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# Satellite High Resolution Image Classification Using Fuzzy Logic

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**Abstract**

This paper present the novel idea of detailed step-by-step method for classification of very high resolution urban satellite images (VHRSI) into specific classes such as road, building, vegetation, etc using fuzzy. In this study, an inclusive semi-automatic method for image classification is offered, which presents the configuration of the related fuzzy functions as well as fuzzy rules. The produced results are compared to the results of a normal classification using the same parameters, but with crisp rules. In this paper we use different parameter Gaussian membership function. There are several methods to classify images and they provide good classification result but they fail to provide satisfactory classification result when the image contains blurry and noisy content. The two main methods for image classification are supervised and unsupervised classification. In general, this is a final stage of pattern matching. The classification process described the percentage of accuracy in pattern recognition. Feature extraction is another vital stage in pattern matching. These extracted feature are used for classification of the image database, that is pattern matching.

## 1. INTRODUCTION

With the development of satellite images to provide finer spatial resolutions, they can provide finer more details in urban mapping [1]. Vision is the most advanced of our

senses so images play an important role in human perception. Pictures or images received by human are in pictorial form. In the present context, the analysis of pictures that employ an overhead perspective, including the radiation not visible to human eye are considered. Thus our discussion will be focusing on analysis of remotely sensed images [2]. To differentiate impervious urban land covers such as buildings, roads, and parking and paved areas additional information should be incorporated into the classification process. Additional information could be the spatial measures extracted either from the image, in the forms of textural, morphological, and contextual measures, or from ancillary data [2]. The main objective of satellite image processing for planning purposes is land use classification. The availability of satellite-based land use maps, generally improved with ancillary data, constitutes a starting point for many applications in different domains of spatial planning. One of these approaches is the use of fuzzy technique and another is neural network approach to classify satellite images. In this paper we use these techniques. High quickness comparing existing approaches such as classification based on maximum likelihood and high accuracy are from its advantages. Results on a vegetation classification task show an improvement in classification performance over feature selection and other band selection techniques. Fuzzy classification, estimates the contribution of each class in the pixel and in computations, it assumes that a pixel is not solid but indecomposable unit in the image analysis and consequently works on a new principle. On the other hand, extraction of urban objects such as roads and buildings is more challenging, since they have more similar spectral reflectance and texture. However, buildings have more compact geometric shapes, while roads are typically elongated features. Contextual information is also a good tool for VHRSI classifications; for example, buildings are elevated objects so there are shadows associated with them in the direction opposite to sun's azimuth. Therefore, if an urban object has a shadow in the related direction, it is a building [3]. In this article, first data specifications are presented. Then, the fuzzy-based methodology is explained and fuzzy membership functions and fuzzy rules are introduced.

## 1.1 CLASSIFICATION OF NEURAL NETWORKS BASED ON TYPES OF LEARNING

**1.1.1 Supervised -** The supervised classification methods are based on user-defined classes and corresponding representative sample sets. The sample sets are specified by training raster data sets, which must be created, prior to entering the process. In supervised classification, spectral signatures are developed from specified locations in the image. These specified locations are given the generic name *training sites* and are defined by the user. The training data consists of pairs of input objects and desired output. Supervised classification requires the analyst to select training areas where he/she knows what is on the ground and then digitize a polygon within that area. The computer then creates mean spectral signature. Thus, in a supervised classification we are first identifying the information classes which are then used to determine the spectral classes which represent them. Similarly all the pixels are analyzed by the

analyst and corresponding spectral signature are created. The Result is Information--in this case a Land Cover map.

Supervised classifiers Method

a. Parallelepiped

b. Minimum distance to mean Maximum likelihood.

**1.1.2 Unsupervised** - Rather than defining training sets and carving out pieces of n-dimensional space, we define no classes beforehand and instead use statistical approaches to divide the n-dimensional space into clusters with the best separation using clustering algorithms. After that, we assign class names to those clusters. It is distinguished from supervised learning by the fact that there is no a priori output. The analyst requests the computer to examine the image and extract a number of spectrally distinct clusters. The result of unsupervised classification is not yet informative until the analyst determines the ground cover for each of the clusters.

