IMPLEMENTATION OF K-MEANS CLUSTERING AND FUZZY C-MEANS ALGORITHM FOR BRAIN TUMOR SEGMENTATION

Archana Lala[1], Jitendra Kumar Gupta [2], Mrinalini Shringirishi[3]

Director, S R Group of Institution college of Science & Engineering Jhansi (U.P.)[1]
Assistant Prof. College of Science & Engineering, CS Deptt. Jhansi (U.P.)[2]
M.Tech Scholar College of Science & Engineering, CS Deptt. Jhansi (U.P.)[3]

ABSTRACT

This paper deals with the implementation of Simple Algorithm for detection of range and shape of tumor in brain MR images. Tumor is an uncontrolled growth of tissues in any part of the body. Tumors are of different types and they have different Characteristics and different treatment. As it is known, brain tumor is inherently serious and life-threatening because of its character in the limited space of the intracranial cavity (space formed inside the skull). Most Research in developed countries show that the number of people who have brain tumors were died due to the fact of inaccurate detection. Generally, CT scan or MRI that is directed into intracranial cavity produces a complete image of brain. This image is visually examined by the physician for detection & diagnosis of brain tumor. However this method of detection resists the accurate determination of stage & size of tumor. To avoid that, this work uses computer aided method for segmentation (detection) of brain tumor based on the k.means and fuzzy c-means algorithms. This method allows the segmentation of tumor tissue with accuracy and reproducibility comparable to manual segmentation. In addition, it also reduces the time for analysis.

KEYWORDS: *Abnormalities, Magnetic Resonance Imaging (MRI), Brain tumor, Pre-processing, K-means, fuzzy c-means, Thresholding*

1. INTRODUCTION

This paper deals with the concept for automatic brain tumor segmentation. Normally the anatomy of the Brain can be viewed by the MRI scan or CT scan. In this paper the MRI scanned image is taken for the entire process. The MRI scan is more comfortable than CT scan for diagnosis. It is not affect the human body. Because it doesn't use any radiation. It is based on the magnetic field and radio waves. There are different types of algorithm were developed for brain tumor detection. But they may have some drawback in detection and extraction. In this paper, k-means algorithm and fuzzy c-means algorithm is used for segmentation. So it gives the accurate result for tumor segmentation. Tumor is due to the uncontrolled growth of the tissues in any part of the body. The tumor may be primary or secondary. If it is an origin, then it is known as primary. If the part of the tumor is spread to another place and grown as its own affects CSF (Cerebral Spinal Fluid). It causes for strokes. The physician gives the treatment for the strokes rather than the treatment for tumor. So of the person who affected by the brain tumor will increase if it is detected at current stage. That will increase the lifetime about 1 to 2 years. Normally tumor cells are of two types. They are Mass and Malignant. The detection of the malignant tumor is somewhat difficult to mass tumor. For the accurate detection of the malignant tumor that needs a 3-D representation of brain and 3-D analyzer tool. In this paper we focused on detection of mass tumor detection. The developing platform for the detection is mat lab [1].

2. EXISTING METHOD

The existing method is based on the thresholding and region growing. The thresholding method was ignored the spatial characteristics. Normally spatial characteristics are important for the malignant tumor detection. In the thresholding based segmentation the image is considered as having only two values either black or white. But the bit map image contains 0 to 255 gray scale values. So sometimes

it ignores the tumor cells also. In case of the region growing based segmentation it needs more user interaction for the selection of the seed [2]. Seed is nothing but the center of the tumor cells; it may cause intensity in homogeneity problem. And also it will not provide the acceptable result for all the images.
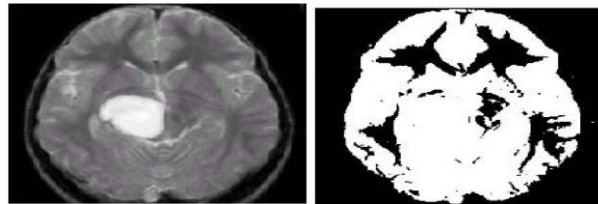

Fig-1 Input Image   **Fig .2** output image

Fig.1 is the input image for thresholding. From the MR image itself we can see the tumor area but it is not enough for further treatment. For that it is given to the thresholding process. Fig2 is the output image for the thresholding. It consists of only two gray values .That is white as 1 and black as 0. The background value is assigned to binary value 0 and object gets the value 1. So we cannot extract the tumor from the image. This is the main drawback of the existing system. Due to that we go for the proposed method for tumor segmentation.

