AN ASSORTMENT OF FUZZY C MEANS SEGMENTATION ON VARIOUS EDGE DETECTION TECHNIQUES USING REMOTE SENSING IMAGES

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ABSTRACT

In day-to-day life, image segmentation techniques are very exigent and vitally used in field of Satellite images processing. Image segmentation is the technique of partition a digital image into multiple regions and boundaries. In this paper, well-organized clustering algorithms are proposed to inherent the geographical phenomena on satellite images. The main goal of clustering is to differentiate the objects in an image using similarity and dissimilarity between the regions. In remote sensing images, clustering algorithms Fuzzy C Mean are used to executed based on spectrally defined features such as texture, densities and variation on the surface materials across different spectral bands and give a fundamental mechanism for understanding the image features. The purpose of segmentation techniques is to get significant result, efficient storage and fast retrieval in various areas.

KEYWORDS: Image processing, remote sensing image, clustering algorithm, image segmentation Fuzzy C means.

INTRODUCTION

An image is a two dimensional function f(x,y),where x and y are the spatial (plane) coordinates, and the amplitude of at any pair of coordinates (x,y) is called the obsession of the image at that point. If x,y and the amplitude values is a finite and discrete quantities, we depict the image as a digital image. A digital image is composed of a finite number of elements called pixels, each of which has a particular location and value. Remote sensing image segmentation is a method to isolate an image into homogenous regions and to

recognize interested regions of objects, which is an significant step toward advanced stage image processing. Since remote sensing images are multi-spectral, multi sensor and multi resolution, they enclose shape, spectrum, texture and various characteristics information. Image segmentation is the process of partitioning a digital image into multiple segments (a set of pixels). in Satellite images. Segmentation plays a most important role for feature extraction, image measurements and image display. Image Segmentation is a crucial operation in image analysis and in many computer vision, image analysis [14], pattern recognition system with application in scientific and industrial field such as medicine, remote sensing, etc. Remote sensing image segmentation refers to the task of extracting information classes from a multiband raster image. Remote sensing is a process of gathering information about an object, area or phenomenon without being a direct contact with the object.

Clustering is a grouping of data with similar characteristics. This "similarity" in a given set may vary according to data, because clustering is used in various fields such as numerical taxonomy, morph metric, systematic, etc. Thus, a clustering algorithm that fits the numerical measure of optimization in a data may not optimize another set of data (for example, depending on the units selected). There are many algorithms to solve a clustering problem. From the machine learning perspective, clustering can be viewed as unsupervised learning concept. Supervised machine learning means that the cluster depending on the predefined classes and training samples while classifying the data object. But in unsupervised machine learning, cluster does not depend the predefined classes and training samples. Clustering algorithm is mainly divided into two techniques they are, hierarchical algorithm and partition algorithm.[1] A hierarchical clustering algorithm divides the given data set into smaller subset. A partition clustering algorithm partition the data set into desired number of set in a single step.

The histogram of a digital image is a distribution of its discrete intensity levels in the range [0,L-1]. The distribution is a discrete function h associating to each intensity level: the number of pixel with this intensity: Histogram equalization is a method to process images in order to adjust the contrast of an image by modifying the intensity distribution of the histogram. The objective of this technique is to give a linear trend to the cumulative probability function associated to the image.

Edge detection is an image processing technique for finding the boundary of object within images. It works by detecting discontinuities in brightness.[7] Edge detection is used for

image segmentation and data extraction in area such as image processing, computer vision and machine vision. Edge detection refers to the process of identifying and locating shape discontinuities in an image.[10] The discontinuities are abrupt changes in pixel intensity which characterize boundaries of object in a scene. In this paper, remote sensing image are segmented by using Fuzzy c means, Histogram Equalization and the edges are detected by using sobel, prewitt, edge detection algorithm.

2. Proposed Work

In this paper, the most popular method is Fuzzy C-Means algorithm is proposed to a form a clustering in which each data point can belong to more than one cluster or partition, this algorithm refers to soft clustering[8] This algorithm is prominent to cluster massive data rapidly and efficiently so it can be used in image processing techniques especially in segmentation.[3] This algorithm is used to detect the nuclei edge and highlight the cancer cell. And minute edges are detected by using sobel prewitt edge detection algorithm.

2.1 Segmentation Using Fuzzy C Means Cluster

Fuzzy c-means (FCM) is a data clustering technique in which a dataset is grouped into n clusters with every data point in the dataset belonging to every cluster to a certain degree. Fuzzy C-Means clustering also referred to as soft clustering.[8] It starts with an initial guess for the cluster centers, which are intended to mark the mean location of each cluster. The initial guess for these cluster centers is most likely incorrect. Next, fcm assigns every data point a membership grade for each cluster. By iteratively updating the cluster centers and the membership grades for each data point, fcm iteratively moves the cluster centers to the right location within a data set. This iteration is based on minimizing an objective function that represents the distance from any given data point to a cluster center weighted by that data point's membership grade.[3] Fig1. Shows the steps for the Fuzzy C-Means clustering algorithm.
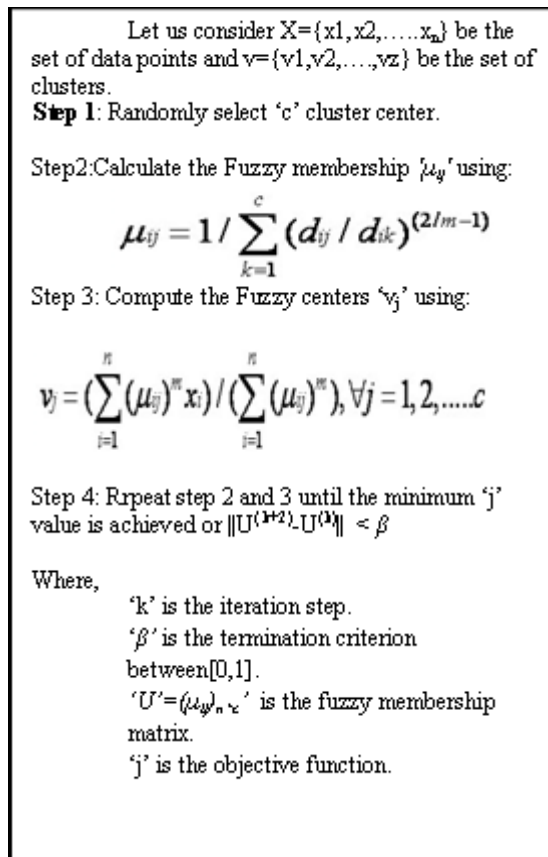
Let us consider X={x1,x2,.....xₙ} be the set of data points and v={v1,v2,....,vz} be the set of clusters.

