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Simultaneous Process Using Soft Computing

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Abstract: ***It is the necessary to detection of brain tumor which is used in MRI image. We proposed a method of image segmentation of brain tumor detection in which first we take image as input, second step is that remove noise from input image with the help of filtering technique, third step is convert image to gray scale image, forth is apply segmentation techniques simultaneously with the help of soft computing approach in which we have the algorithm of pre processing that run the algorithm simultaneously. In soft computing, it computes the different segmentation method with same input image. It gives the result with different execution time. We want to improve the speed of execution time and noise free image.***

Keywords: Brain tumor detection Algorithm, segmentation techniques, Soft Computing model and MATLAB tool

1. Introduction

Image segmentation is basically used to locate objects and boundaries. It is one of the important to identify and analysis the diseases of the human body [15]. Fuzzy c-means, many other algorithms are very helpful for finding the medicinal decision to diagnose brain tumor and cancer diseases and help in their decision. Data mining can be used to explore many data sets in diagnosis of various types of tumors. Data mining is concerned with building the model, a model is simply an algorithm. One another problem of body is brain tumor detection. Feature extraction and selection of image is very important step in detection and classification [16]. For brain tumor detection widely used technique is clustering. Clustering refers to the classification of objects into groups according to criteria of objects. In the clustering techniques, it allows to extract a vector from local areas in the image. A standard procedure for clustering is to assign each pixel to the nearest cluster mean. Clustering algorithms are classified clustering (k- means clustering) fuzzy clustering, etc [1], [3] and [4]. The K-Means Algorithm K-means algorithm is the most well-known and widely-used unsupervised clustering [5]. In this work we are using three types of clustering techniques. Fuzzy c-means and k-means techniques are implemented by MATLAB tool using soft computing approach.

2. Objectives

We have proposed the method of segmentation. It does the work of the image clustering according to pixels similarity [9] and [10]. In this first the image is divided into multiple segments, then the fuzzy c and k-means algorithm is applied to the preprocessed image. Fuzzy c means, it gives high computational complexity [3] and [6]. It has good efficiency and convergence rate. It performs the iterative process for a set of fuzzy cluster. Fuzzy clustering allows the similar types of data points in more than one group. We want to reduce the time complexity of given input.

3. Methodology

The proposed methodology is based on soft computing techniques. Soft computing is one of the intelligence systems that perform the simultaneous operation in which we get result at a time [7] and [14]. Soft computing solves real world problem. Soft computing is one of the approach that solve the problem when there is not enough information available. This is the implementation of parallel computing using MATLAB tool. We are using three segmentation techniques applying in our model using MATLAB that process the image under simultaneous process. These are the common method of segmentation, thresholding, FCM and KMC. FCM is widely used clustering method.

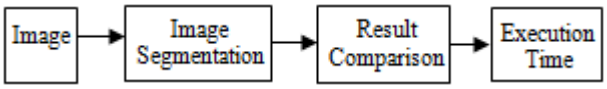

Figure 1: Proposed Techniques

For Histogram thresholding techniques, Once tumor is detected, thresholding is done for image segmentation by calculating a threshold point. One of the oldest methods for image segmentation is thresholding. It is method which is used separating pixels in different classes which depending on their gray levels pixels. An intensity value decided by thresholding method, called the threshold. Thresholding is one of the most commonly used methods for image segmentation. This method is more effective for images with different intensities. Using this method, the image is partitioned directly into different regions based on the intensity values [16].