Common Unsupervised classification Methods

a. Simple One-Pass Clustering

b. K Means

c. Fuzzy

d. Minimum Distribution Angle

e. Adaptive Resonance

**1.2 FUZZY LOGIC** - Fuzzy logic starts with the concept of a fuzzy set. A fuzzy set is a set without a crisp, clearly defined boundary. It can contain elements with only a partial degree of membership. Reasoning in fuzzy logic is just a matter of generalizing the familiar yes-no (Boolean) logic. If you give true the numerical value of 1 and false the numerical value of 0.

**1.3 MATLAB's Fuzzy Logic Tool Box**

In the lack of precise mathematical model which will describe behavior of the system, Fuzzy Logic Tool box is a good "weapon" to solve the problem: it allows using logic if-then rules to describe the system's behavior. This Toolbox is a compilation of functions built on the MATLAB numeric computing environment and provides tools for creating and editing fuzzy inference systems within the framework of MATLAB.

Fuzzy Logic Toolbox allows building the two types of system:

a) Fuzzy Inference System (FIS) and

b) Adaptive Neuro -Fuzzy Inference System (ANFIS)

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### 1.4 IMAGE DESCRIPTION AND ALGORITHM FOLLOWED

The input image from the satellite was in form of 7 bands which were then reduced to following 3 bands

1. Red
2. Green
3. Near infrared Region

Using Fuzzy toolbox image is classified into 3 sets called membership functions. These membership functions are as given below

1. Vegetation
2. Water
3. Building

The aim of this method is to classify the mixed pixel to specific category with the help of the fuzzy logic

## 2. EXISTING METHODOLOGY

In this project the image is classified into 3 major classes: Vegetation, Water, and Bare land. In the hierarchy of the classification, first shadow is extracted. Then, from shadow and unclassified segments, vegetation is extracted. This means that shadow is not excluded from the classification process in this step. The logic behind it is that some parts of vegetation are covered by the shadow of the others, while still demonstrating similarities to vegetation and we do not want to exclude them from vegetation class. After, vegetation extraction, road classification, building detection and contextual analysis are done, respectively. Finally, the remaining unclassified features are assigned to bare land. Figure 1 shows the flow chart of the presented method.[4].In the existing model there are many steps and there are two steps segmentation is used the whole procedure is very costly. Proposed a new methodology within few steps and reduce the cost of whole procedure. There is only one step segmentation is used when we the fuzzy logic member ship function. In this model used the unsupervised technique.

