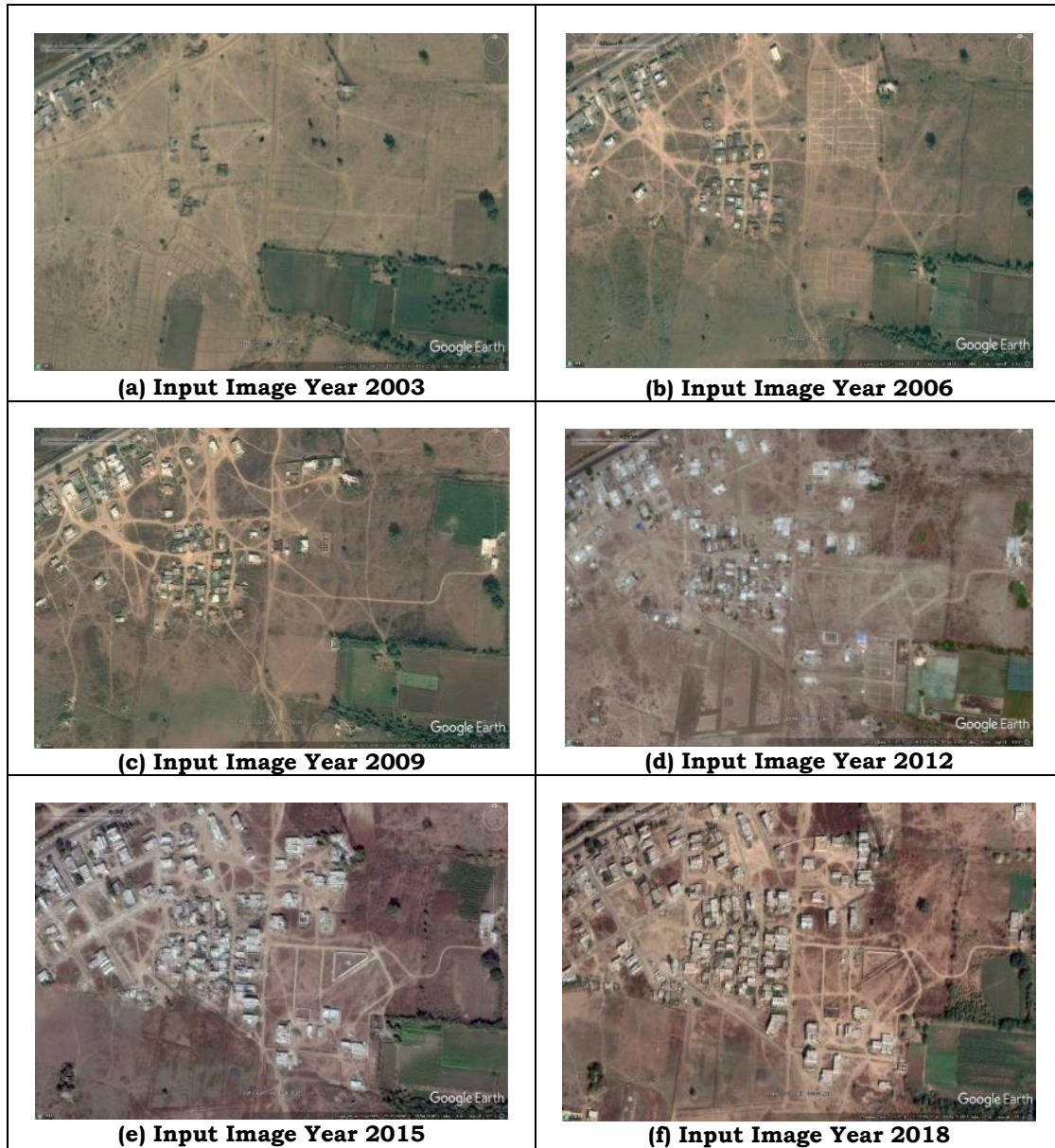
Figure 1. Source of input Images: Maharashtra Remote Sensing and Application Centre Nagpur.
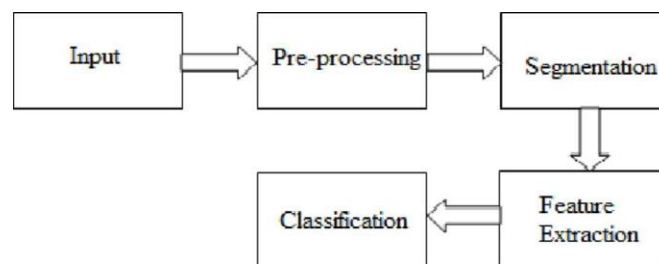
Figure 2. Basic flow diagram of satellite image analysis

