

Comparative Study on Supervised and Unsupervised Fuzzy Approach for Image Classification

Sabna Sharma¹

¹Sikkim Manipal Institute of Technology,
Computer Science and Engineering Department
Majitar, Rangpo, East Sikkim, India

Pratikshya Sharma²

²Sikkim Manipal Institute of Technology,
Computer Science and Engineering Department
Majitar, Rangpo, East Sikkim, India

Abstract--The importance of mapping of land use and land cover is highlighted in this paper. One way of mapping land use and land cover is through image classification. Image classification is the process of sorting all the pixels of an image into a finite number of classes. It can be further classified into two categories: supervised and unsupervised classification. The comparative study of supervised and unsupervised method of classification using fuzzy logic is also discussed. Fuzzy logic is comparatively a new theory and is broadly used in the classification of remotely sensed images, for a variety of land use and land cover classes. A Fuzzy approach can be applied in both supervised classification and unsupervised classification.

Keywords: Image Classification, fuzzy, Supervised, Unsupervised

1. INTRODUCTION

When we talk about land, the two basic approaches of describing land are land use and land cover. The term “land use” refers to the way humans utilize a particular piece of land, and the term “land cover” refers to the physical material on the surface of any piece of land. The combination of land use and land cover has high potential as it gives vital information related to a land such as the landscape condition and processes that are occurring at a particular place. Today, research on regional landscape change is one of the most trending topics as it helps in management of land use.

To enhance understanding regarding interrelationships that exist among landscape structure, natural environment, and human activities; a study on landscape changes becomes a necessity. Any landscape changes caused by human interference can be monitored by performing such types of study, which not only helps to identify the severity of changes but also helps to identify the magnitude and direction of changes in the landscape. Such studies ultimately lead to an important scientific basis which helps in providing a long term development of the region.

Image classification is a novel technique which has a variety of applications such as medical diagnosis, robotics remote sensing etc. It can also be used as a landscape monitoring and assessment tool. This paper gives an extensive review

about the image classification for land use and land cover using a technique called fuzzy logic.

2. IMAGE CLASSIFICATION

A world-wide accepted definition of Image classification is – it is the process of sorting all the pixels into in an image into a finite number of individual classes. For classifying an image correctly the main emphasis should be given to the numerical properties of an image which can help in organizing the extracted data into appropriate categories. A characteristic feature of any classification technique is employing two phases of processing i.e. training and testing.

Two classical approaches for performing image classification are supervised classification and unsupervised classification.

2.1 Supervised classification

While performing classification using supervised method the only data required as an input to the system is the training data set. This is due to the reason that for such cases prior information about the classes are already present in the image to be classified; hence its name is supervised classification. There are three basic steps involve in supervised classification method: identifying training sites, creating signatures and classifying the image. There are numerous supervised classification techniques that exists currently, some common techniques are: Maximum likelihood classifier, parallelepiped classifier.

2.2 Unsupervised classification

For unsupervised classification; as the name suggests requires no training data. In this method the unknown pixels in the image are examined thoroughly. The examined pixels are then aggregated into finite number of classes which are based on the cluster present in the image. Unsupervised classification can be used in situations where less information is present prior to classification. The grouping of data with similar characteristics is called clustering. Some of the common unsupervised classification methods are: K

Means, Simple one pass clustering, minimum distribution angle.

3 FUZZY LOGIC

Fuzzy logic is an area which is still in an emerging phase; however its application is widespread in fields like process control, management and decision making, operation research, economics etc. The concept of fuzzy logic was first introduced in 1964 by Lotfi A. Zadeh, UC Berkeley where; fuzzy sets were discussed to demonstrate the fuzzy logic's emphasis on imprecision. Between 1965-1975 the foundation of fuzzy set theory was broadened by him to a great extent.

