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# Detection and Classification of Brain Tumor Using Artificial Neural Network with Fuzzy Rules

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**Abstract**

To detect these tumours ,the existing method is KNN algorithm in this method there are certain drawbacks that tumour classification is done at initial state so accuracy is reducing ,feature extraction done by basic methods so appropriate or accurate feature is not extracting, here In-appropriate thresholding concepts are used so that location of tumour pixels are not properly identified .To overcome these drawbacks the proposed method we are using in our project is Artificial Neural Network[ANN]. It is a computer based method for defining tumour in the MRI brain image .It is a interconnection of group of nodes by a simplification neurons in a brain .This method mainly focuses on detecting and localizing the tumour region existing in the brain using patient's MRI image .The proposed methodology consists of three stages i .e ,pre processing, edge detection and segmentation .In pre-processing stage involves converting original image into a gray scale image and removes noise if present or crept in this is followed by edge detection using sobel , prewitt and canny algorithms with image enhancement techniques .Segmentation is applied to clearly displayed the tumour affected region in the MRI images. Finally, the image is clustered using ANN algorithm. Here we have used the MATLAB2017a for the development of project.

## 1. INTRODUCTION

The tumor is a standout amongst the most widely recognized as relatable point Brain illnesses. The World Health Organization (WHO) estimates that Analysis and medicine would vital to more than five lakh persons would endure from tumor for every year in the globe. Developments in restorative imaging systems permit using them inside few domains of medicine, for instance, workstation helped pathologies diagnosis, surgical arranging and guidance, longitudinal dissection. Around every last one of restorative image modalities, Magnetic Resonance Imaging (MRI) also Computed Tomography (CT) need aid the mossycup oak intermittently used imaging strategies clinched alongside neuroscience Furthermore neurosurgery. Segmentation of objects, primarily anatomic structures and more Pathologies starting with MRI images may be a crucial task, since the outcomes every now and again turned the foundation to different requisitions. Systems for performing segmentation shift comprehensively contingent upon those specific provisions and image modality. Additionally, the segmentation from claiming medicinal images will be a was troublesome task, Since they for the most part incorporate an expansive amount of data, Furthermore here and there a couple artifacts due to patient's restricted securing run through Furthermore fragile tissue boundaries, typically not great defined.At managing brain tumors, separate issues arise, which make their segmentation troublesome. There may be a limitless population about tumor sorts which bring a mixture of shapes also sizes. It might develop at whatever range also done divergent image intensities. Some about them misshape those encompassing structures or might make identified with edema that transforms those intensities from claiming images around those tumors. Additionally, those presences from claiming a couple MRI procurement conventions provides for divergent majority of the data on the brain. Each image generally highlights a specific region of the tumor. The Robotized segmentation with former models alternately using the former information will be challenged with executes. The flawed segmentation for interior structures of the Brain is from claiming great energy should contemplate also for those

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medications from claiming tumors. It dives during diminishing those mortal sins also upgrading the surgical or radio restorative.Tumors are formed in brain due to the uncontrolled development of cells. These tumors can be cured if it is timely detected and by proper medication.

This research work proposes a computer aided automatic detection and diagnosis of Benign and Malignant brain tumors in brain images using Artificial Neural Network [ANN] as classifier. The proposed system consists of feature extraction, classification, and segmentation and diagnosis sections. In this research work, Grey level Co-occurrence Matrix (GLCM) and Grid features are extracted from the brain image and these features are classified using ANN classifier into normal or abnormal. Then, morphological operations are used to segment the abnormal regions in brain image. Based on the location of these abnormal regions in brain tissues, the segmented tumor regions are diagnosed.

## 2. LITERATURE SURVEY

**Gomathi & Thangaraj (2010**) bring advertised an image segmentation methodology utilizing altered fuzzy C-Means (FCM) calculation and more FPCM. This approach is a summed up adaptation from claiming standard FCM calculation. The constraint of the traditional FCM strategy will be wiped out over modifying those standard systems. The altered FCM calculation is figured eventually Tom's perusing modifying those separation estimation of the standard FCM algorithm to tolerance the labeling of a pixel on be impacted by just other pixels also will limit the clamor impact throughout segmentation. As opposed to Hosting only particular case expression in the destination function, a second term may be included, forcing the enrollment to make concerning illustration secondary Concerning illustration conceivable without a greatest farthest point demand about one. Analyses are led with respect to genuine images should examine the execution of the recommended changed FCM techno babble done segmenting those therapeutic images. Standard FCM, altered FCM, FPCM calculation are contrasted with investigating the correctness of the recommended approach.

