ISSN XXXX XXXX © 2017 IJESC

Research Article Volume 7 Issue No.5

Area and Stage Identification of Brain Tumor using Fuzzy C-Means Clustering

Prof. V.S.Kulkarni[1], PoonamKamble[2], VrushaliJadhav[3], Sonal Khobarkhede[4]
Assistant Professor[1], BE Student[2, 3, 4]
Department of Electronics & Telecommunication
RajarshiShahu College of Engineering, Pune University, Maharashtra, India

Abstract:
Brain tumor extraction and its analysis are challenging tasks in medical image processing because brain image and its structure is complicated that can be analyzed only by expert radiologists. Segmentation plays an important role in the processing of medical images. MRI (magnetic resonance imaging) has become a particularly useful medical diagnostic tool for diagnosis of brain and other medical images. This paper presents a comparative study of two segmentation methods implemented for tumor detection .The methods include k-means clustering with Fuzzy c- means clustering with genetic algorithm. k-means algorithm is sensitive to the initial cluster centers. Genetic c-mean and k-means clustering techniques are used to detect tumor in MRI of brain images. At the end of process the tumor is extracted from the MR image and its exact position and the shape are determined. The experimental results indicate that genetic c-means not only eliminate the over segmentation problem, but also provide fast and efficient clustering results.

Keyword: MRI, brain tumor, segmentation, k-means clustering, Fuzzy c-means clustering, Feature Extraction.

1. INTRODUCTION:

Automated classification and detection of tumors in different medical images is motivated by the necessity of high accuracy when dealing with a human life. Also, the computer assistance is demanded in medical institutions due to the fact that it could improve the results of humans in such a domain where the false negative cases must be at a very low rate. It has been proven that double reading of medical images could lead to better tumor detection. But the cost implied in double reading is very high, that's why good software to assist humans in medical institutions is of great interest nowadays.

Conventional methods of monitoring and diagnosing the diseases rely on detecting the presence of particular features by a human observer. Due to large number of patients in intensive care units and the need for continuous observation of such conditions, several techniques for automated diagnostic systems have been developed in recent years to attempt to solve this problem. Such techniques work by transforming the mostly qualitative diagnostic criteria into a more objective quantitative feature classification problem In this project the automated classification of brain magnetic resonance images by using some prior knowledge like pixel intensity and some anatomical features is proposed. Currently there are no methods widely accepted therefore automatic and reliable methods for tumor detection are of great need and interest. The application of PNN in the classification of data for MR images problems are not fully utilized yet. These included the clustering and classification techniques especially for MR images problems with huge scale of data and consuming times and energy if done manually. Thus, fully understanding the recognition, classification or clustering techniques is essential to the developments of Neural Network systems particularly in medicine problems.

2. LITERATURE:

Swapnil R. Telrandhe et.al [1] proposed a medical device because of this they found that MRI image is not sufficient for detection of tumor so they include K-means clustering with preprocessing of image.First stage in preprocessing of brain tumor image is removing the noise with the help of median filter which gives better result. J.selvakumar et.al [2]implements algorithm which detects the range and shape of tumor.Using this algorithm it become easy to determine the size and shape of tumor.Mass tumor is extracted by K-means algorithm noise free image is a input to the K-means. Olga Regina Pereira Bellonet.a l[3] presents edge detection of images in order to provide a reliable and meaningfiul edge map,which helps to improve image segmentation by clustering techniques. Edge map can supply required information to the clustering algorithm based on features extraction. Pavanilakshmi.a et.al [4] detect and locate early stage brain tumors from MRI data.A system which enhances the MRI data and gives the exact location and the area of the tumor required for the diagnostic and analysis of tumor easily in biomedical field. T. Kalaiselvi and K. Somasundaramet.al [5] Fuzzy c-means (FCM) is soft segmentation technique applicable for MRI brain segmentation. The performance of this method to obtain an optimal solution depends on the initial positions of the centroids of the clusters.This paper initialize the method based on histogram to start the FCM clustering to segment the MRI brain scan image SubhranilKoley and AurpanMajumderet.al [6] segmentation of brain MRI for the purpose of determining the exact location of braintumor using CSM based partitional K means clustering algorithm. This algorithm is the simplest method to obtain the efficient segmentation with less computational complexity compared to other methods which have been mentioned earlier

as we used only two features which are locations and gray level values of every pixel for our work.

