A NOVEL BRAIN TUMOR DETECTION WITH MODIFIED FUZZY CLUSTERING TECHNIQUE

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Abstract- In this paper presents a new approach for Brain tumor detection with Fuzzy C-means algorithm. The proposed segmentation processes includes new morphological mechanism for clustering the high resolution elements of images in order to reduce the computation time, and improves the precision. The existing K-means clustering algorithms consumes time and providing low accuracy, to overcome these problems in this paper we proposed an optimized Fuzzy C-means algorithm. This algorithm is able to optimize the K-means clustering for image segmentation. This paper evaluates the proposed approach for image segmentation by comparing the state-of-art of the methods. The proposed simulation results are to clarify the effectiveness of our approach to improve the quality of segmentation.

Keywords- Image segmentation, FCM, Color Spaces.

I. INTRODUCTION

In digital image processing segmentation the major role is to classify the similar colors of image in the similar group elements. The clustering is based on various colors into various groups based on similarity or distance between intensities of inside image. The role of image segmentation is to extract the color spaces of dominated colors on selected MRI images. The proposed morphological technique is based on image segmentation which is very important for an information extraction from images as both color, shape and texture features. We have various application of image segmentation classified in many field such as image compression, medical image processing, object detection, and image retrieval, and image enhancement.

Last two decades onwards several approaches are already introduced for image segmentation. In those technologies most popular methods for image segmentation is K-means [1][2], and C-means algorithms. These techniques are widely used algorithms for ability to cluster for image segmentation or huge data cluster quickly.

This paper proposes a novel approach for image segmentation by using C-means to optimize the K-means clustering. But the major problem is that the FCM technique is time consuming. We are proposed the segmentation efficiency of the FCM algorithm improved by silhouette method based on clustering instead of random initialization. The proposed FCM algorithm is implemented using the concept of parallel processing. Cheng and goldgof proposed fast clustering algorithm based on random sampling which can improve the processing speed 2 to 3 times when compared with K-means and conventional FCM algorithms. For this performance the vector quantization based FCM is implemented to speed-up the segmentation processes. The proposed modified FCM algorithm is used to clustering the abnormal MR brain images from four tumor classes namely metastase, meningioma, glioma, and astrocytoma. Mainly for image clustering correlation, entropy, and contrast are extracted from images used for the clustering algorithm. The proposed segmentation outputs are analyzed based on segmentation efficiency and convergence rate. The simulation results for the modified FCM algorithm.

II. RELATED WORK

Basically the image segmentation system is pre-proceeds mainly three steps: one is noise removal, second is dataset normalization, and third is color space transformation. Initially for image enhancement we have to apply the mean or median filter for noise removal. Our system is to provide the function is to convert the RGB of an image into HSL and CIELAB color system. Because of that various colors of CIELAB we have to apply the data normalization. The proposed system is to clusters the image for segmentation by applying the K-means segmentation.

For noise removal filtering is used by wiener filter is applied for noise removal on images. In that filters wiener filter is considered as one of the best fundamental noise removal or reduction method, it is mostly used for image restoration.

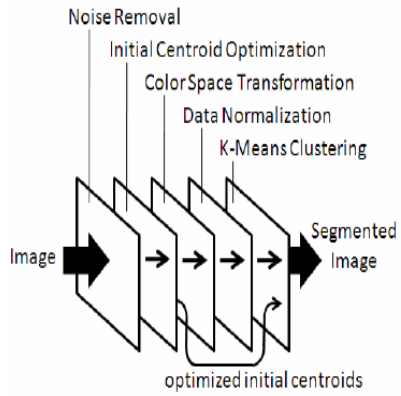

Fig.1.various steps for image segmentation.

The enhancement processes mainly focus on image such a way that the image is more suitable than original image. The technique have two domain of images are applied. These are frequency domain and spatial domain. The frequency domain image works with Fourier transform technique. But the spatial domain refers whole pixels of image composed to spatial domain operation directly on the pixels. This enhancement technique is to improve the image quality. It can be improves the image brightness and contrast.

2.1 Morphological operations and operators:

This morphological operation is on set of pixels. It uses for membership function to convert binary image, these operations are to separate the tumor region of the image. The region of the tumor is visible in the image as a white color. The entire image has only two possible values in the image 0 for black and 1 for white color.

