

Remote Sensing Image Classification using Back Propagation

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ABSTRACT

The resolution of remote sensing images increase every day .Most of the existing methods is used the same method for years. The existing method does not provide satisfactory result. The aim is to develop an artificial neural network based on classification method consists of segmentation and classification .Segmentation followed by K-Means method and then classification performed with back propagation neural network which provide accuracy and satisfactory result compare to the other method.

General Terms

Artificial neural network, Image Classification

Keywords

BP network, K-means method, Feature extraction, Segmentation

1. INTRODUCTION

Remote sensing can be defined as any process whereby information is gathered about an object ,area or phenomenon without being contact with it in developing information about earth's land surface ,oceans and the atmosphere .The Advancement in remote sensing make high resolution data are available at short interval of time [1] .Firstly the image are classified on the based on texture information which include angular second moment ,contrast ,correlation in year in 1973s [2].

Satellite image classification is a key component of remote sensing .which compare the distinguishing and measuring the land portion, urban area, military etc. Many traditional classification methods are capable of image classification but under the certain condition .The methods which existing are maximum likelihood classifier. This technique become in capable due to estimation of multi source classification. The conventional method is supervised and unsupervised classification for image classification .Unsupervised classification referred as "self organization" means itself organizes the data presented to the network. The method is useful where classes are limited and its based on local information .While the supervised classification method is useful where classes are numerous [3].The result obtained by this method are more accurate then the unsupervised method due to need of external teacher that the target output is fixed to the input.[4]

The neural network is first introduced in year 1991s for RSD classification but failed due to poor classification ability. Artificial neural network are the most innovative technique that have shown great potential in analyzing and making use of improved remote sensor data .With development in neural network are been employed to multi spectral remote sensing

images [5]. Neural network processes information in the similar way the human brain does. The network is composed of a large number of highly interconnected processing element working in parallel to solving particular problem. Neural network are also applied where the data diversity is large for segmentation and classification purpose. In image classification artificial neural network give more accurate result then the existing methods .Neural network provide high tolerance to noisy data. It also provide high spatial resolution at high frequency. Neural network are used in the problem of the hyper spectral remote sensing images [6]. Neural network are also used in pattern recognition and provide satisfactory result.

This paper argues that segmentation process is apply to image data by using K-means algorithm and then this segmentation result are apply to artificial neural network .By using BP(Back-propagation) network the segmentation images are applied to the network .In sampling and testing five images are taken and thus applied the BP network and thus obtained the result. This classification result is compared to the other existing method. The result are compared which method give more accuracy to the classification of image.

2. METHODOLOGY

2.1 K-Means algorithm

The segmentation is a process which extracts the outline of the ground object by defining homogenous region. K-means algorithm are used for segmentation process and its defined as some cluster of pixel in feature space and then is defined by its center .The flow diagram in figure 1 of k means algorithm in which the new centres are computed with new cluster [8].

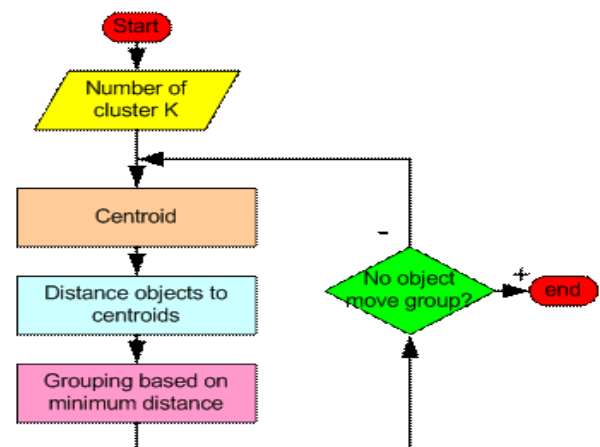


Fig. 1: Flow Chart of K-means algorithm.

This algorithm aim at minimizing an objective function, in this case a squared error function is

$$J = \sum_{j=1}^k \sum_{i=1}^N ||x_i^{(j)} - c_j||^2 \quad (1)$$

Where $||x_i^{(j)} - c_j||^2$ is a chosen distance measure between a data point $x_i^{(j)}$ and the cluster centre c_j , is an indicator of the distance f the data point from their respective data cluster centre.