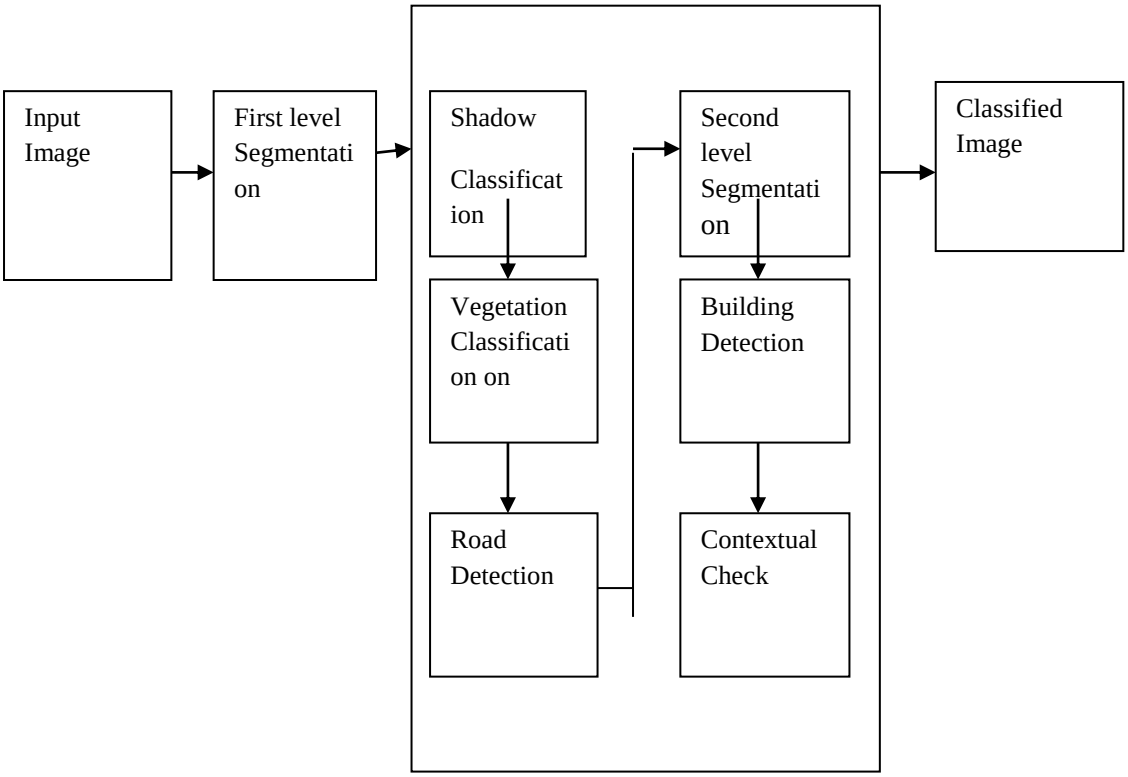


**Figure 1:** Flow chat of present model

In this study, in order to classify a VHRSI, first the image is segmented, and then using the related fuzzy rules, segments are assigned to specific classes; this process is explained in the rest of this article.

**2.1 Image Segmentation -** Generally, object-based image classification is based on image segmentation, which is a procedure of dividing an image into separated homogenous non-overlapping regions based on the pixel gray values, texture, or other auxiliary data [5].

**2.2 Fuzzy Image Classification** - In traditional classification methods such as minimum distance method, each pixel or each segment in the image will have an attribute equal to 1 or 0 expressing whether the pixel or segment belongs to a certain class or not, respectively. Fuzzy logic, which is developed by [6], has been used in image classification in several studies [7]. In [7], a fuzzy membership matrix for supervised image classification was used.

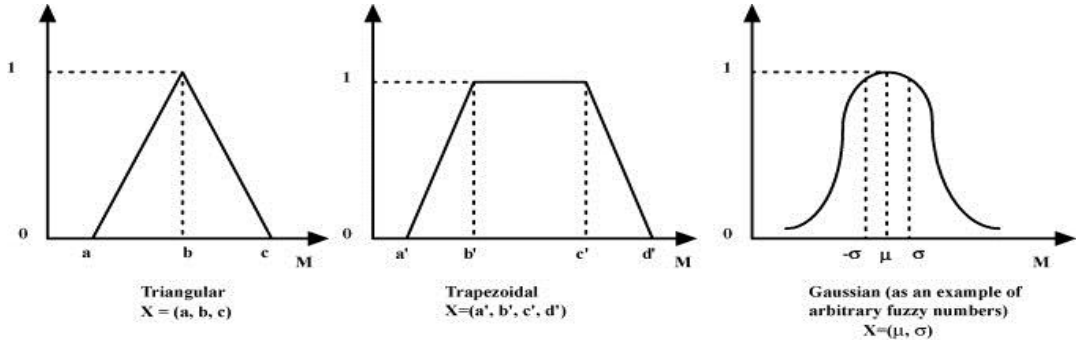


**Figure 2:** Triangular, Trapezoidal and Gaussian graphs

## 3. PROPOSED METHOD

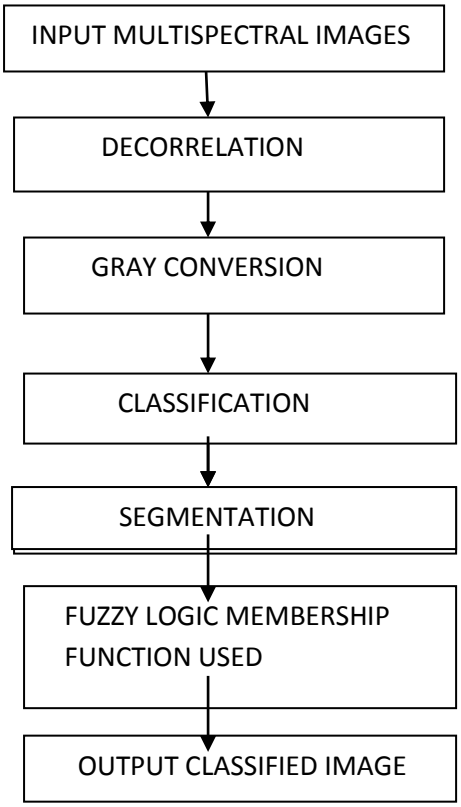


**Figure 3:** Flow chat of proposed method

**STEP 1** - Input gives as the Multispectral Image. Multispectral images is that imagery gives the power to see as humans (red, green and blue), goldfish (infrared), bumble bees (ultraviolet) and more. This comes in the form of reflected EM radiation to the

sensor. Spectral imaging can allow extraction of additional information the human eye fails to capture with its receptors for red, green and blue.