3. PROPOSED METHOD

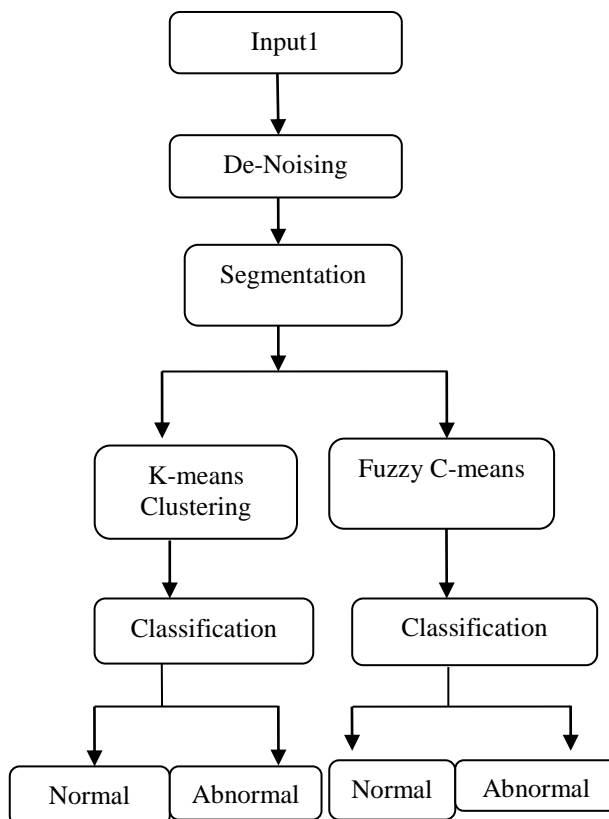In the proposed method Segmentation is carried out by advanced K-means and fuzzy c-means algorithms. [3].

Fig.3 Block Diagram

4. PRE-PROCESSING

According to the need of the next level the pre processing step convert the image. It performs filtering of noise and other artifacts in the image and sharpening the edges in the image. RGB to grey conversion and Reshaping also takes place here. It includes median filter for noise removal. The possibilities of arrival of noise in modern MRI scan are very less. It may arrive due to the thermal effect. The main aim of this paper is to detect and segment the tumor cells. But for the complete system it needs the process of noise removal.

5. SEGMENTATION USING K-MEANS ALGORITHM

K-Means is one of the simplest unsupervised learning algorithms that solve the well-known clustering problem. The procedure follows a simple and easy way to classify a given data set through a certain number of clusters (assume k clusters) fixed a priori. The main idea is to define k centroids, one for each cluster. These centroids should be placed in a cunning way because of different location causes different result. So, the better choice is to place them as much as possible far away from each other [4]. The next step is to take each point belonging to a given data set and associate it to the nearest centroid. When no point is pending, the first step is completed and an early group age is done. At this point it is necessary to re-calculate k new centroids as bar centers of the clusters resulting from the previous step. After obtaining these k new centroids, a new binding has to be done between the same data set points and the nearest new centroid. A loop has been generated. As a result of this loop, one may notice that the k centroids change their location step by step until no more changes are done. In other words centroids do not move any more. Finally, this algorithm aims at minimizing an *objective function*, in this case a squared error function ([5],[6],[7]).