Comparative study of supervised and unsupervised method of classification using fuzzy logic

Fuzzy logic is an area which is yet to be explored to its fullest and it can be used in wide range of domains. In this survey paper the focus is given on application of fuzzy in images for pattern recognition and classification. This technique is slowly gaining popularity since one of its major advantages is that it describes the problems in a more natural way rather than trying to establish a relationship between numerical values. Classification based on fuzzy technique can clearly classify combinational pixels. It is an efficient approach for classifying land cover which is not visible clearly. Fuzzy classification has an upper hand for representing real world through sharp objects and crisp classes.

It has been observed that a fuzzy approach gives better results when prior knowledge about the classes is present. Thus fuzzy based supervised classification is preferred to fuzzy based unsupervised classification. Fuzzy based supervised classification also gives higher accuracy rate as compared to fuzzy based unsupervised classification. However, supervised classification has one drawback i.e. it overlooks uncertain attributes which may occur in due course of time and concentrates more on instances in the training sets.

Unsupervised classification also suffers from a drawback i.e. classes formed may not be appropriate or informative enough or useful. In the research carried out by Manibhusan et.al [3] the satellite images were classified using fuzzy logic Supervised method of classification was implemented. After classification of images the results proved that the accuracy of fuzzy classification was better than crisp classification. This was due to the main reason that fuzzy operators can solve overlapping problems better than crisp operators.

In the research carried out by Dr.C Jyothi et.al [1] the accuracy assessment showed that the unsupervised classification gave slower performance as compared to supervised classification as pointed out by the author in his work the reason behind the slow performance is that the unsupervised classification procedure does not need any labeled data set as a training data. However supervised classification procedure showed a better performance since it has a labeled data set as training data.

CONCLUSION

Thus we can see that fuzzy approach can be used in both supervised and unsupervised classification methods. It is used to find uncertainty in the boundary between classes. One of the major problems identified for performing image classification is the vagueness in the boundaries of land cover classes. In such situation fuzzy approach proves to be very beneficial.

REFERENCES

- [1] Dr. C. Jothi Venkateswaran, R.Vijaya .A.M.Saravanan, A Fuzzy Based Approach to Classify Remotely Sensed Images, International Journal of Engineering and Technology, Vol 5 No 3, 3051-3055, Jun-Jul 2013
- [2] Shivakumar.B.R, Pallavi.M, Fuzzy Logic Based RS Image Classification Using Maximum Likelihood and Mahalanobis Distance Classifiers, International Journal of Current Engineering and Technology ISSN 2277 – 4106, Vol.3, No.2 (June 2013)
- [3] Manibhushan, Nilanchal Patel, Gadadhar Sahoo & Anil Kumar Singh, Image Classification for Different Land Use and Land Covers Using Fuzzy Logic for the Improvement of Accuracies, Journal of Agricultural Science; Vol. 5, No. 3; 2013.
- [4] Vini Malik, Aakanksha Gautam, Aditi Sahai, Ambika Jha, Ankita Ramvir Singh, Satellite Image Classification Using Fuzzy Logic, International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-2, Issue-2, May 2013
- [5] I. Nedeljkovic , Image classification based on Fuzzy logic, The International Archives of the Photogrammetric, Remote Sensing and Spatial Information Sciences, Vol. 34, Part XXX
- [6] B Sowmya and B Sheelarani, Land cover classification using reformed fuzzy C-means, Indian Academy of Sciences, Vol. 36, Part 2, pp. 153–165, April 2011.
- [7] Muntaser Abdul Wahed Salman and Nazar Essmat Seno, West of Iraq Satellite Image Classification Using Fuzzy Logic, Journal of Kufa for Mathematics and Computer, Vol.1, No.4, Nov2011, PP. 36-48
- [8] Nayak,S.,and Behera,M.D, Improving land-Use and vegetation Cover Classification Accuracy using Fuzzy Logic-A Study in Pilibhit District,Uttar Pradesh,India,International Journal of Geoinformatics, Vol.5, No.2, June, 2009.
- [9] Rafael C. Gonzalez, Richard E. Woods and Steven L.Eddins "Digital Image Processing Using Matlab," Pearson Education, Second Impression, 2007.
- [10] Santosh Hedge, Modeling land cover change: A fuzzy approach, International Institute for Geo-Information Science and earth observation, The Netherlands, December 2003.