After converting the image in the binary format some morphological operations are applied on the converted binary image. The purpose of the morphological operators is to separate the tumor part of the image. The portion of the tumor in the image is visible as white color which has the highest intensity then other regions of the image. Some of the commands used in the morphing are strelwhich is used for creating morphological structuring element, imerode which is used to erodeor shrink an image an dimdilate which is used to fordilatingi. e.expanding an image[7]. After segmentation and thresholding some percent to fnoise will be there, inordertoremovethis noise twoimportant morphological operations have been used: opening and closing.

III. PROPOSED METHOD

The segmentation processes is to partitioning image into various segments. The proposed segmentation can also be process of assigning a label into every pixel image such that the pixels are same label are shares various categories. Most of the segmentation techniques are based on mainly two basic properties of intensity values such as similarity and discontinuity. In these two first one is to partition image based on abrupt changes in gray level intensity levels such as edges. Another one is depends on partitioning image into various regions that are similar according to static conditions. In this project is used second approach.

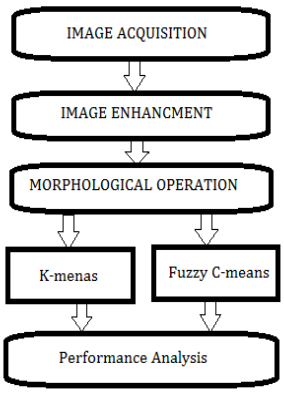

Fig.2. the detailed design flow chart of each has been described as follows.

3.1 K-means based segmentation:

This algorithm is an iterative technique it can be used to partition the image into K clusters.
The basic algorithm is as follows:

- ✓ Select K-cluster centers either and omly or based on some heuristic
- ✓ To assigneach pixel in the image to the cluster that minimizes the distance between the pixel and the cluster centerRe-compute the cluster centers by averaging all of the pixels in the cluster To Repeat steps2 and 3 until convergence is attained means no pixel is changed.
- ✓ Thek-means method is the simplest methods in unsupervised classification.

K-means clustering is an iterative procedure. This clustering algorithm clusters data by iteratively computing a mean intensity for each class and segmenting the image by classifying each pixel in the class with the closest mean. Here the distance is the squared or absolute difference between a pixel and a cluster center.
The difference is typically based on pixel color, intensity, and location, or a weighted combination of there factors. K can be selected manually, randomly, orbyaheuristic.
This algorithm is guaranteed to converge but it may not return the optimal solution. The quality of the solution depends on the initial set of clusters and the value of K.

3.2 Fuzzy C-means:

In fuzzy clustering, each point has a degree of belonging to clusters, as in fuzzy logic, rather than belonging completely to just one cluster. Thus, points on the edge of a cluster may be in the cluster to a lesser degree than points in the center of cluster. For each point x we have a coefficient giving the degree of being in the kth cluster $u_k(x)$. Usually, the sum of those coefficients for any given x is defined to be 1:

$$\forall x \left(\sum_{k=1}^{\text{num. clusters}} u_k(x) = 1 \right).$$

With fuzzy c-means, the centroid of a cluster is the mean of all points, weighted by their degree of belonging to the cluster:

$$\text{center}_k = \frac{\sum_x u_k(x)^m x}{\sum_x u_k(x)^m}.$$

The degree of belonging is related to the inverse of the distance to the cluster center:

$$u_k(x) = \frac{1}{d(\text{center}_k, x)},$$

then the coefficients are normalized and fuzzyfied with a real parameter m > 1 so that their sum is 1. So

$$u_k(x) = \frac{1}{\sum_j \left(\frac{d(\text{center}_k, x)}{d(\text{center}_j, x)}\right)^{2/(m-1)}}.$$

For m equal to 2, this is equivalent to normalising the coefficient linearly to make their sum 1. When m is close to 1, then cluster center closest to the point is given much more weight than the others, and the algorithm is similar to k-means.

The fuzzy c-means algorithm is very similar to the k-means algorithm:[4]

- Choose a number of clusters.
- Assign randomly to each point coefficients for being in the clusters.
- Repeat until the algorithm has converged (that is, the coefficients' change between two iterations is no more than ε, the given sensitivity threshold) :
  - Compute the centroid for each cluster, using the formula above.
  - For each point, compute its coefficients of being in the clusters, using the formula above.