3.A) BLOCK DIAGRAM OF PROPOSED WORK

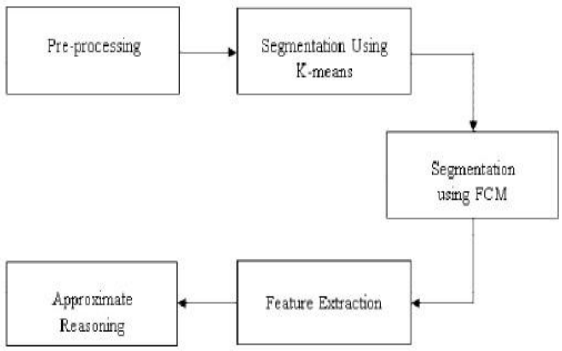

Fig.1 Flow diagram for proposed method with all the processing steps

Pre-Processing:-
Pre-processing step translate the image, it completes filtering of noise and other artifacts in the image and sharpening the edges in the image. It includes a median filter for noise deduction.

K-Means clustering :-
A cluster is a collection of objects which are similar between them and are dissimilar to the objects belonging to other clusters. Clustering is an unsupervised learning method which deals with finding a structure in a collection of unlabeled data. K-means clustering is an algorithm to group objects based on attributes/features into k number of groups where k is a positive integer.

Fuzzy C-means Algorithm:
Fuzzy c-means (FCM) 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.

Fuzzy C-means Segmentation:
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.

3 b) METHODS USED FOR SYSTEM

CLUSTERING:
Clustering can be considered the most important *unsupervised learning* problem, so it deals with finding a *structure* in a collection of unlabeled data. A *cluster* is therefore a collection of objects which are "similar" between them and are "dissimilar" to the objects belonging to other clusters. Clustering algorithms may be classified as listed below*k*-means clustering, Overlapping Clustering, Hierarchical Clustering, Probabilistic Clustering. From the above listed clustering methods, we used K-means clustering. In this case data are grouped in an exclusive way, so that if a certain data belongs to a definite cluster then it could not be included in another cluster.

***K*-MEANS CLUSTERING**
This is a method of vector quantization, originally from signal processing, that is popular for cluster analysis in data mining. *K-means* clustering aims to partition*n* observation into *k* clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. This results in a partitioning of the data space into Voronoi cells.

Fuzzy Clustering Algorithms
Clustering is a task of assigning a set of objects into groups called clusters. In general the clustering algorithms can be classified into two categories. One is hard clustering; another one is soft (fuzzy) clustering. Hard clustering, the data's are divided into distinct clusters, where each data element belongs to exactly one cluster. In soft clustering, data elements belong to more than one cluster, and associated with each element is a set of membership levels. In our work fuzzy c means clustering algorithm is used. These algorithms produce good results in a wide variety of real world applications. Fuzzy clustering is a powerful unsupervised method for the analysis of data and construction of models. In many situations, fuzzy clustering is more natural than hard clustering. This algorithm works by assigning membership to each data point corresponding to each cluster center on the basis of distance between the cluster center and the data point. More the data is near to the cluster center more is its membership towards the particular cluster center. Clearly, summation of membership of each data point should be equal to one. After each iteration membership and cluster centers are updated according to the formula.