The basic step of k-means clustering is simple determine number of cluster K and assume the centroid or center of these clusters take any random objects as the initial centroids or the first K objects in sequence can also serve as the initial centroids.

2.2 Artificial Neural Network (ANN)

An artificial neural network having many inputs and one out put. The neuron has two mode of operation the training mode and the using mode. In training mode the neuron can be travelled for particular input pattern and in the using mode where a taught input patter is detected the input, its associated output become the current output as seen in figure 2 .The neural network are used to solve the complex problem in classification method also used in the pattern recognition problem .This method provide the effective result [9].

The general training process of Back propagation (BP) method are as follows

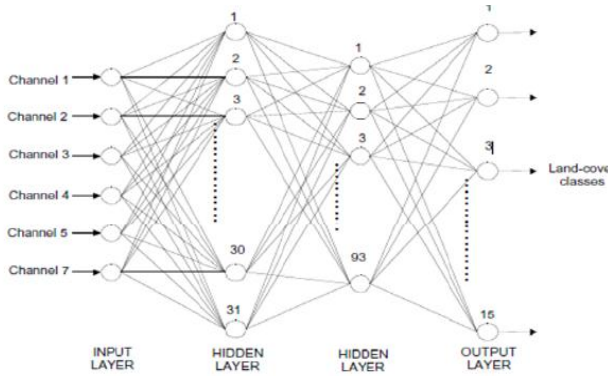


Fig. 2: Back Propagation Network

The learning process of a BP network structure consist of two parts positive dissemination and propagation. In the BP network the error correction with weight and threshold of each layer.

In network training, the hidden layer is given as

$$O_{kj} = f_j \left(\sum_i a_{ji} O_{ki} + \theta_j \right) \quad (2)$$

Where f_j means activation function, a_{ji} is defined as the weight of the former layer of neuron O_{ki} is defined as the output of the k sample θ_j is the threshold of the neuron.

The training error is shown as

$$\delta_{kj} = O_{kj} (1 - O_{kj}) (t_{kj} - O_{kj}) \quad (3)$$

Where t_{kj} is defined as k samples of a target unit j, δ_{kj} is hidden error of training

The weight is trained as

$$w_{ji}(t+1) = w_{ji}(t) + n\delta_{kj} O_{kj} + \alpha[w_{ji}(t) - w_{ji}(t-1)] \quad (4)$$

The threshold is trained as

$$\theta_j(t+1) = \theta_j(t) + n\delta_j + \alpha[\theta_j(t) - \theta_j(t-1)] \quad (5)$$

The given input and output of each iteration of equation (3)-(5) will repeat whether the result give the accuracy after all samples trained if the result is not occurs well the sample will be trained again to give more accuracy to the network.

3. RESULT

The various method are used for segmentation but by using the Kmeans clustering method the result are compare to the other method. In the kmeans clustering method finally the threshold of the above image is taken to view clear segmentation and which are useful in classification method.

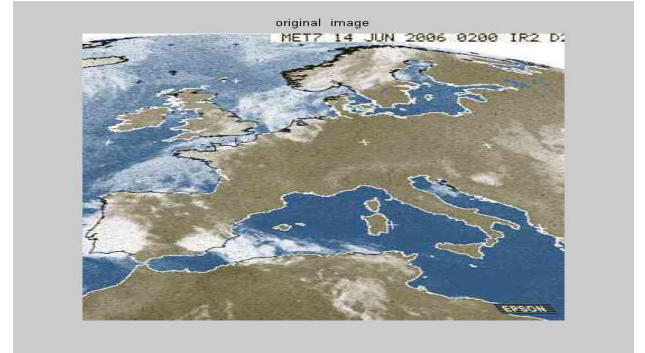


Figure 3 Image are used for K-means method

In the kmeans clustering method the figure 3 image are taken and then the image are convert from RGB color space to Ycber color space. The image are then classify using the Kmeans clustering .Clustering is a way to separte group of object .The method treat each object having a location in space .It find the partition such that object within each cluster are close to each other as possible and far from object .The image are then label every pixel using the result from Kmeans. Create the that segment the above image by color. Segment the original image into a separte image.