Steps for k-means:
1. Give the no of cluster value as k.
2. Randomly choose the k cluster centers
3. Calculate mean or center of the cluster
 4. Calculate the distance b/w each pixel to each cluster center
5. If the distance is near to the center then move to that cluster.
6. Otherwise move to next cluster.
7. Re-estimate the center.
8. Repeat the process until the center doesn't move

6. SEGMENTATION USING FUZZY C-MEANS

Fuzzy C-Mean (FCM) is an unsupervised clustering algorithm that has been applied to wide range of problems involving feature analysis, clustering and classifier design. FCM has a wide domain of applications such as agricultural engineering, astronomy, chemistry, geology, image analysis, medical diagnosis, shape analysis, and target recognition. With the developing of the fuzzy theory, the fuzzy c-means clustering algorithm based on Ruspini fuzzy clustering theory was proposed in 1980s. This algorithm is examined to analyze based on the distance between the various input data points. The clusters are formed according to the distance between data points and cluster centers are formed for each cluster. The basic structure of the FCM algorithm is discussed below. The Algorithm Fuzzy C-means (FCM) is a method of clustering which allows one piece of data to belong to two or more clusters([8],[9]).

Steps for Fuzzy C-means:
▸ Initialize $U=[u_{ij}]$ matrix, $U^{(0)}$
▸ At k-step: calculate the centers vectors $C^{(k)}=[c_j]$ with $U^{(k)}$

$$c_j = \frac{\sum_{i=1}^{N} u_{ij}^m \cdot x_i}{\sum_{i=1}^{N} u_{ij}^m}$$

▸ Update $U^{(k)}$, $U^{(k+1)}$

$$u_{ij} = \cfrac{1}{\sum\limits_{k=1}^{c} \left(\cfrac{\|x_i - c_j\|}{\|x_i - c_k\|} \right)^{\frac{2}{m-1}}}$$

▸ If $\| U^{(k+1)} - U^{(k)} \| < \varepsilon$ then STOP; otherwise return to step 2.

7. RESULTS

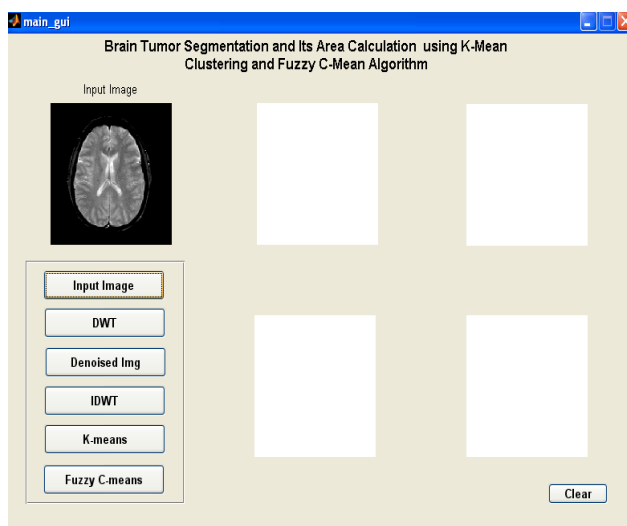 Screen shot for pre-processing ,K-means and fuzzy c-means .