The primary component extractions in image preparing are Principal Component Analysis (PCA) and GLCM. PCA is a change that changes over the classification of connected factors into set of uncorrelated factors. To start with main segment has most extreme difference. GLCM ascertains the co- event network of an image by figuring how regularly a pixel with a specific power "I" happens in connection with other pixel "j" at a specific separation "d" and orientation. Zhou et al. (2006) have created an image segmentation approach by investigating one-class SVM for the extraction of brain tumor from MRI. A scientific model that disposes of the requirement for framework, preparing and gives the data on the outskirts of suspected micro calcifications for include extraction was proposed.

## 3. PROPOSED METHOD

Tumors are formed in brain due to the uncontrolled development of cells. These tumors can be cured if it is timely detected and by proper medication. This research work proposes a computer aided automatic detection and disgnosis of Benign and Malignant brain tumors in brain images using Artificial Neural Network [ANN] classifier. The proposed system consists of feature extraction, classification, and segmentation and diagnosis sections. In this research work, Grey level Co-occurrence Matric (GLCM) and Grid features are extracted from the brain image and these features are classified using ANN classifier into normal or abnormal. Then, morphological operations are used to segment the abnormal regions in brain image. Based on the location of these abnormal regions in brain tissues, the segmented tumor regions are diagnosed.

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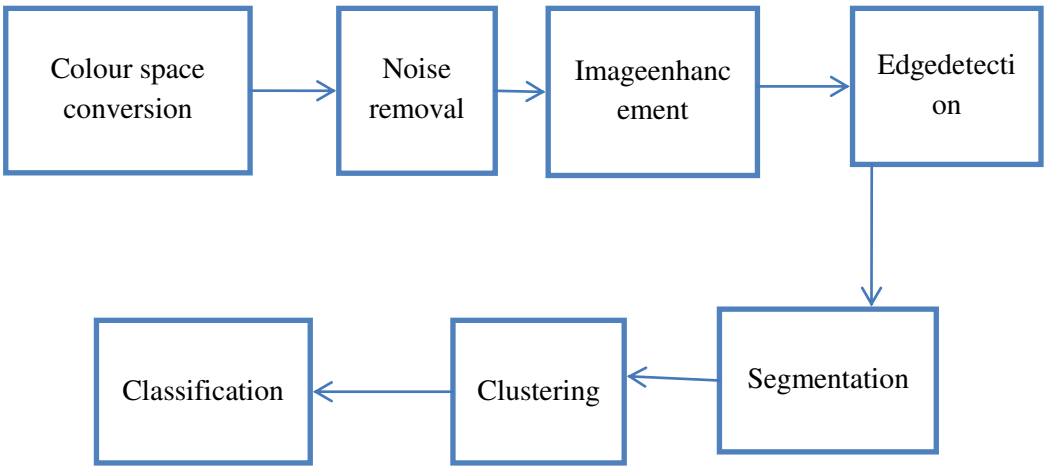


Figure 1: Proposed block diagram

It is used to remove the noises in the brain MRI image. In this research work, median filter is applied on the brain MRI image in order to remove the noises if the source image is affected by noises.In this research work, Multilevel Linear Clustering Algorithm is used to segment the classified brain MRI image into Grey matter, White matter and CSF regions. This brain tissue segmentation algorithm is explained in the following steps

Step 1: Initialize the centroid of the cluster regions. In this work, the numbers of centroid are assumed to be 3 due to the segmentation of three brain tissue regions.

Step 2: Apply linear partitioning technique on cluster regions.

Step 3: Allocate histogram of pixels in different cluster regions and assign individual labels to each cluster regions.

Step 4: The cluster regions are grouped based on the intensity variations of the pixels.