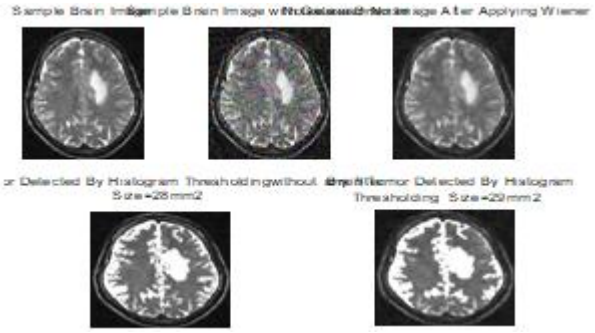

Figure 2: Histogram thresholding techniques

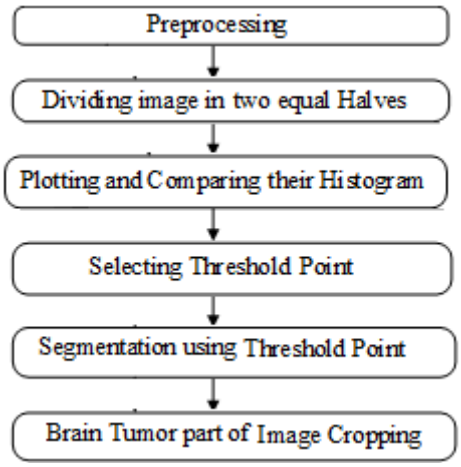

Figure 3: Process of Histogram thresholding techniques

For FCM
It is the method of two or more clusters. It allows one piece of data, similar group of data set [13]. , Fuzzy C-Means tries to reduce or cost function. For some predefined number of finite input data points this algorithm refrain all clusters and partition matrix.

Fuzzy C-Means clustering decreases a cost function iteratively. This cost function is distance between pixels and cluster centers. The fuzzy clustering algorithm is an iterative clustering method which can produces an optimal *c* partition by minimizing the weighted within group sum of squared error objective function *J*

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$$J_m = \sum_{i=1}^{N}\sum_{j=1}^{C} M_{ij}^m \left\|x_i - c_j\right\|^2$$

where $m > 1$ (any real number)

M_{ij} is membership degree of x_i in the cluster j

x_i is any d dimensional data

c_j is cluster centre such that $c_i=\{c_{i1}, c_{i2}, c_{i3}, \ldots\ldots c_{in}\}$

c is the number of clusters in x with limit $2 \leq c < n$
m is a weighting exponent on each fuzzy membership

Now to obtain fuzzy partition, objective function is optimized iteratively

$$M_{ij}^m = \frac{1}{\sum_{k=1}^{c}\left(\frac{\left\|x_i - c_j\right\|}{\left\|x_i - c_k\right\|}\right)^{\frac{2}{m-1}}}$$

Cluster centre *c* is also updated by

$$c_j = \frac{\sum_{i=1}^{N} M_{ij}^m . x_i}{\sum_{i=1}^{N} M_{ij}^m}$$

The iteration stops when

$$max_{ij}\left\{\left|M_{ij}^{(K+1)} - M_{ij}^{(K)}\right|\right\} <$$

Where, ε is limitation criterion between 0 and 1 and *k* is the iteration step.
The distance between x_i and c_i given

$$d_{ik}^2 = \left\|x_i - c_j\right\| = (x_i - c_j)^T (x_i - c_j)$$

Where, T is the transition function.

The weighting exponent *m* controls the relative weights of each error. With increasing m there would be subsequent decrease in membership. An optimal solution of the objective function *J* can be reached by following steps within Fuzzy C-Means algorithm

1) Define the initial values of *c, m and max. iteration*.
2) Choose the initial fuzzy partition matrix $M = [M_{ij}]$ *where j=0, 1, ...max. iteration*
3) Compute Cluster centre $C=[c_j]$ *where* $j=1,2,\ldots.c$ by eq. 3.4

$$c_j = \frac{\sum_{i=1}^{N} M_{ij}^m . x_i}{\sum_{i=1}^{N} M_{ij}^m}$$

4) Calculate the membership matrix $M^{(k)}$ and $M^{(k+1)}$ by eq. 3.5

$$M_{ij}^m = \frac{1}{\sum_{k=1}^{c}\left(\frac{\left\|x_i - c_j\right\|}{\left\|x_i - c_k\right\|}\right)^{\frac{2}{m-1}}}$$

where $1 \leq k \leq N$ and $1 \leq i \leq C$
5) Compare $M^{(k)}$ and $M^{(k+1)}$ in optimal matrix form, if $\left\{\left|M_{ij}^{(K+1)} - M_{ij}^{(K)}\right|\right\} < \varepsilon$ then stop otherwise set $M^{(k+1)} = M^{(k)}$ and go back to step 3