Figure 3. a) Input image of year 2003, b) Result of Histogram Equalization on 2003 image
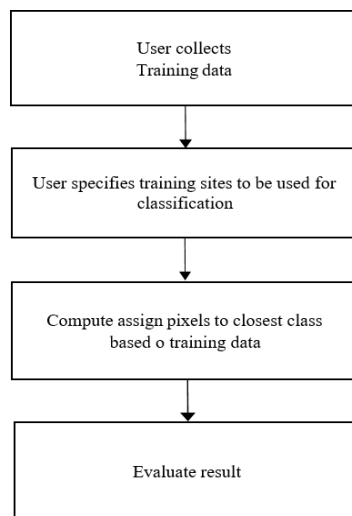
Figure 4: Algorithm of Supervised Classification
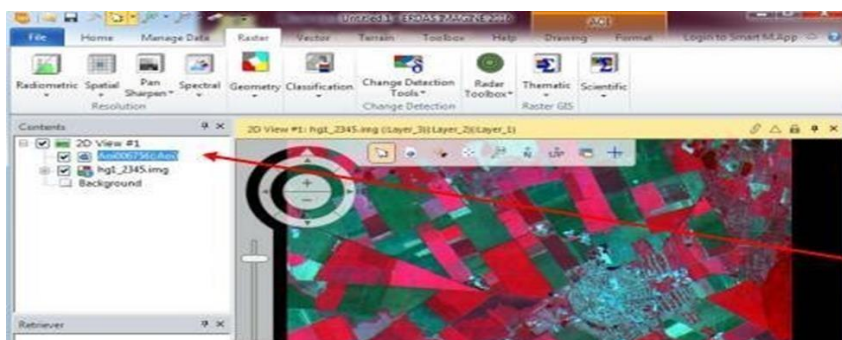
Figure 5. Choosing Area of Interest in ERDAS Imagine software.

