COLOR BASED REMOTE SENSING IMAGE SEGMENTATION USING FUZZY C-MEANS AND IMPROVED SOBEL EDGE DETECTION ALGORITHM

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Abstract - Now-a-days image processing techniques are very exigent and broadly used in satellite images. The color based segmentation of remotely sensed image is used to assign corresponding levels with respect to groups with harmonized characteristics, with the aim of discriminating multiple objects from each other within the image. Every level of an image is called class. This will be executed on the basis of spectral or spectrally defined features such as density, texture and many other things in the feature space. In this research, well organized algorithm is proposed for Remote sensing image, edge are detected based on improved sobel edge detection algorithm and nuclei segmentation of Remote sensing image using Fuzzy c means clustering algorithm[1], the recital patterns of the algorithm are analyzed. Finally, edge detected image will be a binary image, this image is converted into color image using olive color map function. The olive color map function consists of colors that are shades of green and yellow. The olive colormap function takes less computational time than other colormap function.The improved sobel edge detection algorithm takes less computational time and greatest PSNR than edge detection algorithm.

Keywords- image processing, Remote sensing image, Fuzzy c means, improved sobel edge detection algorithm.

1. INTRODUCTION

Image processing is a form of signal processing for which the input is an image, such as a photograph or video frames, the output of an image processing may be either an image or a characteristic or parameter related to the image [2]. Satellite image segmentation has been a focused research area in the image processing, for the last few decades. Many papers has been published, mainly focused on gray scale images and less attention on color image segmentation, which convey much more information about the object or images. Image segmentation is the process of partitioning a digital image into multiple segments (a set of pixels).in medical images. Segmentation plays a most important role for feature extraction, image measurements and image display.Color based segmentation of image is a crucial operation in image analysis and in many computer vision, image interpretation[3], 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.

Edge detection is an image processing technique for finding the boundary of object within images. It works by detecting discontinuities in brightness[4]. 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. 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 and improved sobel edge detection algorithm and finally, the image are converted into color by using olive colormap function.

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[5]. 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 improved sobel edge detection algorithm. The output image will be binary image, that image is converted into color by using olive colormap function. Olive colormap function takes less computational time than other colormap function and improved sobel edge detection algorithm takes less computational time than 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, fuzzy c means assigns every data point a membership grade for each cluster. By iteratively updating the cluster centers and the membership grades for each data point, fuzzy c means clustering 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 [6]. Fig1. Shows the steps for the Fuzzy C-Means clustering algorithm.

Let us consider $X=\{x1,x2,.....x_n\}$ 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:

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

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

Where,

'k' is the iteration step.

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

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

'j' is the objective function.

Fig 1 Fuzzy c means clustering Algorithm.

2.2 IMPROVED SOBEL EDGE DETECTION

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 as

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

Fig 2 .Horizontal filter

1	2	1
0	0	0
-1	-2	1

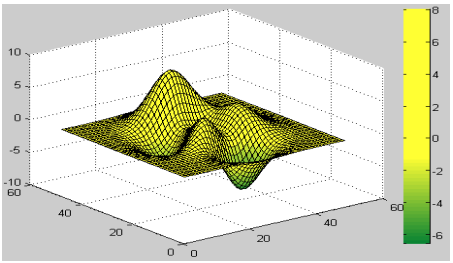
Fig 3. Vertical filter

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. In this research improved sobel edge detection algorithm is proposed, this algorithm is same as that of sobel edge detection algorithm. But the minority differences is that, in sobel edge detection algorithm the dividend value is eight and in improved sobel edge detection algorithm the dividend value is two. The advantage of improved sobel edge detection algorithm takes less computational time than other edge detection algorithm.

2.4 OLIVE COLORMAP FUNCTION

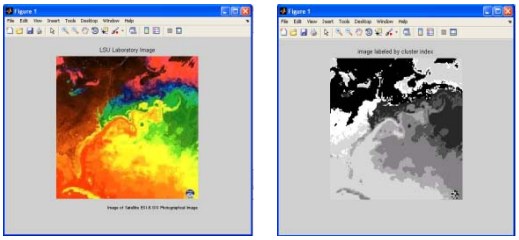
The colormap function is a type of raster data render. It transforms the pixel values to display the raster data as either a gray scale or a color (RGB) image based on specific colors in a colormap file, or based on a colormap. A colormap contain a set of value that are associated with color and used to display s single band raster consistently with the same color. Each pixel value is associated with a color, defined as a set of RGB values. Colormap are capable of supporting any bit depth, except FLOAT.