In this research work, grey level and GLCM features are used to classify the brain MRI image into Benign and Malignant tumor affected image or non Benign and Malignant tumor affected image. These features are explained in the following sections. the grid features are extracted from the preprocessed brain MRI image. This feature correlates the center pixel of 3*3 sub window with its neighboring pixels.

In this research work, GLCM matrix is constructed using the number of repeated pixels in a preprocessed image at different orientations as 0, 45, 90and 135 . From GLCM matrix, the following GLCM features as Contrast, Energy, Homogeneity and Correlation are extracted.

In this work, ANN classifier is used to classify the brain MRI image into either normal or Benign and Malignant tumor affected image. This ANN classifier can be operated in two classes as supervised or unsupervised. The unsupervised ANN classifier works without setting of internal weights from the input features and the classification accuracy of unsupervised classifier is low. In case of supervised classifier, the weights of the internal layer are set by user which increases the classification accuracy. Hence, this work uses supervised ANN classifier for the classification of brain MRI image into either Benign and malignant tumor affected image or non- Benign and Malignant tumor affected image. Morphological operations as dilation followed by erosion is used to segment the abnormal tumor region in Benign and Malignant tumor affected image.

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Adaptive Neuro-Fuzzy Inference System (ANFIS) is an extremely well known strategy which incorporates advantages of both methods, they are named underneath: Artificial Neural Network, Fuzzy Inference System.

An ANN is a computational structure that is roused by observed process in common systems of natural neurons in the brain. Neural systems are normally organized in three layers which are comprised of various interconnected nodes contain an 'activation function. Every neuron applies an activation function to its net contribution to decide its output signal. The artificial neural network has three layers, for example, Input layer, Hidden layer and Output layer. The architecture of ANN is revealed in Figure 2.

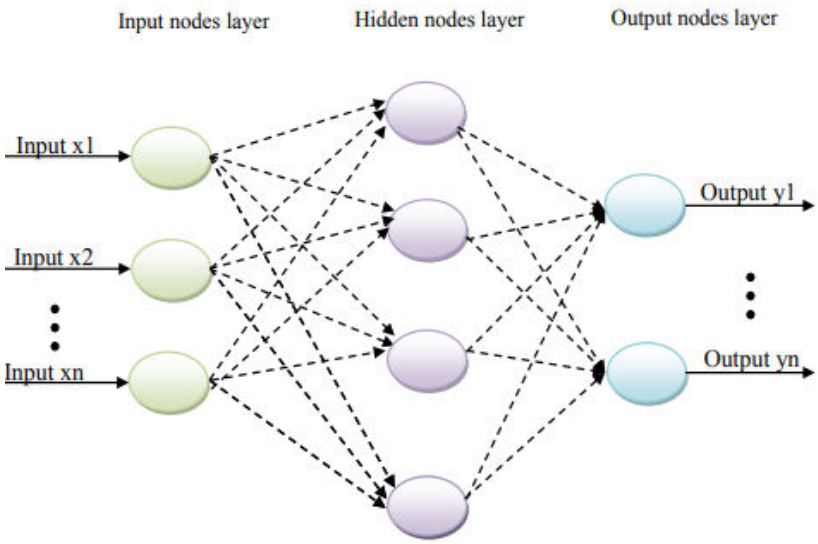


Figure 2 Artificial Neural Network

Input patterns are presented to the system through the input layer, which conveys to at least one hidden layers where the real processing is done by means of an arrangement of weighted associations. The hidden layers are related to an output layer where the required output is acknowledged. ANN can recognize and learn associated patterns amongst input and comparing target values. ANN emulates the learning procedure of the human brain and can handle issues including non-straight and complex information regardless of the possibility that the information is imprecise and noisy.

Fuzzy Inference System: A fuzzy neural network or neuro-fuzzy framework is a learning machine that finds the constraints of a fuzzy framework (i.e., fuzzy sets, fuzzy standards) by misusing estimation procedures from neural networks. Fuzzy inference is the way toward detailing an input fuzzy set guide to an output fuzzy set utilizing fuzzy rationale. Gradient descent and Back propagation calculations are utilized to alter the parameters of membership functions (fuzzy sets) along with the weights of defuzzification (neural networks) for fuzzy neural networks. The essential structure of a fuzzy inference framework is promoted in figure 3. The framework changes over the crisp input to a linguistic variable utilizing the membership functions put away in the fuzzy information database. It is contained three stages that progression the framework inputs to the fitting framework outputs.