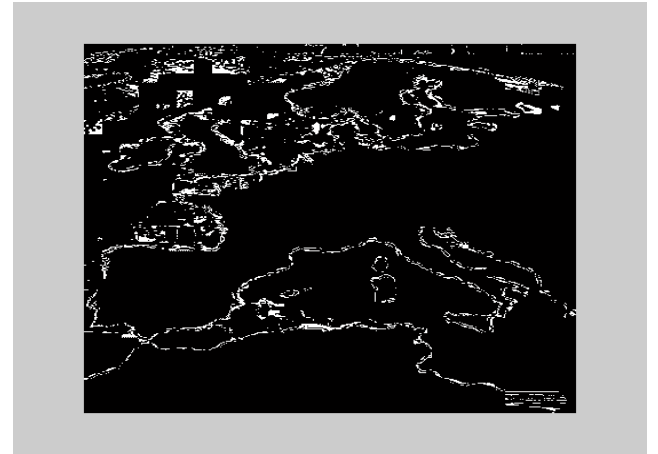


Figure 4 Threshold of image is taken to view clear segmentation.

In figure 4 show the output response of K means are shown which shows more accuracy and then by Kmeans clustering method the threshold of image are seen and this show the segmented images . Kmeans method provide efficient result compare to the other method as shown in figure 4 which shows the segmentation of an image.

B. Output of Back Propagation network

In remote sensing Neural Network play an important role in image classification. The development of Neural Network made easy the complex image classification method and provides accuracy to the classification result. In this method by using five images are taken for training and testing and by applying neural network the following estimation are made

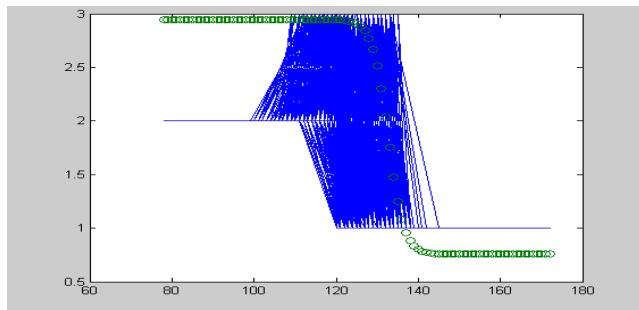


Figure 5 Output response of training of BP network

In figure 5 the output response of the training of the back propagation method in which shows the less error and are estimated with the testing images then thus the compared the result. In testing five images are taken and estimated the output response of the BP network in figure 6 shows the output response of the testing images.

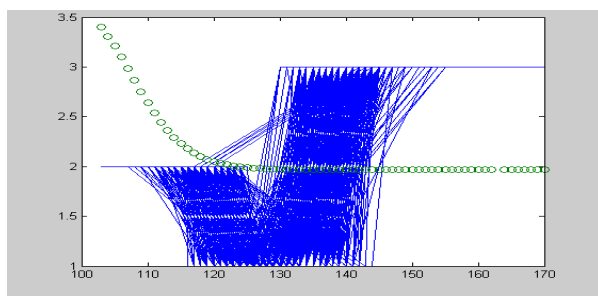


Figure 6 Output response of testing of BP network

By comparing the both the output response the BP network provides accuracy in image classification and provides the satisfactory result. In the network we set the number of iteration up to 1000 and the no. of epoces and then calculate the response of the gradient and compare the result of training and testing of the result and provide satisfactory result.

4. CONCLUSION

In the experiments of artificial data and remote sensing data with neural data the following conclusion are made:

The BP network are provide stable classification result ,less consumption of time in the classification result in the future the BP network are compared with one of the RBF network which provide help in to compare the result and which method are provide more accuracy .The result obtained from the BP network provide accuracy of 89% which are stable and less consumption of time.

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