Step 1: Randomly select 'c' cluster center.

Step2:Calculate the Fuzzy membership μ_{ij}' using:

$$\mu_{ij} = 1 / \sum_{k=1}^{c} (d_{ij} / d_{ik})^{(2/m-1)}$$

Step 3: Compute the Fuzzy centers 'v$_j$' using:

$$v_j = \left(\sum_{i=1}^{n} (\mu_{ij})^m x_i\right) / \left(\sum_{i=1}^{n} (\mu_{ij})^m\right), \forall j = 1, 2, ...c$$

Step 4: Rrpeat step 2 and 3 until the minimum 'j' value is achieved or $\|U^{(j+1)} - U^{(j)}\| < \beta$

Where,

     'k' is the iteration step.

     'β' is the termination criterion between[0,1].

     '$U' = (\mu_{ij})_{n \cdot c}$' is the fuzzy membership matrix.

     'j' is the objective function.

Fig. 1: Fuzzy c means clustering Algorithm.

3. Edge Detection Algorithm

Edge detection is an image processing technique for finding the boundary of object within images. It works by detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in area such as image processing, computer vision and machine vision.[7] Edge detection refers to the process of identifying and locating shape discontinuities in an image. The discontinuities are abrupt changes in pixel intensity which characterize boundaries of object in a scene. Common edge detection algorithm includes sobel, prewitt, canny and Roberts.

3.1 Sobel Operator

The sobel edge filter is used to detect edge based on applying a horizontal and vertical filter in sequence. The sobel operator performs a two dimensional spatial gradient measurement on an image and so emphasized region of high spatial frequency that correspond to edge. Typically it is used to find the approximate absolute gradient magnitude at edge point in a n input grayscale image. The sobel operator consist of 3*3 convolution masks a.

Vertical filter　　　　　Horizontal filter

-1	0	1
-2	0	2
-1	0	-1

1	2	1
0	0	0
-1	-2	1

The sobel operator is very similar to prewitt operator. Like prewitt operator, sobel operator is also used to detect two kind of edge in an image as vertical direction and horizontal direction.

3.2 Prewitt Operator

The Prewitt operator is used in image processing, particularly within edge detection algorithms. Technically, it is a discrete differentiation operator, computing an approximation of the gradient of the image intensity function. At each point in the image, the result of the Prewitt operator is either the corresponding gradient vector or the norm of this vector[8]. The Prewitt operator is based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical directions and is therefore relatively inexpensive in terms of computations like Sobel operators. On the other hand, the gradient approximation which it produces is relatively crude, in particular for high frequency variations in the image. The convolution masks of the Prewitt detector are represented below:
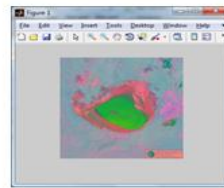
horizontal filter　　　　　Veritical filter

1	1	1
0	0	0
-1	-1	-1

-1	0	1
-1	0	1
-1	0	1

4. EXPERIMENTAL RESULT

The assorted experiment carried out in remote sensing image based on clustering, histogram and edge detection algorithm in MATLAB (2013R). The complete process of image segmentation for Satellite images and the standard are summarized in consequent figure.
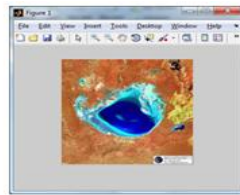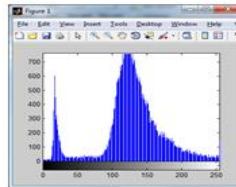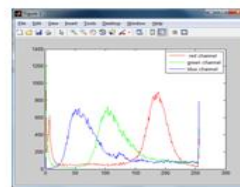
3(a)

3(b)

3(c)

3(d)

3(e)

3(f)

3(g)

3(a). Original image, 3(b). Conversion of RGB into L*a*b color conversion, 3(c).Fifth clustered image using Fuzzy c means,3(d). bimodal function, 3(e). Histogram Equalization, 3(f). Minute edge are detected by using sobel edge detection algorithm 3(g).Minute edge are detected by using prewitt edge detection algorithm.

5. CONCLUSION

Segmentation of image is a crucial operation in image analysis and in many computer vision, image interpretation, pattern recognition system with application in scientific and industrial field such as medicine, remote sensing, etc. Remote sensing image segmentation refers to the task of extracting information classes from a multiband raster image. In this research, well organized algorithm is proposed for Remote sensing image, edge are detected based on sobel, Prewitt, edge detection algorithm and segmentation of Remote sensing image using Fuzzy c means clustering algorithm, the recital patterns of the algorithm are analyzed. Finally,

Histogram Equalizations method is used to measure the RGB values in an image. Segmentation techniques helps to increase the efficiency of the image retrieval process.

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