**Database:** A database which characterizes the membership functions of the fuzzy sets utilized as a part of the fuzzy guidelines.

**Fuzzification:** The way toward changing crisp input values into linguistic qualities is called fuzzification and it includes two procedures. To start with, the input qualities are converted into

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linguistic ideas spoke to by fuzzy sets. Linguistic variables are the input or output variables of the framework whose qualities are from a characteristic dialect, rather than numerical qualities. At that point membership functions are connected to the estimations and the level of truth in each introduce is resolved.

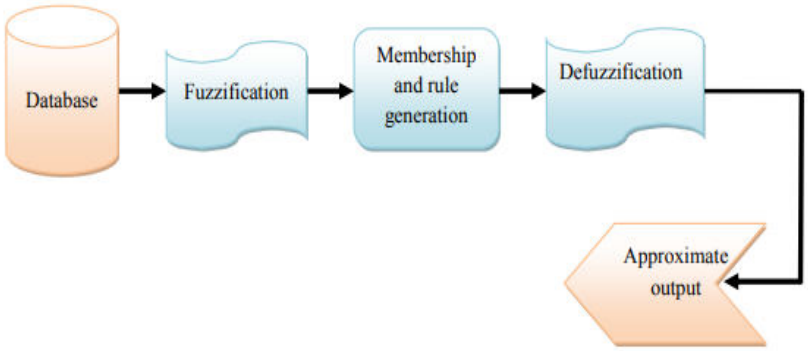
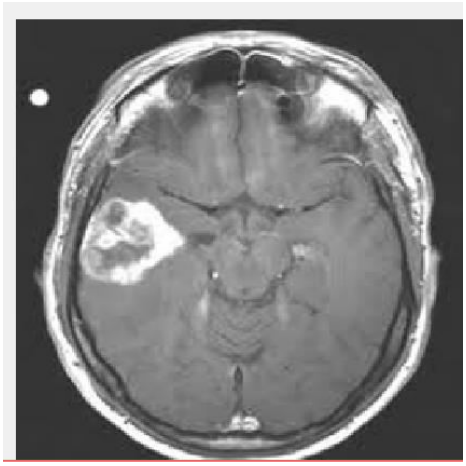



Figure 3 Fuzzy Inference System

**Membership and rule generation:** Membership functions are utilized as a part of the fuzzification and defuzzification ventures of a FIS, to outline non-fuzzy input qualities to fuzzy linguistic terms and the other way around. A membership function is utilized to evaluate a linguistic term. The most wellknown sorts of membership functions are triangular, trapezoidal along with Gaussian shapes. For considering rule generation in a FIS, a rule base is assembled to control the output variable. A fuzzy rule is a simple IF-THEN rule by means of a condition as well as a conclusion. The estimations of the fuzzy rules and the permutation of the consequences of the individual regulations are performed with fuzzy set operations.

**Defuzzification:** On the off chance that a crisp estimation of the framework is required, the last fuzzy output must be defuzzified. This is the motivation behind the defuzzifier segment of a FLS. Defuzzification is performed by the membership function of the output variable. This can be used by different techniques like gravity, bisector of area, mean of maximum, smallest of maximum and largest of maximum.