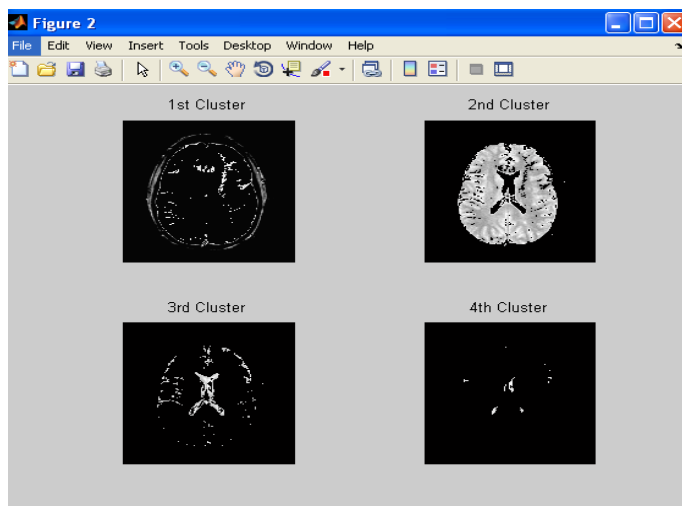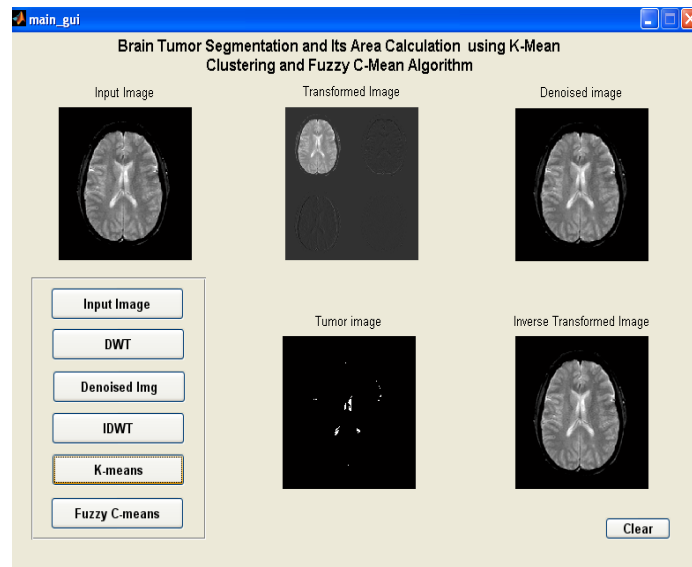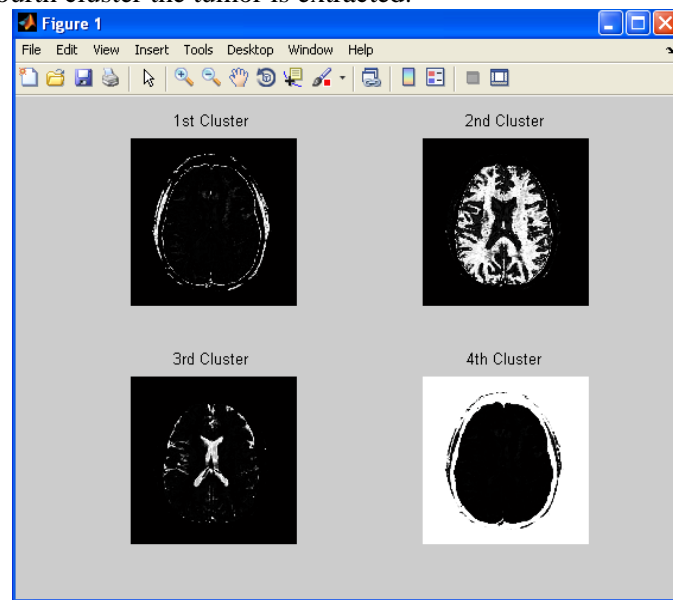**Fig.4** Output image for k-means and fuzzy c-means.

Fig.5 Output image for k-means algorithm

Fig.6 Output image for the tumor is extracted using k-means algorithm.

Fig.6 is the MR image given as input to the preprocessing and K-means algorithm. Here 0.02% of salt and pepper noise is added and that has been removed using the median filter. The K-mean algorithm clusters the image according to some characteristics. Figure is the output for K-Means algorithm with four clusters. At the fourth cluster the tumor is extracted.

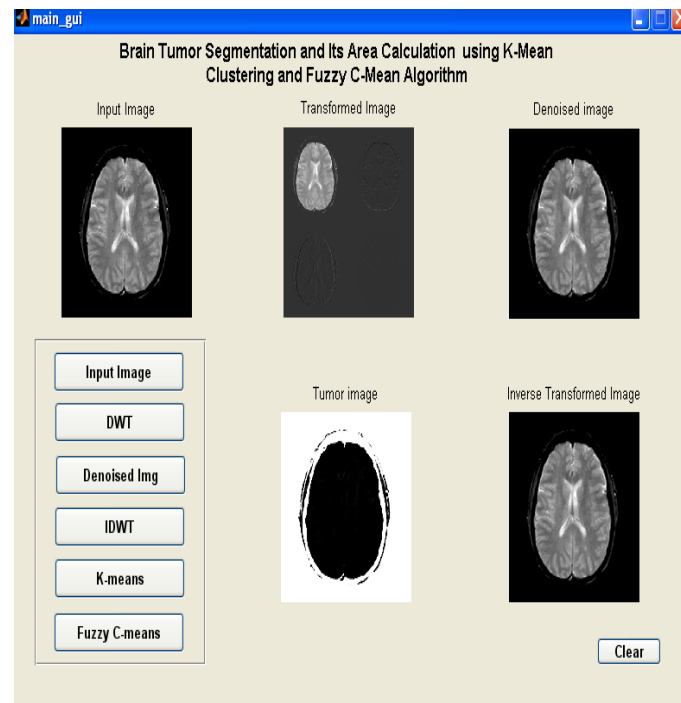**Fig. 7** Output image for fuzzy c-means algorithm

