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# BRAIN MRI SEGMENTATION AND TUMOR DETECTION USING FCM AND NEURAL NETWORKS

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**Abstract-The goal of our project is to present a novel algorithm for tumor segmentation of magnetic resonance imaging (MRI) data of brain.one of the most commonly used methods for Magnetic Resonance Imaging (MRI) segmentation is Fuzzy C Means (FCM). This method in comparison with other methods Preserves more information of the images .Because of using the intensity of pixels as a key feature for clustering, Standard FCM is sensitive to noise.In this project in addition to intensity, mean of neighborhood of pixels and largest singular value of neighborhood of pixels are used as features. Also a method for tumor segmenting MRI images is presented which uses both FCM feed forward neural network and partly decreases the limitation of standard FCMthe different stages of the tumor is also detected based on the area coverage during tumor segmentation by feed forward neural networks**

**Keywords-tumors Segmentation,Magnetic Resonanceimage(MRI),Fuzzy-Means(FCM), feed forward neural networks(FFAN)**

## I.NTRODUCTION

Today because of increasing the number of medical images using computer for analyzing and processing is seemed to be necessary. Specially using computerized algorithm for automation of diagnosis and as a specialist helper is very important. These algorithms that are named image segmentation algorithms are used in many application of medical imaging. One of the most commonly used methods for MRI Segmentation is done using FCM. FCM is an unsupervised method. Since FCM does not use local information of pixels, it is very sensitive to noise Medical images due to different reasons are affected by noise; therefore segmenting them to obvious segmented clusters is difficult. When a pixel is affected by noise, intensity of the pixel is changed. In this situation neighborhood information should be used. To overcome this drawback, in our in addition to intensity, neighborhood information is used as input features in FCM and FEED FORWARD NEURAL NETWORKS

A tumor may be primary or secondary. If it is the origin, then it is known as primary. If the part of the tumor spreads to another place andgrows on its own, then it is known as secondary.

The brain tumor affects CSF (Cerebral Spinal Fluid)and causes strokes. The physician gives the treatment for the strokesrather than the treatment for tumors. So the detection of the tumor isimportant for that treatment, so then our project enables to determine the stage of the tumor

Automated brain tumor detection from MRI images is one of the most challenging task in today's modern Medical imaging research. Magnetic Resonance Images are used to produce images of tumor in human brain. It is used to analyze the human brain without the need for surgery

### 1.1Objective

The objective of our project is to introduce segmentation of MRI image of the human brain. In addition with the help of FCM segmentation and

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FEED FORWARD NEURAL NETWORKS we may determine the different stages of brain tumor

## 1.2Overview of project

Our project 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 theymay have some drawback in detection and extraction

The segmentation, which is done through fuzzy c-means The life expectancy of the person who is affected by the brain tumor will increase if it is detected at an earlier stage. Normally tumor cells are of two types Mass and Malignant. The detection of the malignant tumor is somewhat difficult to mass tumor.

Our project focuses on the detection of any stage of brain tumor. The development platform for thedetection is matlab because it is easy to develop and execute. At the end, we are providing systems that detect the tumor and its shape and helps for further treatment

# II. PROPOSED METHOD

## 2.1 Introduction

The techniques used for this survey are Brain Tumor Detection Using Segmentation Fuzzy C-MeansTechnique with NEURAL NETWORK Initialization for Brain Tissue Segmentation for tumor detection

One of the limitations of FCM is that it doesn't consider local information of pixels. In order to overcome this limitation n addition of intensity of pixel, mean of 3×3 neighborhood of pixels and largest singular value of 5×5 neighborhood of pixels are used as features

## 2.2Advantages

The purpose of image segmentation is topartition an image into *meaningful* regions with respect to a particular application

The segmentation is based on measurements taken from the image and might be *grey level*, *colour*, *texture*, *depth* or *motion*

Usually image segmentation is an initial and vital step in a series of processes aimed at overall image understanding

Enables object surfaces with varying patterns of grey to be segmented

## 2.3 Applications

Identifying objects in a scene for object-based measurements such as size and shape