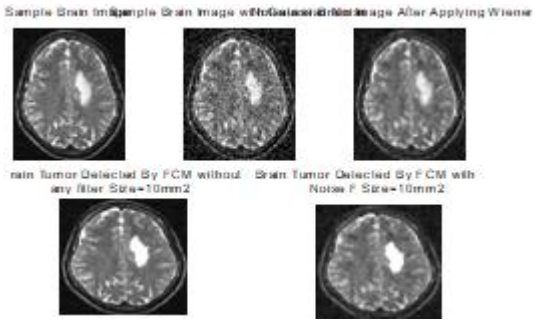

Figure 4: Resultant image of FCM

For kmeans
It is the easiest way of clustering technique. It has the idea of given data set through a certain number of clusters [16] and [15]. K-Means algorithm is has been widely used till past some years. It works on the principle of clustering or grouping of each pixel according to its minimum distance with any cluster. So any number of clusters is first defined, then their centroids are calculated and then one by one components of data set are arranged to nearest centroid. This process continues until all pixels are arranged. Also K new centroids are calculated which will be centroid of clusters. Now again calculation of distances are performed to

minimize it. This process continues until all K centroids are arranged and no more arrangement is possible.

It is clear that component values are arranged according to the predefined numbers of clusters. In starting centroids of these predefined clusters are calculated randomly. Each component value is assigned to the predefined cluster on the basis of their proximity. This can be obtained by calculating any distance measurement technique. After arranging all components according to cluster, the mean of each cluster is calculated again. This process goes on continuing till all further arrangement chances are exhausted.

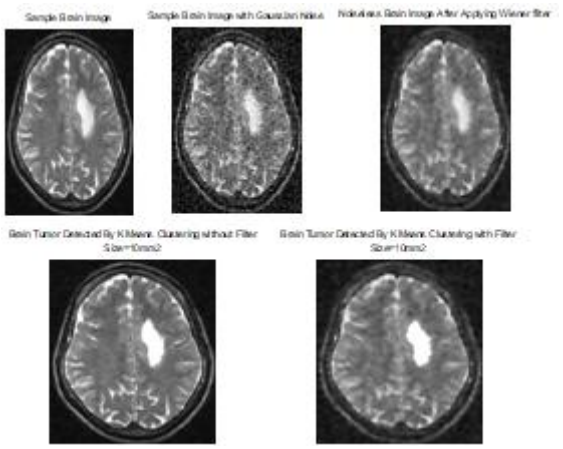

Figure 5: Resultant image of Fuzzy k-means

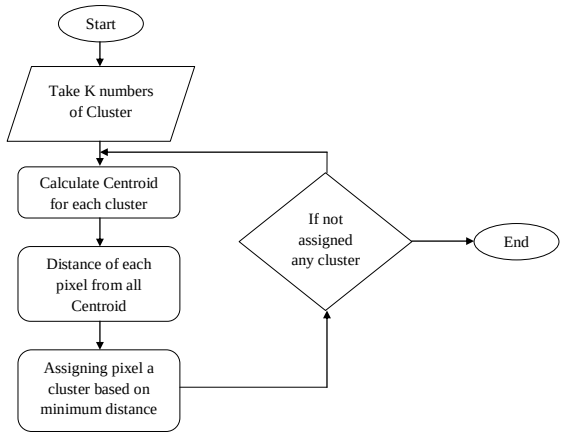

Figure 6: Process of k- means

Step by step explanation of method is given as below:

1) Assign the numbers of cluster value as *k*.
2) Randomly choose the k cluster centers.
3) Calculate mean or center of the cluster, such that cluster can be represented by C_a where $p=(1, 2, 3....k)$
4) Calculate the distance b/w each pixel to each cluster center. It can be performed by nearest neighbor classification technique such as Euclidean Distance Calculation
   $d_{i,j} = \| X_{i,j}-C_a \|$
5) If the distance is near to the center then move to that cluster. Otherwise move to next cluster.
6) Re-estimate the center.
7) Repeat the process until centroid movement stops.