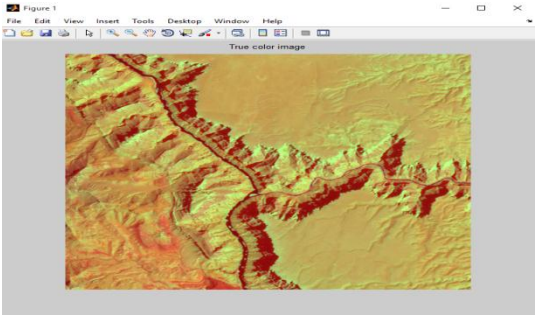


**Figure 4:** True color RGB image

**STEP 2 -** Decorrelation stretching enhances the color separation of an image with significant band-to-band correlation. The exaggerated colors improve visual interpretation and make feature discrimination easier. You apply decorrelation stretching with the decorrstretch function.

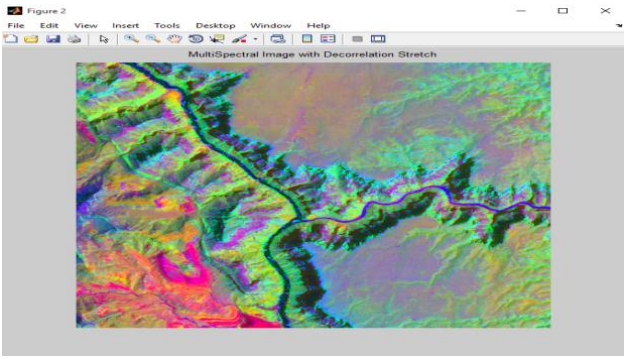


**Figure 5:** Multispectral Image with Decorrelation Stretch

**STEP 3** – Convert the color image into gray scale because all classification is done in gray scale. TheFunction is used for conversion is RGB2 GRAY.

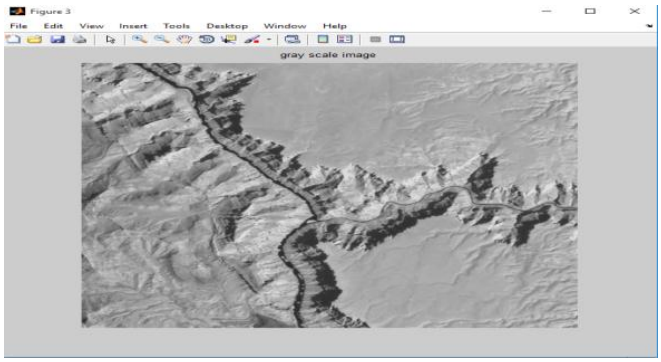


**Figure 6:** Gray scale Imag

**STEP 4 -** Classification is done in this step. Classification means we describe where is the vegetation, where is the Water and where is the building.

**STEP 5 –** The process of organizing objects into groups whose members are similar in some way". A cluster is therefore a collection of objects which are "similar" between them and are "dissimilar" to the objects belonging to other clusters.