Identifying objects in a moving scene for *object-based video compression (MPEG4)*

Identifying objects which are at different distances from a sensor using depth measurements from a laser range finder enabling path planning for a mobile robots

## 3.FUNDAMENTALDEFINITIONAND DESCRIPTIONS

## 3.1 Fuzzy c-means clustering

FCM partitions a set of $n$ objects $x$ $\{x ,x ,..., xn\}$ in $Rd$ dimensional space into $c(1 < c < n)$ fuzzy clusters with y = $\{y1, y2 , y3 ,..., yc\}$ cluster centers or centroids [6]. The fuzzy clustering of objects is described by a fuzzy matrix μ with $n$ rows and $c$ columns in which $n$ is the number of data objects

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and *c* in the number of clusters. µij , the element in the *i*th row and *j*th column in µ , indicates the degree of association or membership function of the *i*th object with the *j*th cluster. The objective function of FCM algorithm is to minimize the following equation

$$J_m = \sum_{j=1}^{c} \sum_{i=1}^{n} u_{ij}^{m} d_{ij}$$ Where

$$d_{ij} = \left\| x_i - y_j \right\|$$

In this survey there are various latest techniques used in image segmentation which are very useful in medical field for diagnosis of a problem. *m*(*m* > 1) is a scalar termed as weighting exponent. *M* controls the fuzziness of the resulting clusters and *dij*is the Euclidian distance from object *i x* to the cluster center *y j*. The *yj*, centroid of the *j*th cluster, is obtained as:

$$y_j = \frac{\sum_{i=1}^{n} u_{ij}^{m} x_i}{\sum_{i=1}^{n} u_{ij}^{m}}$$

The FCM algorithm is iterative and can be stated as follows:

1. Select *m*(*m* > 1); initialize the membership function values µij , *i*= 1,2,..., *n*; *j* = 1,2,...,*c*.
2. Compute the cluster centers *yj* , *j* = 1,2,..., ,c .according to equation (3)
3. Compute Euclidian distance dij ,i=1,2…,n *j=1,2,…,c.*

## 3.2 characteristics of mri scans

The images produced by MRI scans are usually gray images with intensity in the range 0-255. The GM of the brain consists of the cortex that lines the external surface of the brain and the gray nuclei deep inside of the brain, including the thalami and basal ganglia.

The WM constitutes a connected region that is bordered by GM and CSF the display purpose WM is shown in gray color, GM as white color and CSF as black color. In MRI of head scans, the picture of organ isusually surrounded by air particles, known as background (bck) in order to make a matrix representation. This bck is another major ROI in MRI of
head scan

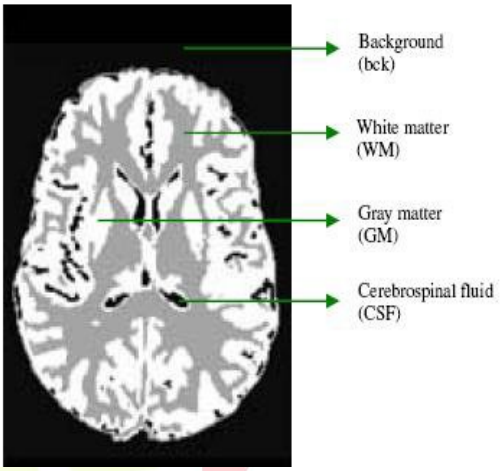


Fig1.Segmentation results of MRI

Low depth of Field method is a method used to give special importance to a part of image which is essential or which has to be focused. This method can be used in the fields like sports, photography & medical. In medical field problem diagnosis can be very easy by making focus to a problematic area such as Brain tumor, Cancer etc. the area which is focused i.e. Object of Interest (OOI) helpful to provide new information & help in research as well. Here, image segmentation algorithm is useful to separate Object of Interest (OOI) from the rest of the image. The algorithm for developing such type of images divided into five parts Deviation Scoring, Score Clustering, Mask Approximation, Color Segmentation and Region Scoring. In the initial stage of the algorithm i.e. Deviation scoring the Gaussian Blur algorithm is used. According to this the image divided in two ways ie. Original image & surface cut of OOI & the difference is calculated from these images which gives a score value. In the second stage of the algorithm.

