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Automated Brain Tumor Detection and Segmentation Using K-Means and Fuzzy C Means

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ABSTRACT: More precisely, we propose to K Means and Fuzzy C means whichis one of the most popular and well motivating classification methods. The experimental study will be carried on real and simulated datasets representing different tumor shapes, locations, sizes and image intensities.Tumor is an uncontrolled growth of tissue in any part of the body. The tumoris of different types and they have different characteristics and different treatment. This paper is to implement of Simple Algorithm for detection of range and shape of tumor in brain MR Images. Normally the anatomy of the Brain can be viewed by the MRI scan or CT scan. MRI scanned image is used for the entire process. The MRI scan is more comfortable than any other scans for diagnosis. It will not affect the human body, because it doesn't practice any radiation. It is centered on the magnetic field and radio waves. There are dissimilar types of algorithm were developed for brain tumor detection.But they may have some drawback in detection and extraction. After the segmentation, which is done through k-means clustering and fuzzy c-means algorithms the brain tumor is detected and its exact location is identified. Comparing to the other algorithms the performance of fuzzy c-means plays a major role.

KEYWORDS: Tumor, MRI Scan, CT scan, K-Means clustering, Fuzzy c-means.

I. INTRODUCTION

Tumor segmentation from MRI data is an important but time-consuming and difficult task often performed manually by medical experts. Radiologists and other medical experts spend a substantial amount of time segmenting medical images. However, accurately labeling brain tumor is a very time-consuming task, and considerable variation is observed between doctors [2].

Throughout the few years, different segmentation methods have been used for tumor detection but it is time consuming process and also gives inaccurate result. So, computer aided system can be designed for accurate brain tumor detection from MRI images. Brain tumor can be broadly classified as primary brain tumor(the tumor originates in the brain) and secondary brain tumor (spread to brain from somewhere else in the body through metastasis) Primary brain tumors do not spread to other body parts and can be malignant or benign and secondary brain tumors are always malignant. Malignant tumor is more dangerous and life threatening than benign tumor. The detection of malignant tumor is more difficult than benign tumor [3]. After the noise removing from the MRI images we have to focus on tumor only for that we need to extract the exact brain tissues for that we have performed the skull removing process in that we have used the horizontal, diagonal, anti-diagonal and vertical masks to perform the erosion and dilation which is results in to the skull masked image which further proceed to segmentation. The criteria for removing an object or a hole can be chosen extremely flexible based on the object features. The task of labeling (object filling, region detection) is to assign labels (mostly unsigned integers) to the pixels in such a way that all pixels belonging to a connected component of the image are assigned the same label, and pixels belonging to different components get different labels [5] This paper proposed concept for brain tumor segmentation and finally the detection of brain tumor. Normally the structure of the Brain can be viewed by the CT scan or MRI scan. In this paper the MRI scanned image is taken for thewhole process. The MRI scan is more comfortable and suitable than CT scan for diagnosis. It is not affect the humanbody. Because of this method doesn't use any radiation. This process based on the magnetic field and radio waves.There are different types of

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algorithm were developed for brain tumor detection. But they may have some drawback in extraction and detection of brain tumor. In this paper, two algorithms are used for segmentation. K-means clustering algorithm and Fuzzy-C means algorithm. So it gives the accurate result for brain tumor segmentation. Tumor is due to the uncontrolled growth of the tissues in any part of our body. The tumor stage may be primary or secondary. If it is an origin, then it is known as primary stage. If the part of the tumor is spread to another place and grown as its own then it is known as secondary stage. Normally brain tumor affects CSF (Cerebral Spinal Fluid). It causes for strokes. The physician gives the treatment for the strokes rather than the treatment for tumor. So detection of tumor is important for that further treatment. The lifetime of the person who affected by the brain tumor will increase if it is detected at current stage correctly. That will increase the lifetime about 1 to 2 years. Normally tumor cells are of two types. They are Mass and Malignant tumor. The detection of the malignant tumor is difficult to mass tumor. In this paper we focused on detection of brain tumor with the help of Brain MRI images. The developing platform for the detection is Matlab. Because it is easy to develop and execute. At the end, we are providing systems that detect the brain tumor and its shape.

