TEST Engineering & Management

January-February 2020
ISSN: 0193-4120 Page No. 12657 - 12662

Identification of Land Area Using Image Processing Technique

Dr. D. Deepa[1], C.S.Praveen[2], N. Sridhar[2], B. Manigandan[2]
[1]Professor, [2]UG Scholars
Bannari Amman Institute of Technology, Tamilnadu

Article Info
Volume 82
Page Number: 12657 - 12662
Publication Issue:
January-February 2020

Article History
Article Received*: 18 May 2019*
Revised*: 14 July 2019*
Accepted*: 22 December 2019*
Publication*: 24 February 2020*

Abstract:
Segmentation and classification of high resolution satellite images is a difficult task due to the fact that it is no useful meaning to carry out this task on a pixel-by-pixel method. The fine spatial resolution infers that each object is an accumulation of various pixels in spatial closeness , and exact categorizing requires that this aspect be easily considered. K-means clustering algorithm is considered as a superior method for classifying high resolution satellite images. k- means clustering or Lloyd's algorithm, is a repetitive, data-partitioning algorithm that allocates n observations to precisely one of clusters determined by centroids, where k is set to initial value before the algorithm starts. The obtained regions are categorized using a minimum distance decision rule. This method fundamentally minimizes the mixed pixel problem suffered by pixel based methods. In this work, we used K-means and fuzzy C means clustering algorithm to classify satellite imagery into specific objects within its boundaries and environmental planning purposes. The various pixels are divided into clusters. A centre point is found for all the centroids. The entire clusters are classified based on this centroid. In our project we are using k-means clustering algorithm and Fuzzy c means to separate the pixels of the satellite images and processing it with the help of matlab software and naming the clusters according to their color configurations. Using this clustering method for satellite images we can name the places in the image based on color. For example green color indicates forest area, blue indicates water mass, brown indicates muddy area and more. Fuzzy C-means is independent of initial clusters and better clustering results are obtained. There are other types of clustering methods like partitioning method, hierarchical method, density-based clustering and model-based clustering.

Keywords: *k-means algorithm, Fuzzy C-means algorithm.*

1. INTRODUCTION

Satellite image processing has become one of the most prominent tools in the field of research and scientific process. It has been used since early 1970's. The various applications of satellite image processing are classifications of land surface, flood mapping, deforestation mapping etc. The satellite images were very expensive and confidential which is used for military purposes. After the launch of many satellites, the satellite images were commercially used for analyzing earth surface, high resolution images to government and other organizations. This technology would be useful in analyzing of land mainly in the destruction area and the place where the humans can't enter. The high resolution images would be useful in the applications of transport mapping, disaster management, telecommunications etc. The Low resolution images were used in the application of urban monitoring, forest management etc. In image classifications the pixels in the image are named with meaningful information for the better information about the environment. Image classification is classified into pixel based or object based methods. In pixel based classification individual pixels are accompanied with spatial information. In this classification spectral patterns are used. In object based classification the pixels are grouped into objects based on chosen similarities like color, texture, intensity ,etc… In this classification mixed pixel problem will not occur. Object based classification requires more

January-February 2020
ISSN: 0193-4120 Page No. 12657 - 12662

information. In this paper, the satellite images of land are processed and classified into empty land, water, greenery areas etc. This process is made by K means and fuzzy C means algorithm.

2. LITERATURE SURVEY

Introduction

Image segmentation is the process of dividing the digital images into various segments to establish boundaries and objects in the images. Developing computer technology needs more efficient method for image processing. Therefore numerous techniques are introduced to reduce the load of the systems. Mainly classification and segmentation of images need more efficient techniques to process the images.

In 2013, Christoph Garbe and Bjorn Ommer proposed a system in which the image processing has the following steps. First the images is imported with optical scanner or digital photography and then to analyze, implement the images and pattern spotting such as satellite images.

A. Color image segmentation

The main approach of image segmentation is clustering of pixels. In 2012 Janakkumar Baldevbhai1 and Anand, found the problem of image segmentation using clustering and proposed to clustering on L*a*b color space of pixels. D.Lu and Q.Weng et.al talk about the present practices, issues and prospects of picture characterization. Unaided K-implies algorithm calculation has been utilized to segment the picture into various classes dependent on the measurable data intrinsic in the thought about images.