SECTION 2: K-means flow Diagram

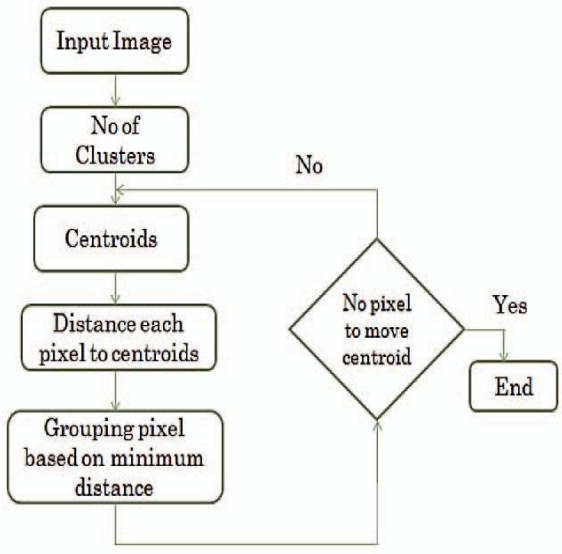

Figure.2. K-Means work flow

In adjacent figure [2] we are showing K-Means segmentation algorithm work flow. The first block shows the input image. It convert that image into numbers of clusters, then it finds the cluster centroid and the distance of each pixel from the centroid. And it will continue to grouping of pixels till it will reached the last pixel and stop.

4. RESULTS:

Figure.3. RBG to Gray conversion

Figure (3) shows the conversion of RBG image to Gray scale image

Figure.4. k-means clustering.

Figure(4) shows the result of Pre-processing and clustering step. In preprocessing, filtering of noise, sharpening the edges and other artifacts in the image is done. It includes a median filter for noise deduction. Clustering is an unsupervised learning method which deals with finding a structure in a collection of unlabeled data. K-means clustering is an algorithm to group objects based on attributes/features into k number of groups where k is a positive integer.

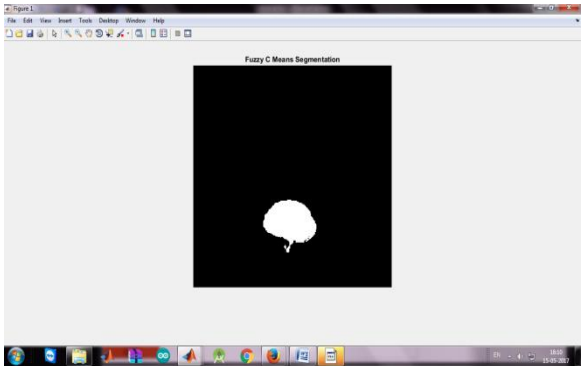

Figure.5. Fuzzy C means clustering

Result fig (5)shows Fuzzy c-means (FCM) 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. In short it defines the fuzziness of an image and also to define the information contained in the image.

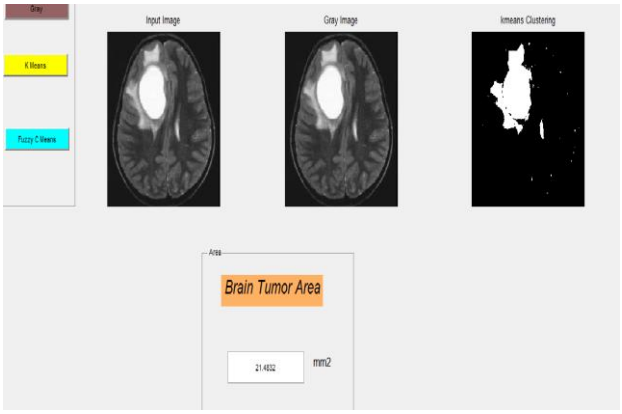

Figure.6. Final output

Result figure (6) shows input image by preprocessing, filtering the noise and sharpening the image. It converted into grey image. Further the clustering and segmentation algorithm gives the proper tumor shape .Brain tumor area is calculated also identified the stage of tumor.