II. RELATED WORK

Intensity in homogeneity often exists in magnetic resonance imaging (MRI) images due to the imperfection of imaging devices. Intensity in homogeneity can be generally modeled as a smooth and spatially varying field, multiplied by the constant true signal of the same tissue in the measured image. The spatially varying field is also named as the bias field. A Bias correction is a procedure to estimate the bias field and restore the true signals, thereby eliminating the side effect of the intensity in homogeneity [2][3].Among the various bias correction methods, those based on segmentation are most attractive. Parametric model is based on the maximum-likelihood (ML) or maximum a posterior. The (MAP) probability is often used to unify segmentation and bias correction [2], whose parameters can be estimated by the expectation maximization (EM) algorithm [3][4].Such algorithms are sensitive to the initialization of the variables [1][3], which limits their applications in automatic segmentation.[5]

In this paper, first we define a maximum likelihood objective function for each point in a transformed domain, where the distribution overlap between different tissues can be suppressed to some extent, and then energy functional is defined by integrating the maximum likelihood function over the entire image domain. Then we incorporate this energy functional into a multiphase level set formulation. The segmentation and bias correction are obtained via a level set evolution process. The advantage of our method is that the smoothness of the computed bias field is ensured by the normalized convolution [5] without extra cost. The evolution is less sensitive to the initialization, thus well suited for automatic applications. [5]

III. MATHEMATICAL MODEL

Mathematical equation in K-means clustering

1. $M = \frac{\sum_{i:c(i)=k} Xi}{Nk}$, k=1, 2,……, K.
2. D (i) = arg min$\|X_i - M_k\|^2$, i=1,2,…..,N.

Mathematical equation in Fuzzy-C means clustering

$Y_m = \sum_{i=1}^{N} \sum_{j=1}^{C} M_{ij}^{m} \|X_i - C_j\|^2$

Where,

m= any real number greater than 1,

M_{ij}= degree of membership of X; in the cluster j,

X_i= data measured in d-dimensional,

R_j= d-dimension center of the cluster,

The update of membership Mij and the cluster centers R, are given by:

$$M_{ij} = \frac{1}{\sum_{K=1}^{C} \left(\frac{||Xi-Cj||}{||Xi-Cj||}\right)^{\frac{2}{m-1}}}$$

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$$R_j = \frac{\sum_{i=1}^{N} Xi.Mijm}{\sum_{i=1}^{N} Mijm}$$

IV. PROPOSED SYSTEM ARCHITECTURE

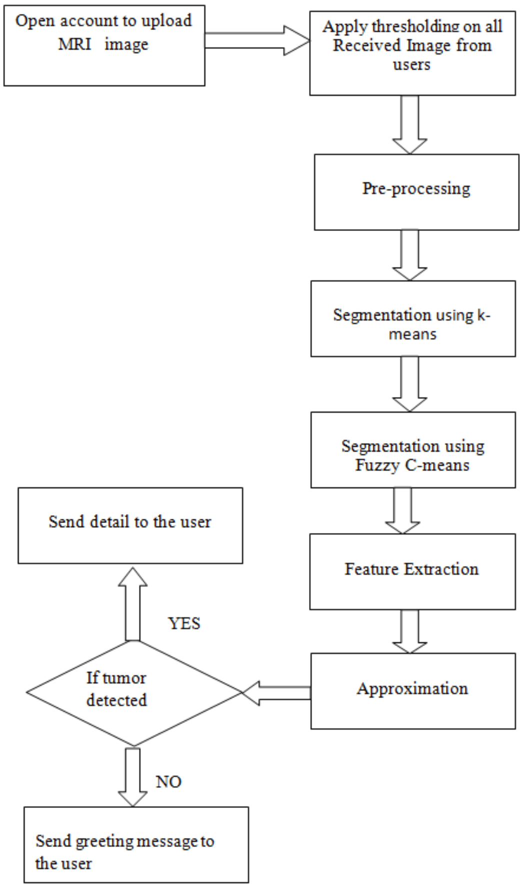

Figure 1 : System Architecture

1. 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.

2. Segmentation using K-means

Steps

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.

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7. Re-estimate the center.
8. Repeat the process until the center doesn't move.

3. Segmentation using Fuzzy C means

The fuzzy logic is a way to processing the data by giving the partial membership value to each pixel in the image.

The membership value of the fuzzy set is ranges from 0 to 1.

Fuzzy clustering is basically a multi valued logic that allows intermediate values i.e., member of one fuzzy set can also be member of other fuzzy sets in the same image.

There is no abrupt transition between full membership and non-membership.

The membership function defines the fuzziness of an image and also to define the information contained in the image.

4. Feature Extraction

The feature extraction is extracting the cluster which shows the predicted tumor at the FCM output.

The extracted cluster is given to the thresholding process.

It applies binary mask over the entire image. It makes the dark pixel become darker and white become brighter.

In threshold coding, each transform coefficient is compared with a threshold.

If it is less than the threshold value then it is considered as zero.

If it is larger than the threshold, it will be considered as one.

