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BRAIN TUMOR DETECTION AND CLASSIFICATION USING C-MEANS ALGORITHM

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Abstract :**In this paper, we will be focusing on brain tumor present in the MRI images. MRI that is directed into intracranial cavity produces a complete image of brain. Identification of Tumor cells leads to classification of stage of Tumor. We have carried out various processing steps to identify the brain tumor using MATLAB. Processing steps like RGB to gray conversion, image resizing are used in this project. We have suggested an effective algorithm on brain tumors based on FCM segmentation. Morphological operations are carried out for background removal and identification of Tumor cells.**

Keywords - brain tumor, MRI, FCM segmentation.

I. INTRODUCTION

Normally the anatomy of the Brain can be viewed by the MRI scan or the CT scan. The MRI scanned image is taken for the entire process. For the accurate detection of the malignant tumor that needs 3D representation of the Brain and 3D analyzer tool. Image segmentation plays an important role in the field of Biomedical applications[2]. In segmentation process pixels having similar characteristics are grouped together to form a cluster. Fuzzy C means algorithm is applied on the formed clusters for the detection of Tumor portion. The word Tumor is a synonym for a word neoplasm which is formed by an abnormal growth of cells. Classification of tumor is done on the basis of stage of tumor whether it is normal, mild or severe conditions.

Primary brain tumors are developed by brain cells covering the brain while secondary tumor is developed when cancer spreads to the brain from other parts of body [3].This paper focuses on the detection of brain tumor using Fuzzy C-means algorithm.

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II. Flowchart/Algorithm

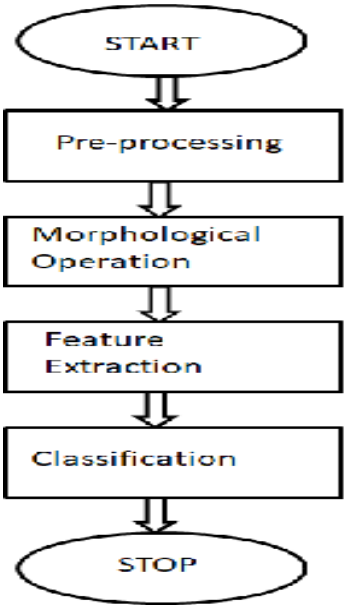

Fig.1Flowchart

III. Proposed Scheme

A. Fuzzy C-means algorithm-

Fuzzy c-means is a data clustering techniques in which a dataset is grouped into n clusters with every data point in the dataset belonging to every cluster to a certain degree. Fuzzy clustering is a form of clustering in which one piece of data can be a member of more than one clusters.

Clustering involves assigning data points to clusters in which items in the same clusters are as similar as possible, while items belonging to different clusters are as different as possible. Clusters are identified via similarity measures. This similarity measures include connectivity, distance and intensity.

$$\mu_{ij} = 1 / \sum_{k=1}^{c} (d_{ij} / d_{ik})^{(2/m-1)}$$

$$v_j = (\sum_{i=1}^{n} (\mu_{ij})^m x_i) / (\sum_{i=1}^{n} (\mu_{ij})^m), \forall j = 1, 2, ...c$$

Where,
n = no. of data points.
vj=jth cluster center.
M= fuzziness index m€ [1, ∞].
c = no. of clusters center.
µij=membership of ithdatatojth cluster center
dij =Euclidian distance between ithdata to jth cluster center.

Main objective of fuzzy c-means algorithm is to minimize:

$$J(U,V) = \sum_{i=1}^{n} \sum_{j=1}^{c} (\mu_{ij})^m \left\| x_i - v_j \right\|^2$$

Where,
$||x_i - v_j||$ = Euclidian distance between ithdata to jth cluster
center.

B. Algorithmic step for Fuzzy C-means clustering-

Let $X = \{x_1, x_2, x_3 ..., x_n\}$ be the set of data points and $V = \{v_1, v_2, v_3 ..., v_c\}$ be the set of centers.

1. Randomly select 'c' cluster centers.
2.Calculate the fuzzy membership 'μ_{ij}' using:

$$\mu_{ij} = 1 / \sum_{k=1}^{c} (d_{ij} / d_{ik})^{(2/m-1)}$$

3.Compute the fuzzy centers 'v_j' using:

$$v_j = (\sum_{i=1}^{n} (\mu_{ij})^m x_i) / (\sum_{i=1}^{n} (\mu_{ij})^m), \forall j = 1, 2, ...c$$

4. Repeat step 2) and 3) until the minimum 'J' value is
achieved or $||U^{(k+1)} - U^{(k)}|| < \beta$.
Where,
K = iteration step.
B = termination criterion between [0, 1].
$U=(\mu_{ij})_{n*c}$ = fuzzy membership matrix.
J = objective function.

