BRAIN TUMOR DETECTION USING K-MEANS CLUSTERING AND FUZZY C-MEANS ALGORITHM

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***Abstract*: Tumor is an uncontrolled development of tissue in any part of the body. The tumor is of various sorts and they have different characteristics and different treatment. This paper is to execute of Simple Algorithm for discovery of range of tumor in brain MR Images. Typically the anatomy of the Brain can be seen by the MRI scan or CT scan. MRI scanned picture is utilized for the whole procedure. The MRI output is more agreeable than any different scans for finding. It won't influence the human body, since it doesn't practice any radiation. It is focused on the magnetic field and radio waves. There are disparate sorts of calculation were created for brain tumor recognition. 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 distinguished and recognized. The patient's stage is dictated by this handle, regardless of whether it can be cured with solution or not.**

***Keywords*: Fuzzy c-means, Image segmentation, K-Means clustering, Magnetic resonance image.**

I.INTRODUCTION

A brain tumor occurs when abnormal cells form within the brain. There are two primary sorts of tumors: malignant (fast growing) and benign (slow growing) tumors. Primary brain tumors also be malignant and affect surrounding tissues and it contain cancerous cells. The secondary brain tumors are spread to the cerebrum from somewhere else in the body. This facts increase the importance of the researches on the tumor detection and this will present the opportunity for doctors to help save lives by detecting the disease earlier and perform necessary actions. Different Kinds of image processing techniques are available to be applied on various image modalities for tumor recognition that will discover certain features of the tumors including the shape, border and texture. These features will make the diagnosis processes more accurate and easier as there are some standard characteristics of each features for a certain tumor.

Medical image segmentation is an important task in many medical applications such as surgery planning, post-surgical assessment, unusualness detection, and so on. Medical images mostly contain complicated structures and their precise segmentation is important for clinical diagnosis. Certainly one of such is brain image segmentation which is quite complicated and challenging but their accurate segmentation is very important for detecting tumors, edema, and necrotic cells. MRI imaging is a popular method to obtain an image of brain with high comparison. Magnetic resonance imaging is a powerful tool for investing the body's internal structure. MRI provides better quality images for the brain, the muscles, the heart and cancerous tissues compared with other medical imaging techniques such as computed tomography (CT) or X-rays. So this technique is a special one for the brain tumor recognition and cancer imaging.

II. RELATED WORKS

Somkantha [1] outlined an edge taking after procedure for boundary detection in noisy images and connected it to object segmentation problem in medical images. The proposed strategy was connected to recognize the object boundaries in several types of noisy images where the ill defined edges were experienced. Gooya [2] introduced a technique GLISTR for division of gliomas in multimodel MR pictures by joint enlisting the pictures to a probabilistic map book of healthy people. Bauer [5] determined a novel approach to adapt a healthy brain atlas to MR images of tumor patients. They presented a new method which makes use of sophisticated models of bio-physio mechanical tumor growth to adapt a general brain atlas to an individual tumor patient image. S.R. Kannanaet. al [3], proposed a robust FCM algorithms with kernel functions for segmentation of brain and breast medical images. Vida Harati Rasoul Khayatiet. al [4], proposed a fully automatic method for tumor region detection in brain MRI. An effective modified region growing method for identification of brain tumor. Modified region growing incorporates orientation constraint in addition to the normal intensity constrain (Weaver et al., 2012). The execution of the strategy is methodicallly assessed utilizing the MRI brain images got from people in general sources. A Self-Organizing Map (SOM) is a focused counterfeit neural system with unsupervised learning. Zaldeh introduced fuzzy set theory to clustering concept so it is named as fuzzy clustering. Matthew C. Clark [6], proposed artificial intelligence techniques based on automated segmentation method using FCM and

multispectral tool. Using a multi-layer Markov random field framework, Gering (2002) [7] proposed a method that identifies deviations from normal brains.