Fig.8 Output image of FCM

Fig.8 is the output image for Fuzzy C Means. It is mainly developed for the accurate prediction of tumor cells which are not predicted by K-means algorithm. It gives the accurate result for that compared to the K Means. This algorithm scans the RGB or grayscale image, converts the image into binary image by binarization technique and detects the edge of tumor pixels in the binary image. Also it calculates the size of tumor by calculating the number of white pixels (digit 0) in binary image.

8. CONCLUSIONS

There are different types of tumors are available. They may be as mass in brain or malignant over the brain. Suppose if it is a mass then K- means algorithm is enough to extract it from the brain cells. If there is any noise are present in the MR image it is removed before the K-means process. The noise free image is given as a input to the k-means and tumor is extracted from the MRI image. And then segmentation using Fuzzy C means for accurate tumor shape extraction of malignant tumor. The proposed method gives more accurate result. In future 3D assessment of brain using 3D slicers with matlab can be developed.

REFERENCES

[I]. M.H. Fazel Zarandia, M. Zarinbala, M. Izadi b(2011), "Systematic image processing for diagnosing brain tumors: A Type-II fuzzy expert system approach," Applied soft computing 11,285-294

[2]. S.Mary Praveena ,Dr.I1aVennila , June 2010, "Optimization Fusion Approach for [mage Segmentation Using K-Means Algorithm," International Journal of Computer Applications (0975 - 8887) Volume 2 - NO.7.

[3]. M. Masroor Ahmed & Dzulkifli Bin Mohammad(2010), "Segmentation of Brain MR [mages for Tumor Extraction by Combining Kmeans Clustering and Perona-Malik Anisotropic Diffusion Model," International Journal of Image Processing, Volume (2) : Issue(I) 27

[4]. Manisha Bhagwatl, R.K.Krishna& V.E.Pise July-December 2010, "Image Segmentation by Improved Watershed Transformation in Programming Environment MATLAB," International Journal of Computer Science & Communication Vol. I, No. 2, pp. 17/-/74

[5]. Tse-Wei Chen , Yi-Ling Chen , Shao-Yi Chien (2010), "Fast Image Segmentation Based on K-Means Clustering with Histograms in HSV Color Space," Journal of Scientific Research ISSN I452-2I6X Vol. 44 No.2, pp.337-35 I

[6]. Anil Z chaitade (2010). "colour based imagesegmentation using k-means clustering." International journal of computer science and Technology Vol. 2(10),5319-5325

[7]. S.Zulaikha BeeviM, Mohamad Sathik (2010)," An Effective Approach for segmentation of MRI images combining spatial Information with fuzzy c-means clustering," European Journal of scientific Research, ISSN 1450-216X Vol.41 no.3 pp. 437-451

[8]. K.S. Ravichandran and 2B Ananthi (2009) , " color skin segmentation using k-means cluster," International Journal of computational and applied mathematics ISSN 1819 Volume 4 Number 2, pp. 153-157

[9]. A.Suman Tatiraju july-2008," image segmentation using k-means clustering, EM and Normalized cuts," Symposium of Discrete Algorithm.

[10] A.R Kavitha, Dr.C.Chellamuthu, Ms.Kavin Rupa," An Efficient Approach for Brain Tumor Dection Based on Medified Region Growing and Network in MRImages,"IEEE, 2012.