The thresholding method is an adaptive method where only those coefficients whose magnitudes are above a threshold are retained within each block.

5. Approximate reasoning

In the approximate reasoning step the tumor area is calculated using the binarization method. That is the image having only two values either black or white (0 or 1).

V. EXPERIMENTAL RESULT AND DISSCUSSION

Proposed Brain tumor detection system is improve with segmentation of preprocessed image then resulted image goes with object labeling and feature extraction. Extracted features used to train database of feature is use for pattern matching and test the system.

1. Calculate the area of tumor=

$$\text{Area} = \sqrt{P} * 0.264 \text{ mm2}$$

Where, p= total no of white pixels of threshold image.
And 0.264 is the 1 pixel size.

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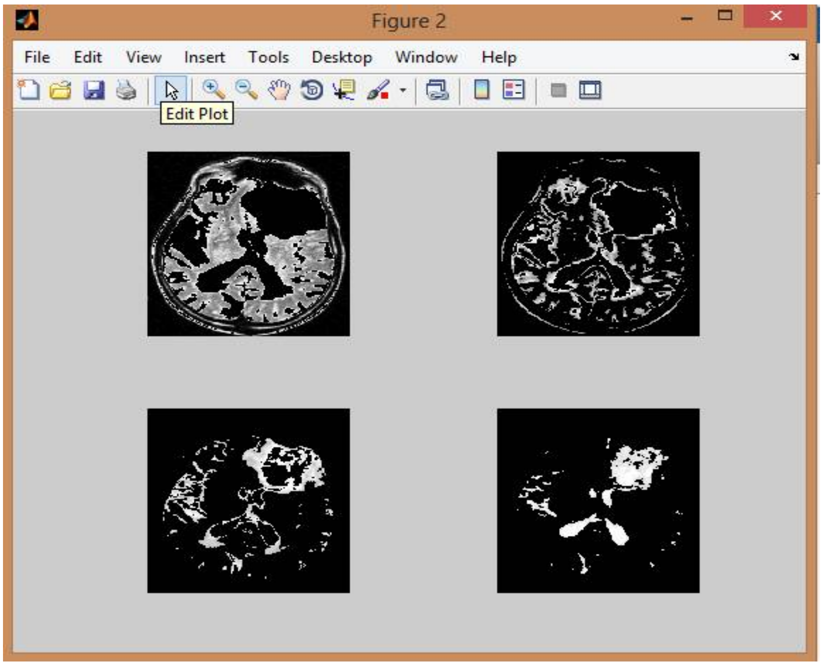

Fig.2 Snapshot of k-means output, for k=4 clusters

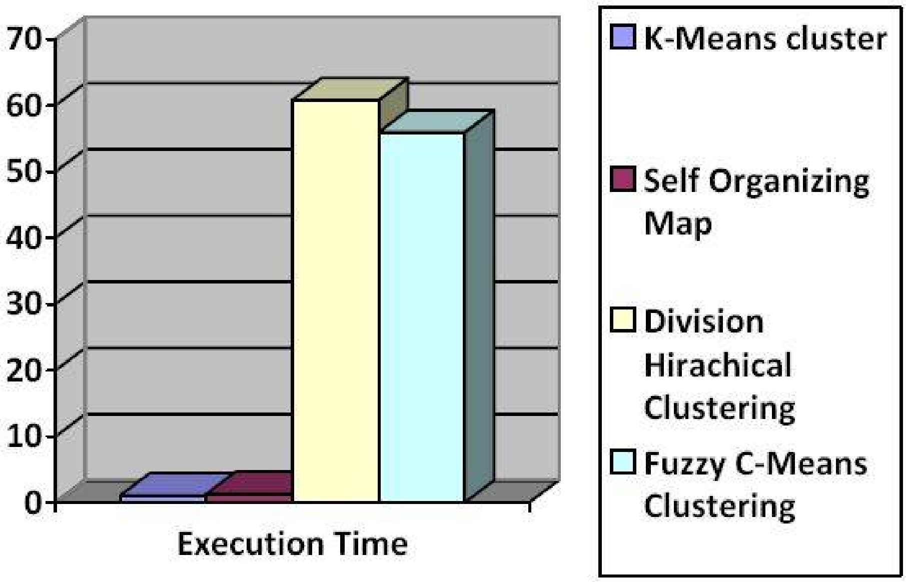

Figure 2: Result analysis of Execution time of various Segmentation methods

The above figure 2shows the result analysis of Execution time of various Segmentation methods. In that the k-means clustering gives fine result than the other methods that's why here in improved system K-Means clustering is used for segmentation.The proposed system gives a faire result for the input that is MRI images. The proposed method includes