III. PROPOSED SYSTEM

A. Implemented System's Block Digram

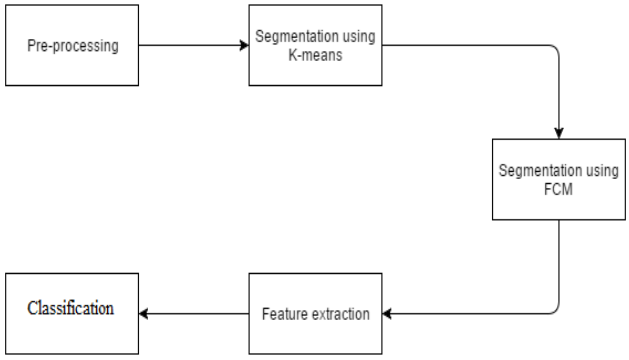

Fig.1. Block diagram

B. Preprocessing

Pre-processing step translate the image, it completes filtering of noise and other artifacts in the image and sharpening the edges in the image. The RGB to grey conversion and Reshaping also takes place here. It includes a median filter for noise deduction. The opportunities of arrival of noise in modern MRI scan are very less. It may reach due to the thermal effect. The aim of this paper is to detect and segment the tumor cells, but for the complete stage it needs the process of noise removal. For better understanding the function of median filter we added the salt and pepper noise artificially and removing it using median filter.

C. K-means Clustering

The purpose of k-means algorithm is to cluster the data. K-means algorithm is one of the simplest partitions clustering method. K-Means is the one of the unsupervised learning algorithm for clusters. Clustering the image is grouping the pixels according to the some characteristics. In the k-means algorithm initially we have to define the number of clusters k. Then k-cluster center are chosen randomly. The distance between the each pixel to each cluster centers are calculated. The distance may be of simple Euclidean function. Single pixel is compared to all cluster centers using the distance formula. The pixel is moved to particular cluster which has shortest distance among all. Then the centroid is re-estimated. Again each pixel is compared to all centroids.

D. Fuzzy C-Means Segmentation

Fuzzy c-means is a method of clustering which allows one piece of data to belong to two or more clusters. The algorithm is an iterative clustering method that produces an optimal c partition by minimizing the weighted within group sum of squared error objective function. The fuzzy logic is a way of 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 member of one fuzzy set can also be members 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.

E. Feature Extraction

The feature extraction is extracting the cluster, which shows the predicted tumor at the FCM (Fuzzy C-means) output. The extracted cluster is given to the threshold process. It applies a binary mask over the entire image. In the approximate reasoning step the tumor area is calculated using the binarization method. It makes the dark pixel become darker and white become brighter. There are three major steps in the proposed approach for brain tumor classification: (a) Feature extraction by using DWT (b) Texture feature extraction by using GLCM (c) Feature Selection by using PCA. The wavelet is a powerful mathematical tool for feature extraction, and has been used to extract the wavelet coefficient from MR images. Wavelets are localized basis functions, which are scaled and shifted versions of some fixed mother wavelets. The main advantage of wavelets is that they provide localized frequency information about a function of a signal, which is particularly beneficial for classification. Texture analysis makes differentiation of normal and abnormal tissue easy. It even provides contrast between malignant and normal tissue, which may be below the threshold of human perception. The statistical features from MR images are obtained using Gray Level Co-occurrence Matrix (GLCM), which is also known as Gray Level Spatial Dependence Matrix (GLSDM). In this method, Gray level co-occurrence matrix was formed and the statistical texture features such as contrast, correlation, energy, homogeneity and entropy. One of the most common forms of dimensionality reduction is principal components analysis. Given a set of data, PCA finds the linear lower-dimensional representation of the data such that the variance of the reconstructed data is preserved. The main idea behind using PCA in our approach is to reduce the dimensionality of the wavelet coefficients. This leads to more efficient and accurate classifier.