The algorithm minimizes intra-cluster variance as well, but has the same problems as k-means, the minimum is a local minimum, and the results depend on the initial choice of weights. The expectation-maximization algorithm is a more statistically formalized method which includes some of these ideas: partial membership in classes. It has better convergence properties and is in general preferred to fuzzy-c-means.

Simulation Results:

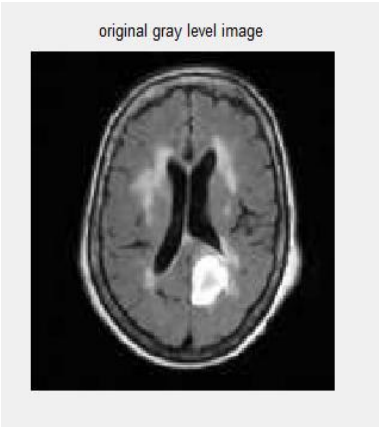

Fig.3. Input MRI image.

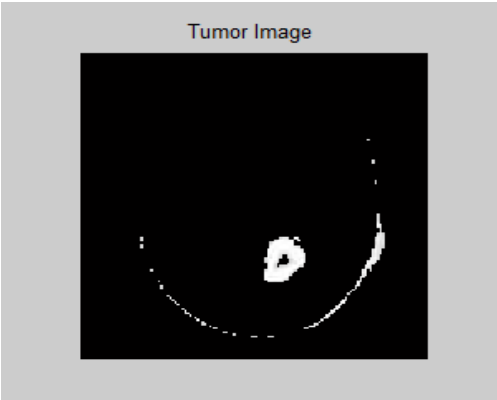

Fig.4. Tumor detected image with K-means

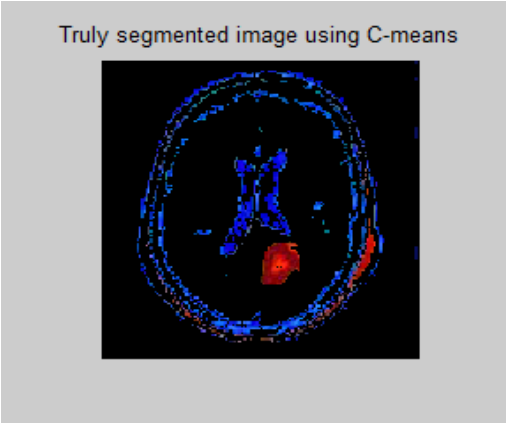

Fig.5. Tumor detected image with Fuzzy C-means.

Fig.6. Tumor detected image with modifies Fuzzy C-means.

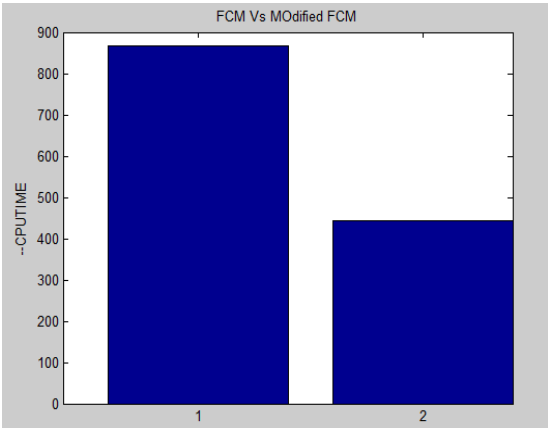

Fig.7. CPUtime comparison Between FCM and Modified FCM.

CONCLUSION

In these days severe types of brain tumors can spoil a human life just within one year. Mostly these brain tumor problems are often with radiation problems. To detect this tumor one of the approach is looking by doctor at MRIs of the brain images. Then they use some treatments to kill tumor cells. Unfortunately some tumors cells are not visible in the MRIs to the naked eyes of doctors. So this procedure is not good, it will kill some healthy brain cells in the region along with tumor region. In this project we are done to tackle these problems and how doctors could more accurately detect the tumor cells while we created a computer program that can detect the brain tumors all by itself without interfere the humans. Generally for image segmentation used thresholding technique and morphological operators it has time complexity and low accuracy. But for easy processes we are used K-means and Fuzzy C-means segmentation processing techniques are applied. In this project we are applied on MRIs and then processed through segmentation such as both K-means and Fuzzy C-means clustering techniques are giving efficient results.

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