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the k-means for segmentation HOG for segmentation and the Fuzzy C Means for pattern mapping and pattern matching process. Before this system there exist the other methods to identify the brain tumor one of them is FCM mean and only simple k-means is used for tumor detection. In above number of images verses accuracy graph the red line shows the graph of proposed algorithm, the green is FCM mean and the blue is k-means algorithm performance according to the accuracy towards the tumor detection.The proposed system is also very sensitive to the errors, because the small error will take the situation in ambiguous state which is not good for diagnosis of tumor so here we are taking a resulted graph of number of images verses overall error in system. Again same FCM mean and k means algorithms are use to compare individual performance with the proposed method and the result of all are compared and we found that the proposed system having less errors in the system.

VI. CONCLUSION

There are different types of tumors available. They may be mass in the 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 present in the MR image it is removed before the K-means process. The noise free image is given as input to the k-means and tumors are extracted from the MRI image. The performance of brain tumor segmentation is evaluated based on K-means clustering. Dataset consists of Magnetic Resonance Imaging (MRI) size of 181X272. The MRI image dataset that we have utilized in image segmentation technique is taken from the publicly available sources. This image dataset consists of 40 brain MRI images in which 20 brain images with tumor and remaining brain images without tumor. The brain image dataset is divided into two sets. Training dataset and testing dataset. Thus, the pre-processing is done by filtering. Segmentation is done by advanced K-means algorithm and fuzzy c means algorithm. Feature extractions is done by threading and finally, approximate reasoning method to recognize the tumor shape and position in MRI image using edge detection method. This method scans the RGB or gray scale, 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 the tumor by calculating the number of white pixels (digit 0) in binary image. The stage of the tumor is based on the area of tumor.

REFERENCES

[1] J.selvakumar, A.Lakshmi and T.Arivoli, “Brain Tumor Segmentation and Its Area Calculation in Brain MR Images using K-Mean Clustering and Fuzzy C-Mean Algorithm”, IEEE-International Conference On Advances In Engineering, Science And Management (ICAESM -2012) March 30, 31, 2012

[2] Samir Kumar Bandhyopadhyay and TuhinUtsab Paul, “Automatic Segmentation of Brain Tumor from Multiple Images of Brain MRI”International Journal of Application or Innovation in Engineering & Management (IJAIEM),Volume 2, Issue 1, January 2013

[3] A. Meena, “Spatial Fuzzy C-Means PET Image Segmentation of Neurodegenerative Disorder” , A. Meena et.al / Indian Journal of Computer Science and Engineering (IJCSE)

[4] SumanTatirajua and Avi Mehta, “Avoiding energy holes in wireless sensor networks with no uniform node distribution,” IEEE Trans. Parallel Distrib. Syst., vol. 19, no. 5, pp. 710–720, May 2008.

[5] AjalaFunmilola A*, Oke O.A, Adedeji T.O and Alade O.M, Adewusi E.A, “Fuzzy k-c-means Clustering Algorithm for Medical Image Segmentation”, Journal of Information Engineering and Applications ISSN 2224-5782 (print) ISSN 2225-0506 (online)Vol 2, No.6, 2012

[6] M.H. FazelZarandia, M. Zarinbal and M. Izadi, “Systematic image processing for diagnosing brain tumors”, Department of Industrial Engineering, Amirkabir University of Technology, P.O. Box 15875-4413, Tehran, Iran , journal homepage:www.elsevier.com/locate/asoc

[7] Samarjit Das, “Pattern Recognition using the Fuzzy c-means Technique” International Journal of Energy, Information and Communications Vol. 4, Issue 1, February, 2013

[8] Vignesh Rajesh, BharathanVenkat, Vikesh Karan and M. Poonkodi, “Brain Tumor Segmentation and its Area Calculation in Brain MR Images Using K-Mean Clustering andFuzzy C-Mean Algorithm”, Department of Computer Science and Engineering, SRM University

[9] Krishna Kant Singh1 and Akansha Singh, “A Study of Image Segmentation Algorithms For Different Types of Images”, IJCSI International Journal of Computer Science Issues, Vol. 7, Issue 5, September 2010

[10] Beshiba Wilson and Julia Punitha Malar Dhas, “ An Experimental Analysis of Fuzzy C-Means and K-Means Segmentation Algorithm for Iron Detection in Brain SWI using Matlab”, International Journal of Computer Applications (0975 – 8887) Volume 104 – No 15, October 2014

[11]D.Judehemanth, D.Selvathi, J.Anitha“ Effective fuzzy Clustering algorithm for abnormal MR brain image segmentation”, IEEE International Advance Computing Conference,2009