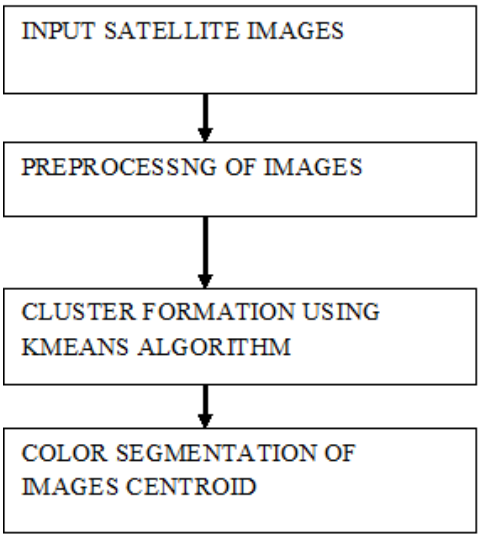
K-means algorithm

Chinki Chandhok and Soni Chaturvedi et.al have proposed a new technique for image segmentation called k-means algorithm. Different initial partitions result in various clusters. A framework of unsupervised clustering of images based on the color feature of the image has been suggested which shows intra-cluster variance, but does not guaranteed that the result has a global minimum of variance.

B. Fuzzy based classification

In 2011, Yousefi and Mirhassani et al introduced fuzzy based clustering for tall building and towers by 3D model using satellite I mages. The vegetation layer based on green layer and intensity were filtered out and building were segmented. In 2011, Hassan Elragal introduced classification of satellite images which makes use of fuzzy rules classifier proper rules.

3. PROPOSED SYSTEM



3.1. DETAILED METHODOLOGY OF PROPOSED SYSTEM

a) *Data collection*

The satellite image of land surface is taken through zoom earth website. This satellite images will be provided with area in terms of square kilometer[4].

(a)

January-February 2020
ISSN: 0193-4120 Page No. 12657 - 12662

(b)

(c)

(d)

Fig 3.1.1.Input satellite images

TYPES OF ALGORITHM USED

1. K-means Algorithm
2. Fuzzy C means Algorithm

II. 3.2. K-MEANS ALGORITHM

The k means algorithm is one of the most popular for clustering the image[1].It can be easily implemented with faster rate and accuracy. The main disadvantage is the initial partition selection. In kmeans k is a user parameter. Initially we assume that we havedata with data points(D=X1,X2…..Xn). First we have to find the initial centroid for the input satellite image. Then repeat the first step to find more centroids based on the image's pixel density. Then map the data pints to nearby centroid. Then compute the cluster center of each cluster. The above step is done until all data points of same pixel values are clustered.

III. METHDOLOGY OF K-MEANS

- Place K points into the space represented by the objects that are being clustered. These points represent initial group centroids.
- Assign each object to the group that has the closest centroid.
- When all objects have been assigned, recalculate the positions of the K centroid.

K-MEANS CLUSTERING

K-means clustering is one of the important unsupervised learning problem which deals with the collection of structures in a unlabeled data. The definition of clustering is the process of gathering objects into groups whose elements are similar in a particular point. Therefore the clustering is the process of collecting objects which are similar in their own cluster and are different when compared with other clusters.

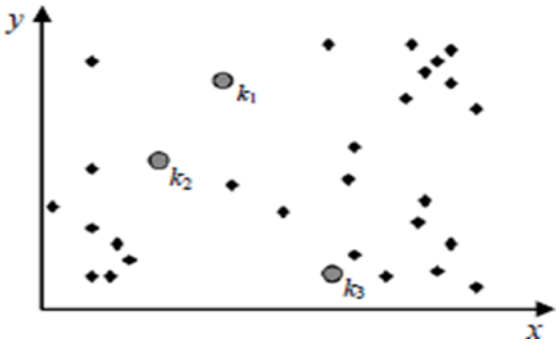


Fig3.2.1: **There are three centroids formed initially**

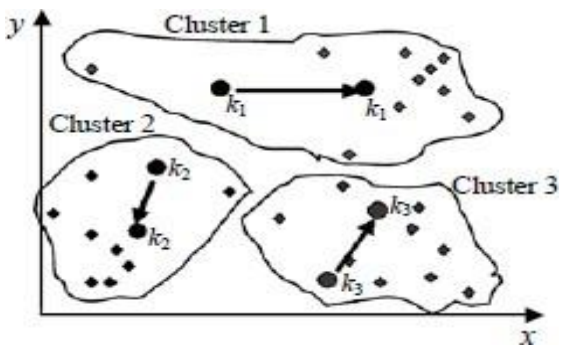


Fig 3.2.2: **Shows that there are three more centroids formed in next iteration.**