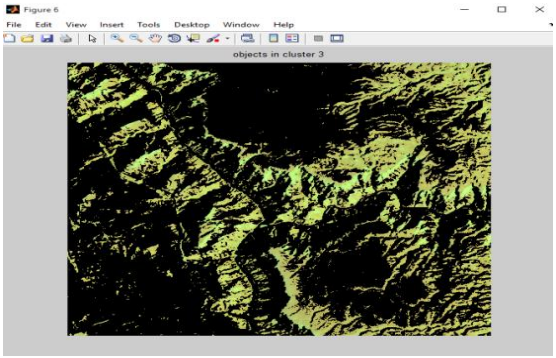


**Figure 7:** Object in cluster 1

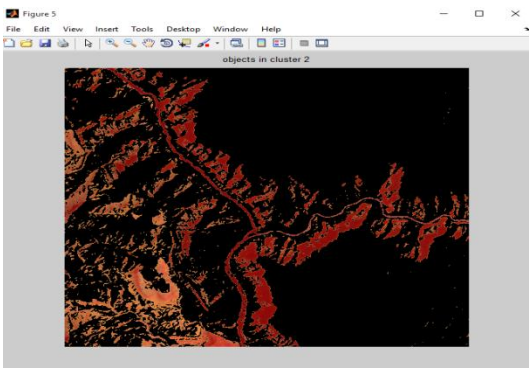


**Figure 8:** Object in cluster 2

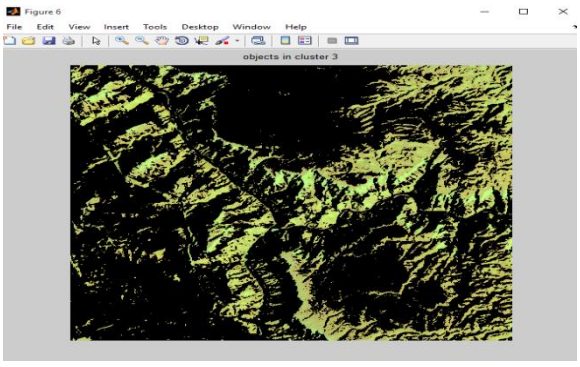


**Figure 9:** Object in cluster 3

**STEP 6 -** Segmentation is a process where the whole images is break or spilt into small Segment according to your requirement. There are two particular region is selected in the whole image. Two images capture Ix and Iy.

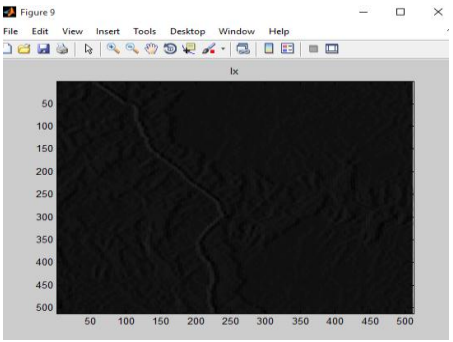


**Figure 10.** Segment Ix

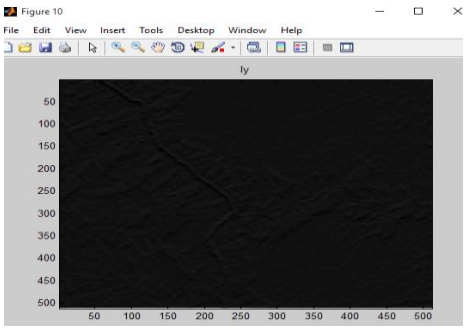


**Figure 11.** Segment Iy

**STEP 7 –** In the proposed method we use two type of fuzzy membership function. The Input is given in Gaussian membership function and the output comes in triangular membership function.