## 4. SIMULATION RESULTS



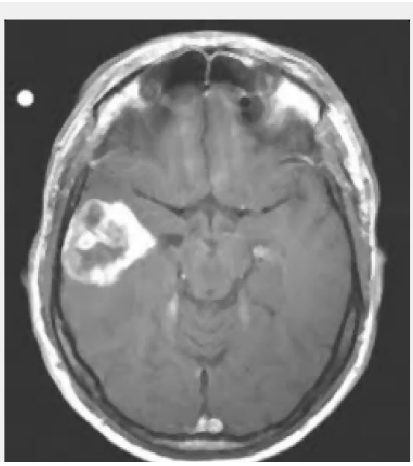


**Fig 4:** input MRI image **Fig 5: Noise removal image**

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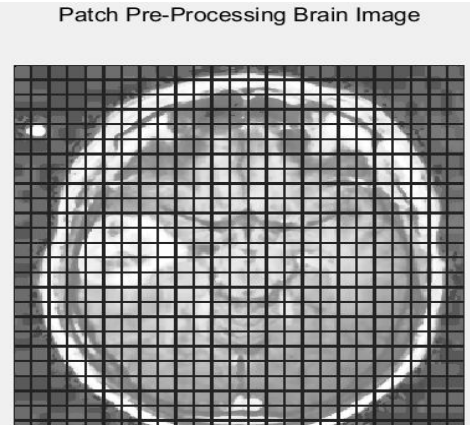


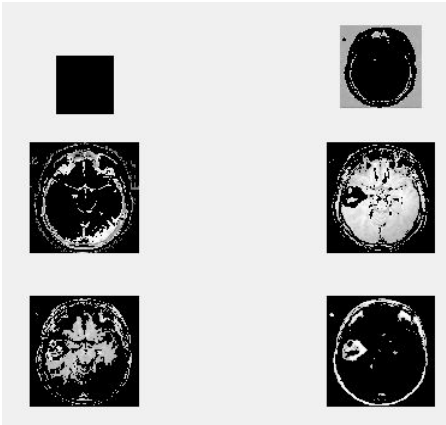
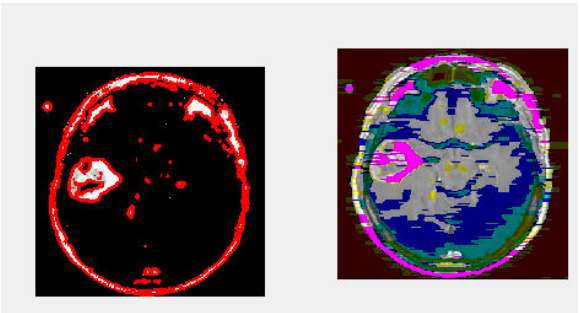



**Fig 6:** Multi Level segmentation **Fig 7:** Multi Level Clustering



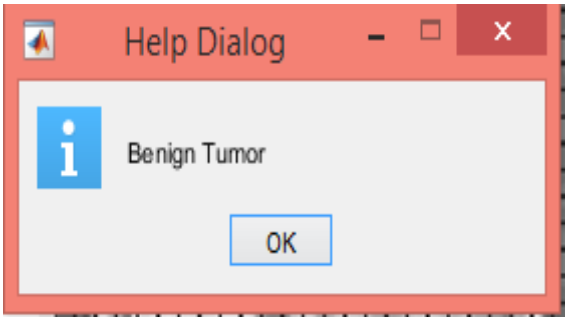



**Fig 8:** Brain Tumor Detected image **Fig 9:** Tumor Classification

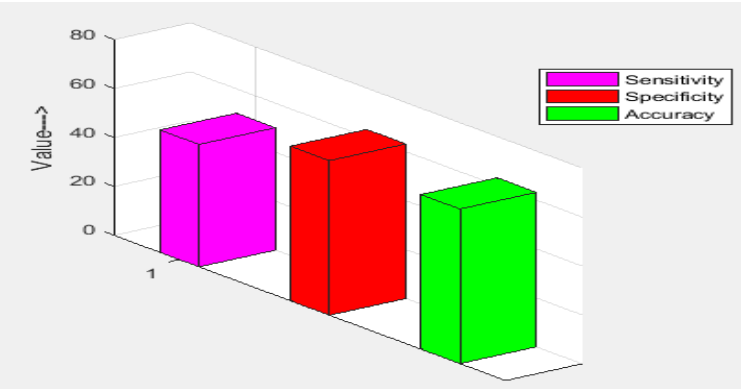



**Fig 10:** Tumor specifications

## 5.CONCLUSION

In this research work, MRI Brain Tumor Classification using ANN classification Techniques has been implemented to produce robust, accurate, increased classification Accuracy and high Computational Speed. The techniques have been tested in both simulated and real brain MRI images and the obtained results have been compared with the existing popular algorithms.

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