IV. RESULTS AND DISCUSSION

A. MRI image is taken as an input image for further processing.

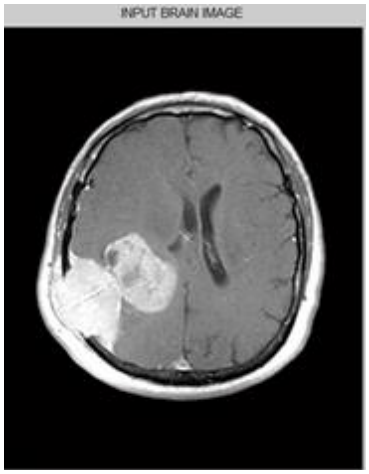

Fig. 2 Brain Tumor Image

B. Image resizing is done in pre processing.

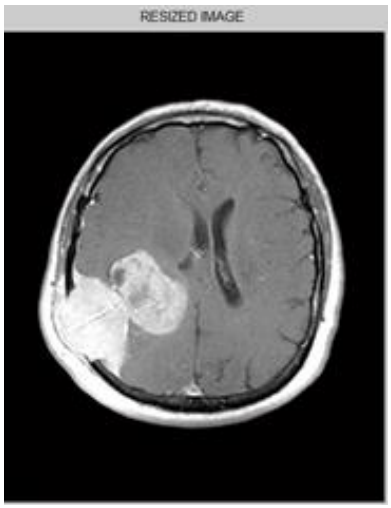

Fig. 3 Resized Image

C. Using Median Filter unwanted noise is removed.

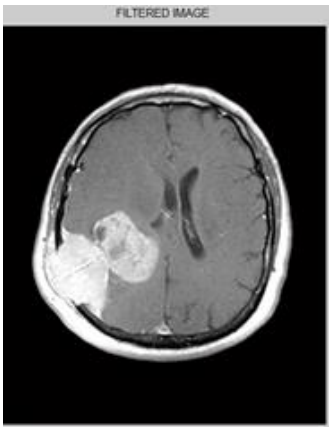

Fig. 4 Filtered Image

D. We have converted the original image to grey scale image using RGB to grey conversion. Tumor

portion in this image is much darker hence identification becomes easier.

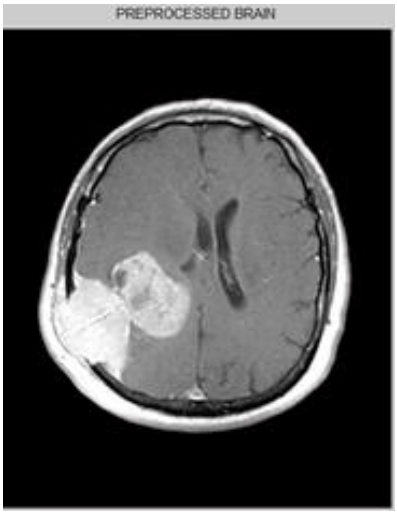

Fig 5Pre-processed Brain

E.To obtain simplified image for easier analysis the Partitioning of image is done.

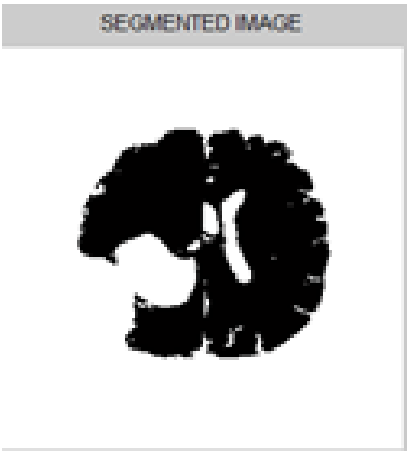

Fig. 6 segmentation 1

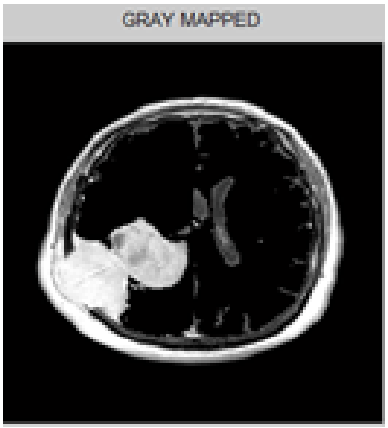

Fig. 7 segmentation 2

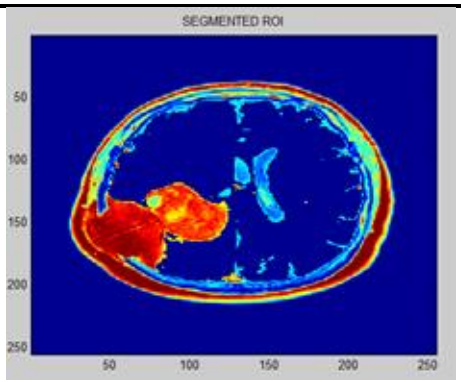

Fig. 8 segmentation 3

F. On the basis of centroid each and every cluster value is evaluated and plotted.

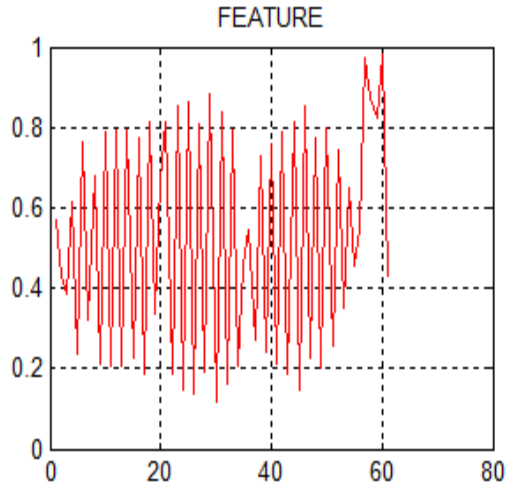

Fig 9 Feature Extraction

V. Conclusion

In this paper implementation of Fuzzy C-means segmentation algorithm for detecting the brain tumor is done successfully using Matlab. The accurate results of fuzzy c- means clustering algorithm effectively extract the brain tumor content from MRI images. It gives more accurate and efficient outcomes when compared to other approaches. This approach is easier to apprehend and apply. The system has been tested in each and every circumstance. In feature extraction LBP and GLCM techniques are used for effective and appropriate result of affected part.

Thus experimental results are compared with conventional FCM and K-Means algorithm. The performance of latest FCM is more satisfactory as compared to other two algorithms.

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