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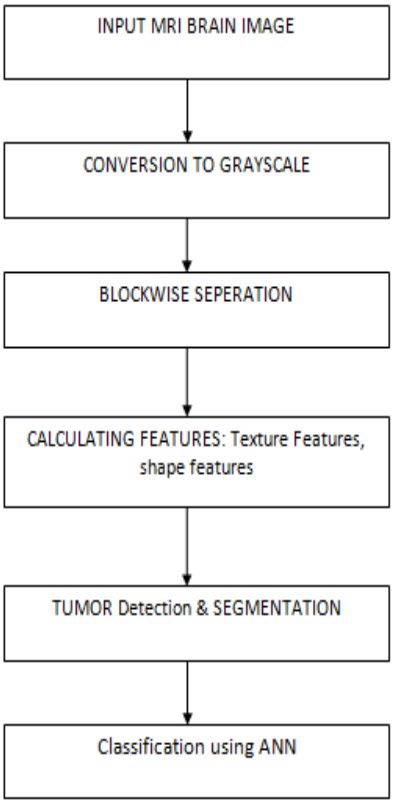
## IV.FLOWDIAGRAM




### 4.1Different Texture Features algorithms:

Haralick features

GLCM (gray level co-occurrence matrix)

Gabor filter

*Haralick Features:*Haralick texture features are derived from the co-occurrence matrix, which contains information about how image intensities in pixels with a certain position in relation to each other occur together. **Measure Texture** can measure textures at different scales; the scale you choose determines how the co-occurrence matrix is constructed. For example, if you choose a scale of 2, each pixel in the image (excluding some border pixels) will be compared against the one that is two pixels to the right. **Measure Texture** quantizes the image into eight intensity levels. There are then 8x8 possible ways to categorize a pixel with its scale-neighbor. **Measure Texture** forms the 8x8 co-occurrence matrix by counting how many pixels andneighbors have each of the 8x8 intensity combinations.

- Angular Second Moment
- Contrast
- Correlation
- Variance
- InverseDifferenceMoment
- Sum Average
- Sum Variance

### 4.2 Image texture

An **image texture** is a set of metrics calculated in image processing designed to quantify the perceived texture of an image. Image Texture gives us information about the spatial arrangement of color or intensities in an image or selected region of an image.[1]

Image textures can be artificially created or found in natural scenes captured in an image. Image textures are one way that can be used to help in Segmentatio or classification of images. To analyze an image texture in computer graphics, there are two ways to approach the issue: Structured Approach and Statistical Approach

## V.TUMOR SEGMENTATION

Digital image processing is vast fields which can be using various applications. Which include Detection of criminal face, figure print authentication system, in medical field, object recognition etc. Brain tumor detection plays an Important role in medical field. Brain tumor detection is detection of tumor affected part in the brain along with its shape size and boundary, so it useful in medical field

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### 5.1 Types of tumor

**Tumor**

The word tumor is a synonym for a word neoplasm which is formed by an abnormal growth of cells Tumor is something totally different from cancer.

There are three common types of tumor:

1) Benign
2) Pre-Malignant
3) Malignant

***Benign Tumor***

A benign tumor is a tumor is the one that does not expand in an abrupt way; it doesn't affect its neighboring healthy tissues and also does not expand to non-adjacent tissues. Moles are the common example of benign tumors.

***Pre-Malignant Tumor***

Premalignant Tumor is a precancerous stage, considered as a disease, if not properly treated it may lead to cancer.

***Malignant Tumor***

Malignancy (mal- = "bad" and -ignis = "fire") is the type of tumor, that grows worse with the passage of time and ultimately results in the death of a person. Malignant is basically a medical term that describes a severe progressing disease. Malignant tumor is a term which is typically used for the description of cancer.