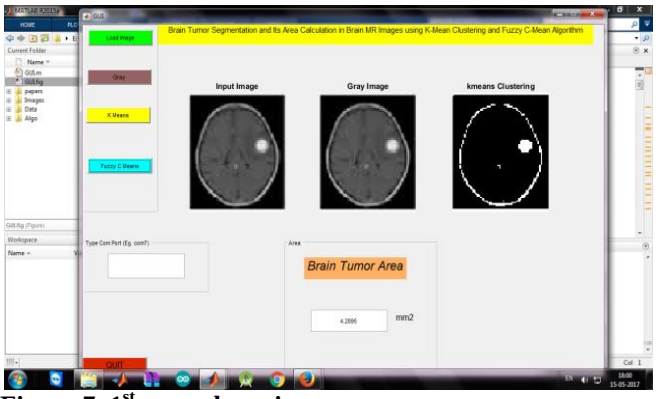

Figure.7. 1st stage detection

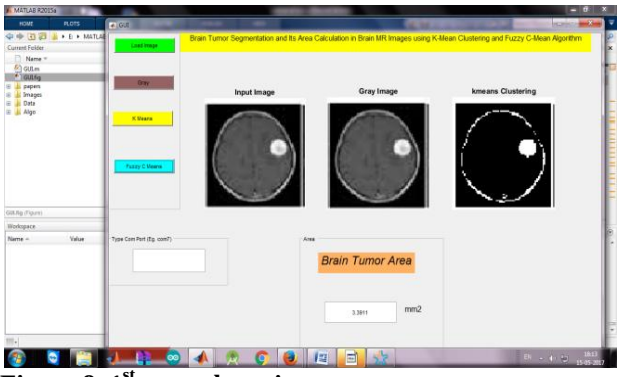

Figure.8. 1st stage detection

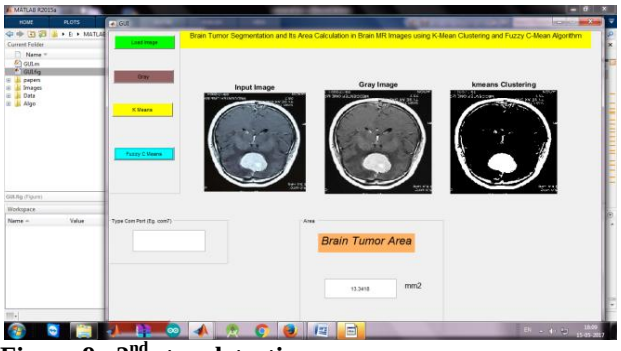

Figure.9. 2nd stag detection

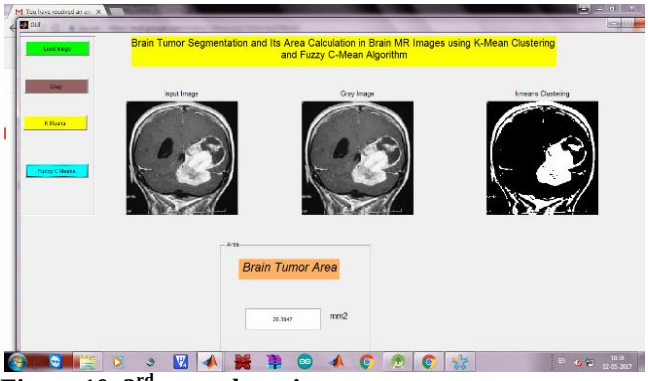

Figure.10. 3rd stage detection

Table.1. Calculation of Area and Stages

Fig.No	Area	Stage
6	21.485	3
7	4.2205	1
8	3.3011	1
9	13.3418	2
10	23.2547	3

This table shows area and different stages of brain tumor. Tumor size is depend on the different range of area of tumor.

5. ACKNOWLEDGEMENT:

We would like to thank our guide, Prof.V.S.Kulkarni for her great guidance and support. We are thankful to Head of Department Prof.Paithane Sir and Principal Dr.R.K.Jain of Rajarshishahu college Of Engg. Tathwade , Pune.

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