They can also support positive and negative values, and the colormap can contain missing values, pixel with those missing value will not be displayed. In this research, a novel color map function is introduced and it named as olive colormap function. The olive colormap function consists of color that is shades of green and yellow as

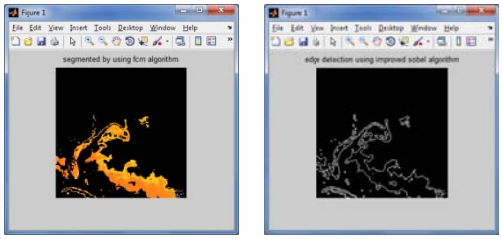


3. EXPERIMENTAL RESULT

The assorted experiment carried out in remote sensing image data set algorithm of fuzzy c means and improved sobel edge detection algorithm in MATLAB 7.6(2008R). The complete process of image segmentation for ovarian cancer images and the standard are summarized in consequent figure.



3(a) 3(b)



3(c) 3(d)

3(e) 3(f)

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). Minute edge are detected by using improved sobel edge detection algorithm, 3(e). olive colormap function, 3(f). The PSNR value for improved sobel edge detection algorithm,

3.1 COMPARISON BETWEEN OLIVE COLORMAP FUNCTION WITH COLORMAP FUNCTION

This experiment reveals the fact that olive colormap function consumes less elapsed time i.e.0.070818 seconds than other color map function. On the basic of the result drawn table by this experiment it may be safely stated that olive colormap function consume less computational time. Fig2.Shows, the comparative analysis betweenolive colormap function and other colormap function.

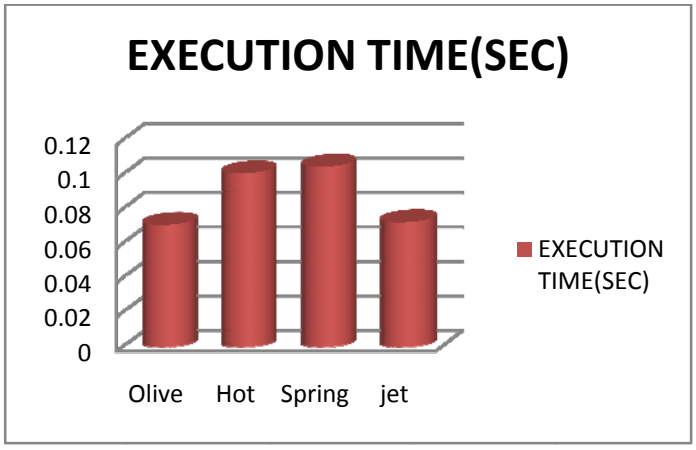


Fig2. Comparison between olive colormap function with other colormap function

4. COMPARISON BETWEEN IMPROVED SOBEL AND EDGE DETECTION ALGORITHM

This experiment reveals the fact that improved sobel edge detection algorithm consumes less elapsed time i.e.4.966971 seconds than sobel edge detection algorithm, which takes 5.220494 seconds. On the basic of the result drawn by this experiment it may be safely stated that improved sobel edge detection algorithm less time and higher PSNR value, when compared to edge detection algorithms.The PSNR values are obtained by calculating signal to noise ratio peak and the root mean square error between the edge detection images and the original ground truth image. The original ground truth image is compared with the different edge detect operators for the original grayscale noisy image without filter and with spatial filter.Then all the spatial filter are applied to noisy images to remove the noise in it. After applying the filters to the images, the edge detector operator is applied to all kinds of filtered images. Then PSNR value is calculated between the original image and filtered edge detected images.

Table1. Shows, the comparative analysis between improved sobel edge detection and edge detection algorithms.

S.NO	EDGE DETECTION ALGORITHM	PSNR VALUE	EXECUTION TIME(SEC)
1	Improved sobel	76.42	4.966971
2	Sobel	73.16	5.220494
3	Prewitt	72.21	5.409502
4	Roberts	74.11	5.204322
5	Canny	74.15	5.592047

5. CONCLUSION

Color based 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 improved sobel edge detection algorithm and nuclei segmentation of Remote sensing image using Fuzzy c means clustering algorithm, the recital patterns of the algorithm are analyzed. Finally, edge detected image will be a binary image, this image is converted into color image using olive color map function. The olive color map function consists of colors that are shades of green and yellow. The olive colormap function takes less computational time than other colormap function.The improved sobel edge detection algorithm takes less computational time and greatest PSNR than edge detection algorithm.

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