## VI.TUMOR SEGMENTATION ANDDETECTION ALGORITHM

step1:Initially the human brain image is obtained from magnetic resonance image(MRI)

step2: Now the brain tissues are segmented using fuzzy c mean algorithm(FCM)

step3: Based on the FCM algorithm the intensity of each segmented image is calculated

step4:Calculate Intensity; mean of 3×3 neighborhood ofpixels and largest singular value of 5×5 neighborhoodof pixels for each pixel.

step5: Now the intensity mean and the largest singular value is calculated so then the brain tumor can be segmented with high intensity coloured image

step6: Now the tumor is segmented; from the segmented coloured pixel image the coverage area of the tumor is calculated by feed forward neural networks

step7: Based on the coverage area of the tumor we may determine whether the tumor is in initial, middle or final stage

step8: Finally the brain tumor is segmented and the tumor stage is detected successfully

## VII.TUMOR DETECTION

### 7.1Image processing techniques

As has just been established, a number of factors can adversely affect RTR image quality. With the use of image enhancement techniques, the difference in sensitivity between film and RTR can be decreased. A number of image processing techniques, in addition to enhancement techniques, can be applied to improve the data usefulness. Techniques include convolution edge detection, mathematics, filters, trend removal, and image analysis. The various image enhancements and image processing techniques will be introduced in this section. Computer software programs are available, including some or all of the following programs:

**Enhancement** programs make information more visible.

- Histogram equalization-Redistributes the intensities of the image of the entire range of possible intensities (usually 256 gray-scale levels).
- Unsharp masking-Subtracts smoothed image from the original image to emphasize intensity changes.

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7.1.1Image analysis

Gray-scale mapping-Alters mapping of intensity of pixels in file to intensity displayed on a computer screen.

Slice-Plots intensity versus position for horizontal, vertical, or arbitrary direction. Lists intensity versus pixel location from any point along the slice.

Image extraction-Extracts a portion or all of an image and creates a new image with the selected area.