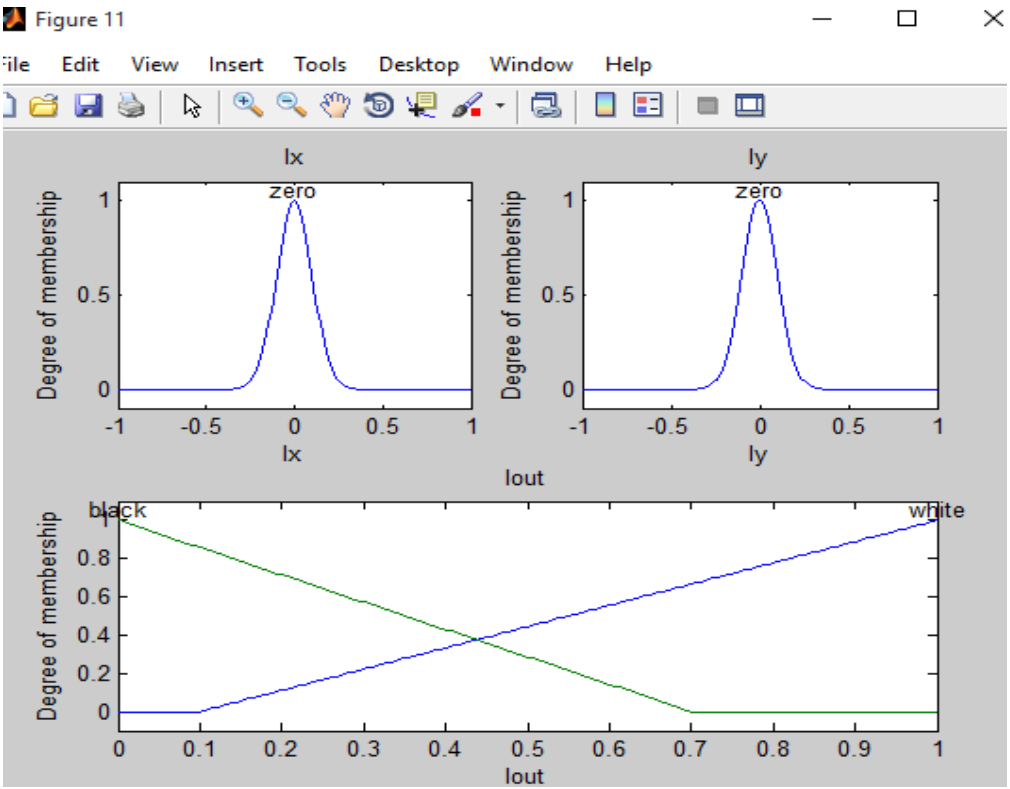


**Figure 12.** Graph of membership function

**STEP 8 –** Output is comes in the classified image.

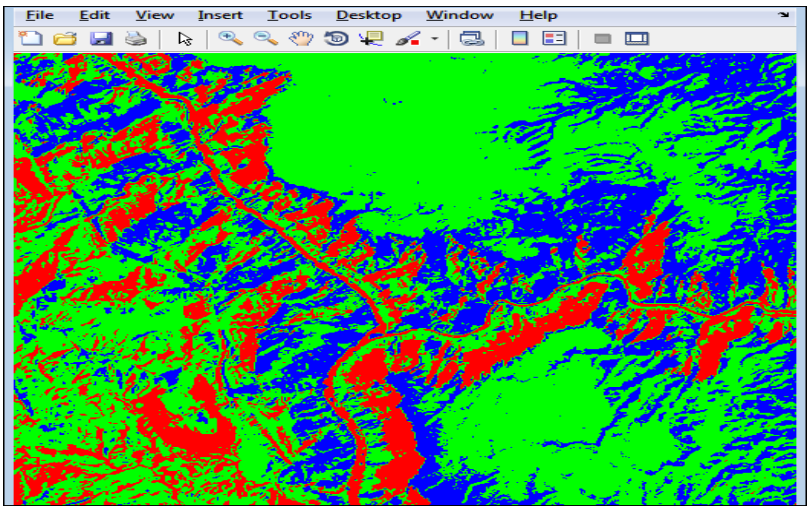


**Figure 13.** Classified image

## 4. CONCLUSION

The satellite image was classified easily using the concept of fuzzy logic. The mixed pixel is classified to a specific category with the help of the fuzzy logic. The presented method is capable of adding any other useful parameters to increase the classification accuracy for other projects in future. Another advantage of Fuzzy method is in deletion of one band and adding new band without any need to structural changes. The satellite image is used because it is noisy free.

## REFRENCES

**[1]** Pacifici, F.; Chini, M.; Emery, W;" A neural network approach using multi-scale textural matrix from very high-resolution panchromatic imagery for urban land-use classification". Remote Sens. Environ. **2009**, 113, pp.1276–1292

**[2]** Foody G. M., "Approaches for the production and evaluation of fuzzy land cover classification from remotely-sensed data", International Journal of Remote Sensing, 17, pp. 1317–1340, **1996**.

**[3]** Watanachaturaporn, P.; Arora, M.K.; Varshney, P.K. "Multisource classification using support vector machines: An empirical comparison with decision tree and neural network classifiers. Photogramm" Eng. Remote Sens. **2008**, 74, pp. 239–246.

**[4]** Shabnam Jabari; Yun Zhang., "Very high resolution satellite image classification using Fuzzy rule based systems", Multidisciplinary Digital Publishing, pp.763-781,October-November **2013.**

**[5]** Jinmei, L.; Guoyu, W. A Refined Quadtree-Based Automatic Classification Method for Remote Sensing Image. In Proceedings of 2011 International Conference on Computer. Science and Network Technology (ICCSNT), Harbin, China, 24–26 December **2011**; pp. 1703–1706.

**[6]** Zadeh, L.A. Fuzzy sets. Inf. Control. **1965**, *8*, 338–353.

**[7]** Wang, F. Fuzzy supervised classification of remote sensing images. IEEE T. Geosci. Remote. Sens. **1990**, *28*, 194–201.

**[8]** Vini Malik, Aakanksha Gautam Satellite Image Classification Using Fuzzy Logic International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-2, Issue-2, May 2013.