January-February 2020
ISSN: 0193-4120 Page No. 12657 - 12662

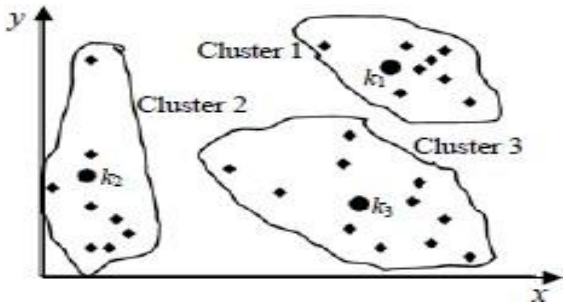


Fig 3.2.3: Shows the final cluster and their centroids.

IV. LIMITATION OF K-MEANS

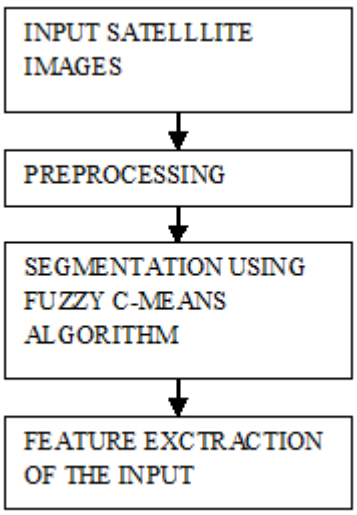
1)The mathematical calculation of kmeans is expensive[4]. The time taken for computation is depends on number of iteration, number of cluster and number of data.

2)The initial centroid selection determines the quality of cluster and reduces the number of centroids used.

3)Empty clusters formed due to the fixed clusters will result in the starting problem of algorithm.

3.3.FUZZY C MEANS

BLOCK DIAGRAM



The fuzzy C means is one of the widely use algorithm in fuzzy clustering. It is introduced by J.C. Dunn in 1973 based on the concept of fuzzy c partition[5]. The fuzzy c means is summarized as

X={x1, x2,…, xn} in which the data point is given by xk(k=1,..n) .

$$M_{fcn} = \{U \in U_{cn} : u_{ik} \in [0,1] \quad \sum_{i=1}^{c} u_{ik} = 1, \quad 0 < \sum_{k=1}^{n} u_{ik} < n \}$$

Here Ucn represent the set of real cxn matrices. The fuzzy C mean is similar to the Kmeans algorithm.

The algorithm of Fuzzy C means follows

- The number of clusters from the given input images is given by the programmer.
- The coefficients for each data point are given randomly. Due to these coefficients the data point will be located inside the cluster.
- Repeat the above process until all the data points are aligned inside the clusters.
- Find the centroid for each clusters.
- The coefficients of each data points inside the clusters should be computed after finding its centroids. The centroid can be found by using the formula

$$c_k = \frac{\sum_x w_k(x)^m x}{\sum_x w_k(x)^m},$$

Here m is the hyper-parameter which controls the fuzzy cluster. The higher of m will be in the end of the cluster.