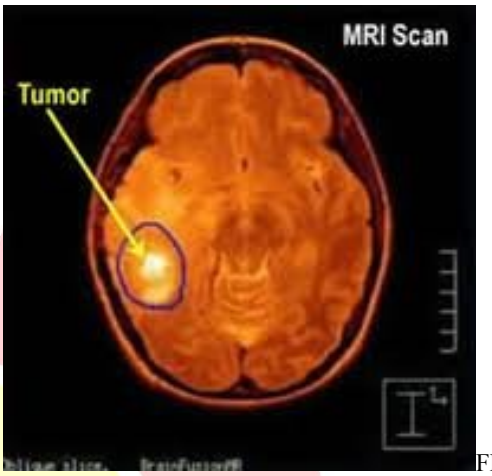


FIG 3 TUMORIDENTIFICATION

## VIII.SIMULATED RESULTS

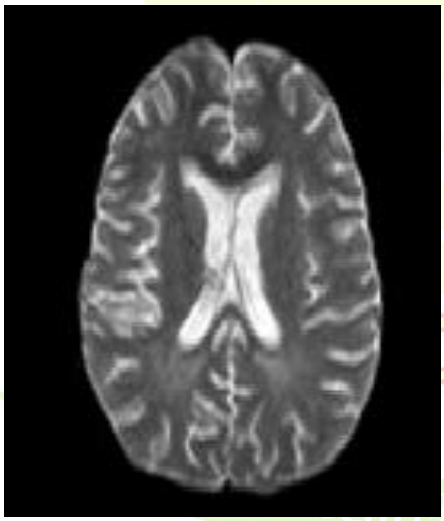

FIG 2 NORMAL MRI IMAGE

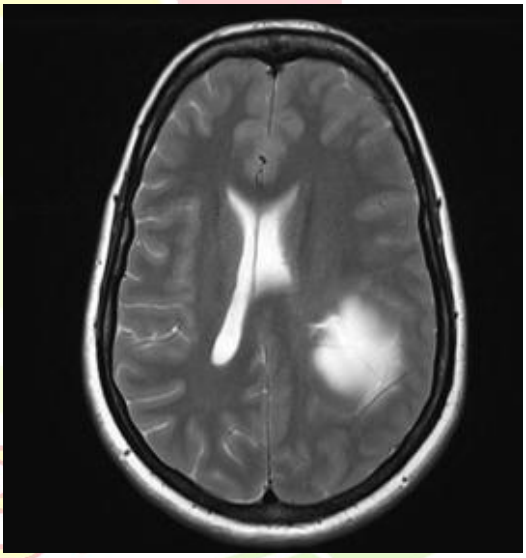

FIG 4 BENIGN TUMOR

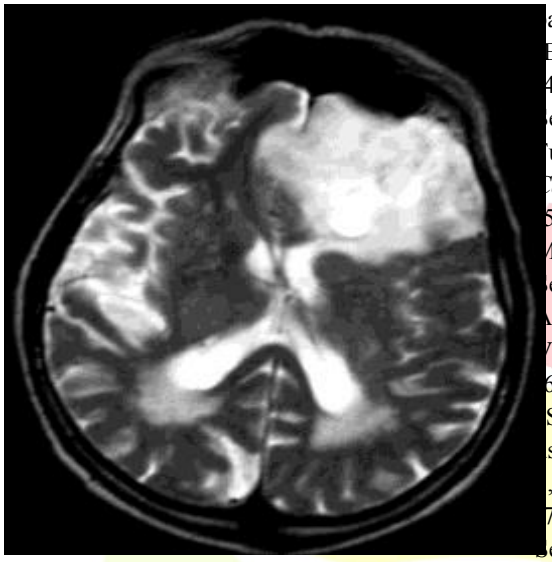

FIG 5 MALIGNANT TUMOR

## VIII. CONCLUSION

Thus the brain MRI segmentation can be done using fuzzy c means and with the help of neural networks we may detect the stage of the tumor.There are different types of tumors available. It may benign or malignant over the brain. Segmentation is done using fuzzy c means algorithm and neural networks detects the tumorstage. Achieved results are shown in upper section which shows the efficient tumor detection by using FCM algorithm rather than any other algorithm and also finding the boundary extraction of tumor.The stage of the tumor is based on the area of tumor. Shape and Size of the tumor and the stage of the tumor can be detected successfully

## IX.REFERENCE

[1] D. Dormont, D. Seidenwurm, D. Galanaud, P. Cornu, J. Yelnik, andE. Bardinet, "Neuroimaging and deep brain stimulation," *Amer. J. Neuroradiol.*,vol. 31, pp. 15–23, Jan. 2014.

[2]Reza Ghaderi,MehdiEzohi,and Jamal Ghasemi, "Brain MRI Segmentation of FCM and RBF neural networks",vol,31.pp.13,feb 2013

[3] S.C. Chen, D.Q. Zhang, Robust image segmentation using FCMwith spatial constraints based on new kernel-induced distancemeasure, EEE Trans. Systems Man Cybernet. B 34 (4) 2013

4] Alan Jose, S.Ravi, M.Sambath, "Brain Tumor egmentation Using K-Means Clustering And uzzy C-Means Algorithms And Its Area *alculation",* Vol. 2, Issue 3, March 2014

5] Shan Shen, William Sandham*, Member, IEEE*, Malcolm Granat, and Annette Sterr,"MRI Fuzzy egmentation of Brain Tissue Using Neighborhood ttraction With Neural-Network Optimization", OL. 9, NO. 3, SEPTEMBER 2013

6] S.JaveedHussain. SatyaSavithri, P.V. Sree Devi, Segmentation of Tissues in Brain MRI Images sing Dynamic Neuro-Fuzzy Technique",Volume- , Issue-6, January 2012

7]Ritu Agrawal, Manisha Sharma, " Review of egmentation Methods for Brain Tissue with Magnetic Resonance Images",vol.4 .2014

[8] M. Murugeswari, and M.Gayathri, "Tumor detectioninmri brain image segmentationusingphase congruency modified fuzzy c mean algorithm",Vol. 1 Issue 2, April 2014

[9] Ivana Despotović, Student Member,IEEE, EwoutVansteenkiste, and Wilfried Philips, Member, IEEE," Spatially Coherent Fuzzy Clustering for Accurate and Noise-Robust Image Segmentation", IEEE Transactions On Image Processing, Vol. 22, No. 2, APRIL 2013.