F. Classification

Image classification refers to the labelling of images into one of a number of predefined categories. Classification is the last step in the process of brain tumor detection used to classify the image into normal or abnormal and classify the abnormality type whether it is benign or malignant. Artificial neural networks are composed of different simple elements operated in parallel. Each element in a network called neuron. The sum of multiplication of weights and inputs plus bias at the node is positive then only output

elements are generated. Means it discharges energy to next element. The input of a specific node is the weighted sum of the output of all the nodes in which it is connected. The output value of a node is a non-linear function of its input value. An Artificial Neural Network is an adaptive, most of nonlinear system that learns to perform a function (an input/output map) from data.

IV. RESULTS AND DISCUSSIONS

Tumor is an uncontrolled development of tissues in any part of body. For precise location of tumor shape and range K-Means clustering and Fuzzy C-Means Clustering is utilized. The advantages of K means algorithm incorporates quickness, strength and easyness to get it. It is moderately productive. Gives best outcome when data set are distinct or all around isolated from each other. Its execution is controlled by initialisation and suitable distance measure. The fuzzy C-means relax the condition by allowing the feature vector to have multiple membership grades to multiple cluster. It gives best result for overlapped data set. ANN is good alternative of the traditional learning classification method. ANN is a kind of novel machine learning method. Good features which directly affect the segmentation effect are selected for the ANN classification.

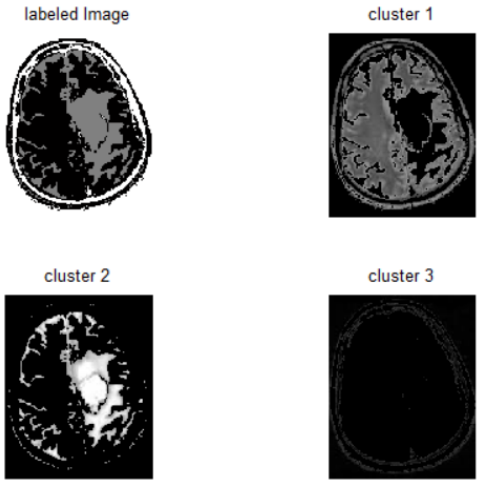

Fig.2. output of k means clustering algorithm.

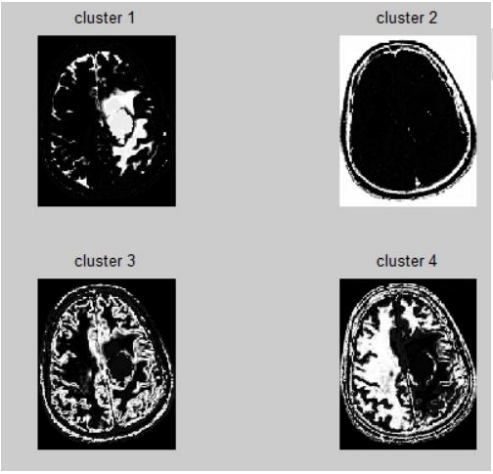

Fig.3. output of Fuzzy C means algorithm.

V. FUTURE ENHANCEMENTS

Future research in the segmentation of the medical images will strive towards improving the accuracy, precision and computational speed of segmentation methods, as well as reducing the amount of manual interaction. Computational efficiency will be particularly important in the real time processing applications. The main drawback of the standard FCM for image segmentation is that the objective function does not take into consideration the spatial information in the image, but deal with images as the same as separate points. A new modify spatial FCM that incorporates the spatial information into the membership function can improve the segmentation results. Spatial function is made of according to distance and value pixels. IFCM algorithm can solve the sensitivity of FCM algorithm to noise. The preprocessing techniques can enhance that brain model fitting may be considered to do the non brain region removal.

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. 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 tumor is extracted from the MRI image. The proposed method gives more accurate result. The future work concentrates on segmentation using Fuzzy C means for accurate tumor shape extraction of malignant tumor and thresholding of output in feature extraction.

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