http://doi.org/10.29369/ijrbat.2023.011.3.0009

Figure 6. Classes Creation Using Signature File

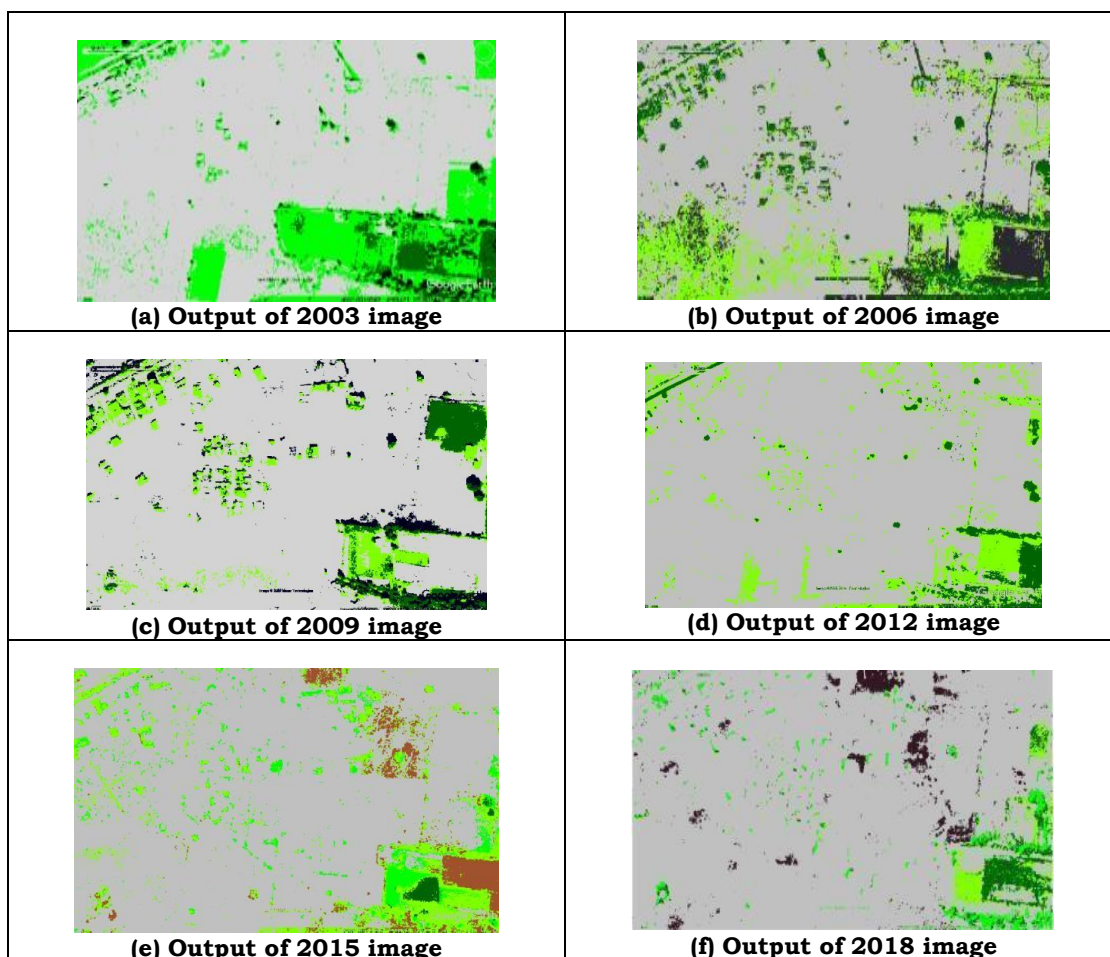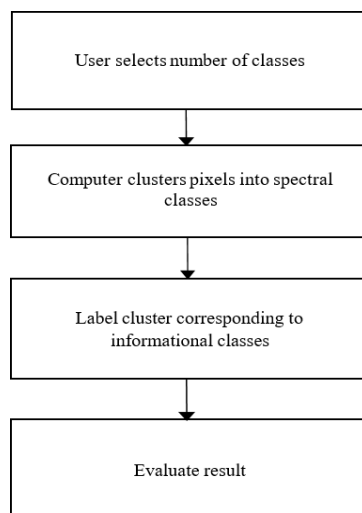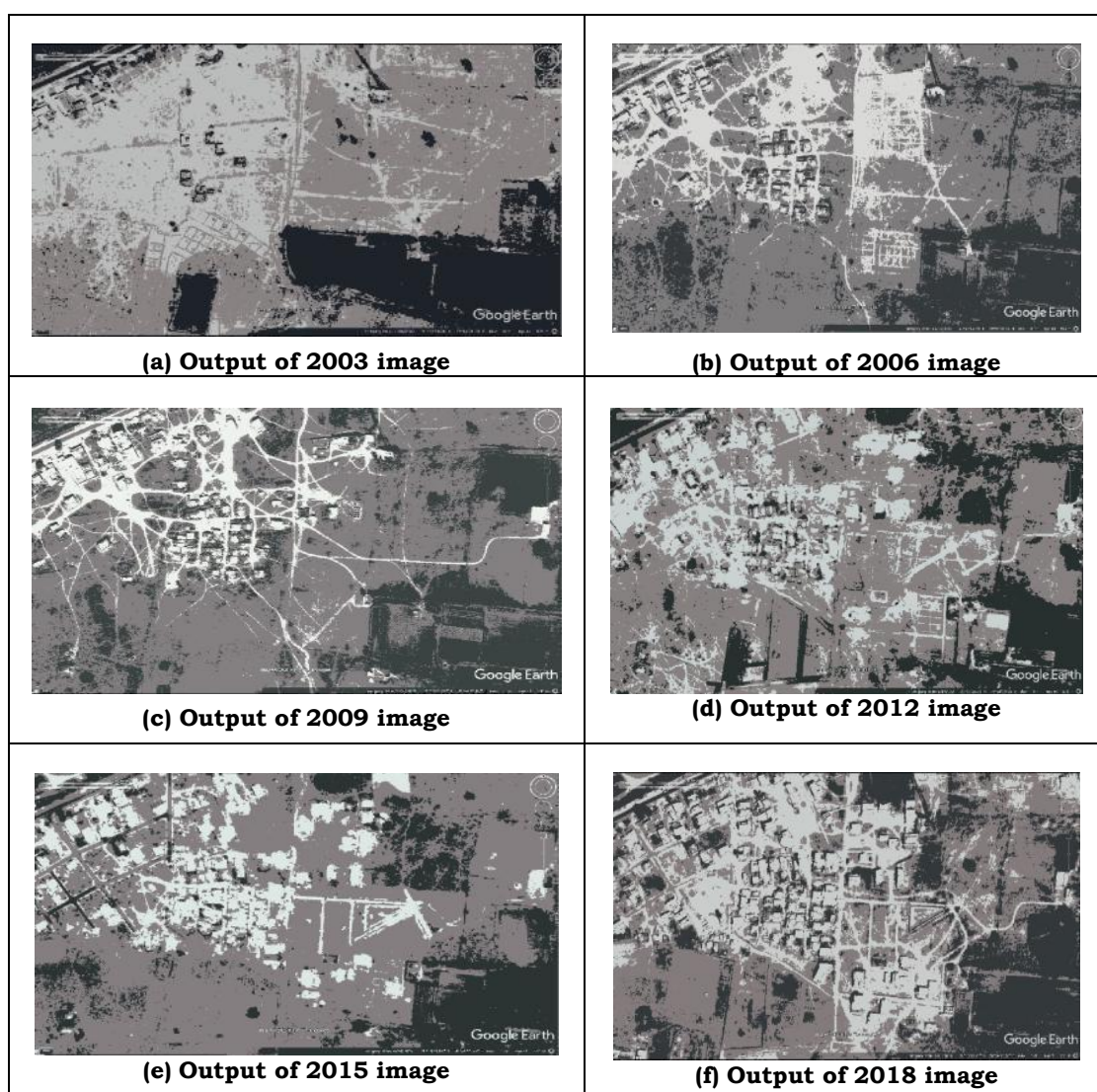| (a) Output of 2003 image | (b) Output of 2006 image |
| (c) Output of 2009 image | (d) Output of 2012 image |
| (e) Output of 2015 image | (f) Output of 2018 image |

Figure 7. Results through ERDAS Imagine software with different years input images of same local area using Supervised Classification method.

Figure 8: Algorithm of Unsupervised Classification

Figure 9. Results through ERDAS Imagine software with different years input images of same local area using Unsupervised Classification method.