4. EXPERIMENTAL RESULTS

4.1.OUTPUTFOR K-MEANS ALGORITHM

Fig 4.1.1: INPUT SATELLITE IMAGE-1

January-February 2020
ISSN: 0193-4120 Page No. 12657 - 12662

Fig 4.1.2.THE VEGETATION AREA

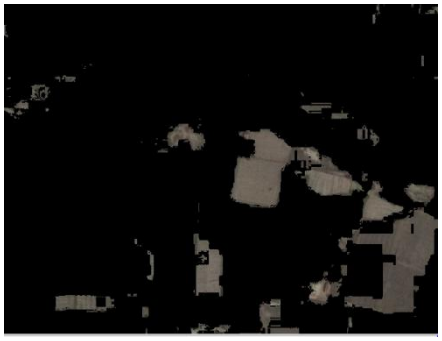


Fig 4.1.3 THE EMPTY LAND AREA

Fig 4.1.4 THE WATER AREA

Fig 4.1.5.INPUT SATELLITE IMAGE-2

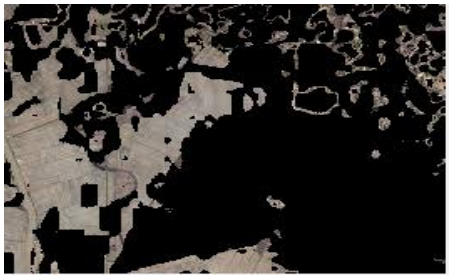


Fig 4.1.6.THE EMPTY LAND AREA

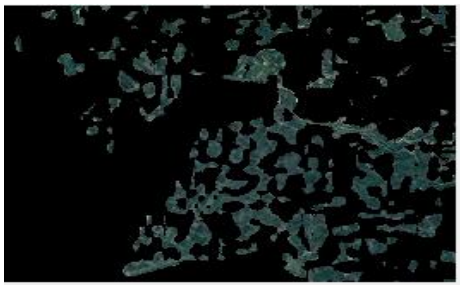


Fig 4.1.7.THE VEGETATION AREA

In k-means algorithm the centroid is formed first. The data points in the input image are assigned to the nearby centroids. The first output image shows the data points that are nearer to a centroid value and it is shown. The second image shows the data points of other centroid in a cluster and it goes on for n number of clusters formed. For the first iteration nearby data points moves towards the nearby centroid. Then it slowly gets closer to the centroid when the iteration increases. Thus it forms a cluster of similar data points or pixels. In this kind of algorithm the data points cannot have membership in two or more clusters.

4.2. OUTPUT FOR FUZZY C-MEANS ALGORITHM

Fig 4.2.1 Input satellite image-1

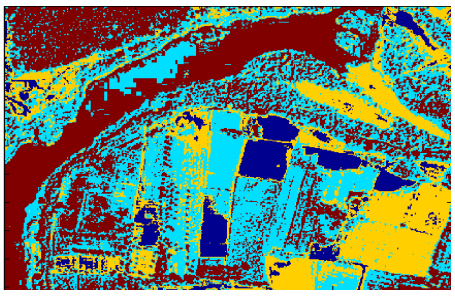


Fig 4.2.2: Output image using fuzzy c-means

TEST Engineering & Management

January-February 2020
ISSN: 0193-4120 Page No. 12657 - 12662

Fig 4.2.3: Input satellite image-2

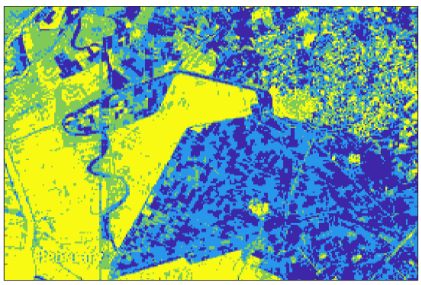


Fig 4.2.4: output image using fuzzy c-means

This algorithm works by assigning the data points to the corresponding cluster based on the distance between the cluster center and the data point. In this clustering algorithm the data points can have membership in two or more clusters. As this algorithm undergoes many iterations the data points may vary from cluster to cluster to get perfection. The cluster center and membership of data points are updated after each iteration. The initial centroid determines the cluster formation. The output image shows the partitioned data points after several iterations. Each data points in that image have centroid with respect to its distance between the centroid an itself.

ADVANTAGES OF FUZZY C MEANS

- It gives the better result for data with overlapped.
- Its execution depends on iterative calculation which takes place at faster rate.
- It gives better result for noisy clustered databases.

COMPARISON OF FUZZY C MEANS OVER K MEANS

- K means is extremely faster than Fuzzy C means in datasets containing regular and irregular patterns [2].
- The accuracy of Fuzzy C means is high compared to K means.

Acknowledgment

"The authors acknowledge the Management of Bannari Amman Institute of Technology, Sathyamangalam for providing high standard infrastructure and laboratory facilities to carry out this work."

REFERENCES

1. Arpita Pandy ,Dr. Priya R.Swaminarayan, March2015. Classification of vegetation area from satellite images using image processing techniques .
2. Zeynel Cebeci, Figen Yildiz ,Comparison of K-Means and Fuzzy C-Means Algorithms on Different Cluster structures.
3. Sumalatha Kuthadi, Detection of objects from high-resolution satellite images,May 2005
4. Jyoti Saini, A. K. A Study of Processing Model and Different Application Aspects of Agricultural Image Processing,2013.
5. Panda, S, Sahu, S, Jena, P & Chattopadhyay, S 'Comparing Fuzzy-C Means and K-Means Clustering Trchnoques: A Comprehensive Study'. Advances in Intelligent and Soft Computing,2012.