In this paper applying these three technique simultaneously and collect result from single processor.

Comparision

In our work resultant is fcm is better then among. Fuzzy C-Means is an efficient technique but it is time consuming. k-Means is not for large database.[6], [9] and [11]. Soft computing is efficient technique for real world problem in which we are using existing method for the detection of brain tumor.

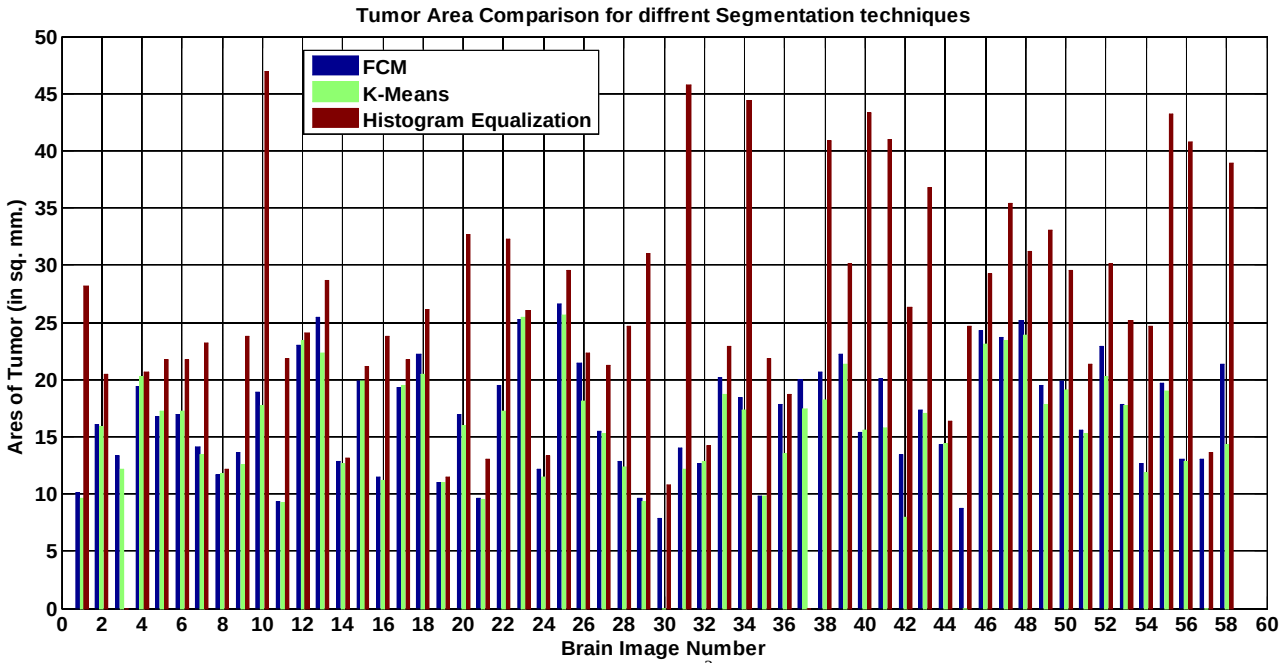

Figure 7: Comparison of Brain Area in mm^2 calculated by three techniques

4. Expected Outcomes

Clustering method provide the advantages of improvement of computational time over fuzzy c means approached. Segmentation accuracy is slighter lower than fuzzy c means. We are using the filter techniques to for removing the noise. This research area includes execution time and wants to reduce the time complexity. Fuzzy c-means clustering gives more accurate result than k means.

5. Conclusion

Here different types of review paper is available they have result in different accuracy and degree of complexity. The proposed technique has the capability of produce the better result with high density of noise so, It is necessary to remove the noise from image and reduce the time complexity of execution speed of given data.

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