# Brain Tumor Segmentation and Detection Using Genetic Algorithm

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## Abstract

In recent years, brain tumour disease is growing very quickly and it takes much more time for the same diagnosis. But here detection is done with the help of Genetic Algorithm in Non-invasive way and can save time money and life for everyone. Here we are using Medical Image Processing for the tumour detection as it is developing very rapidly. The detection, extraction and segmentation of infected tumour region from MRI (magnetic resonance image) are main concern but a monotonous and one of the supreme challenging task performed by radiologists. Processing and analysis of medical image has great importance in the arena of medicine, basically in non-invasive clinical study and treatment. The brain MRI images are acquired by using MATLAB. The pre-processing of the image is done with median filter. Analysis of filtered image is based on PSNR and MSE. This pre-processed MRI brain image is clustered by using K-clustering algorithm to find number of clusters. The Genetic Algorithm implemented to find best suitable cluster for segmentation. After segmentation morphological operations are done to remove unwanted area of the image. The geometrical features of tumour are find out using feature extraction like area, perimeter, eccentricity. To classify stages of tumour and its location whether it is in right or left lobe we are using SVM classifier.

**Key Words**: Image processing, Brain Tumor, Genetic Algorithm, MRI, Segmentation, SVM Classifier, K-means clustering.

## Introduction

The brain is the most critical piece of the focal sensory system. The system and activity of the brain required to be contemplated noninvasively by specialists and analysts utilizing MRI imaging techniques. The body is made out of different kinds of cells. Singular sort of cell has uncommon activities. At the point when cells development capacity can't be controlled they split time after time and with no request. The additional phones frame a mass of tissue called a tumor. X-ray goes about as a collaborator analytic instrument for the specialists at the season of ailment conclusion and treatment. This imaging methodology creates pictures of delicate tissues. The expert therapeutic pictures demonstrates the inside structure, however the specialists need to know more than peer pictures, for example, underscoring the unusual tissue, measuring its size, portraying its shape, et c. In the event that such errands

are secured by the specialists themselves, it might be wrong, tedious and load them vigorously.

In the field of medical science an anomalous cell development inside the cerebrum is known as tumor. Human brain is thought to be the most delicate piece of the body. It control muscle developments and understanding of tangible data like sight, sound, touch, taste, torment and so forth. A tumor can influence such tangible data and muscle developments or even outcomes in more risky circumstance which incorporates death toll too. Since the situation of the tumor isn't settled along these lines it can be framed in any piece of the brain or human body. Contingent on the place of beginning tumor can be classified into essential tumors and optional tumors. On the off chance that the tumor is started inside the skull then the tumor is known as essential cerebrum tumor generally if the tumor's beginning spot is elsewhere in the body and moved towards brain then such tumors are called optional tumors.

The correct reason for disease is obscure. Cerebrum malignancy that starts in the brain is known as an essential cerebrum tumor. It can spread and crush close-by parts of the brain. Malignancies of the lung, skin, or platelets (leukemia or lymphoma) can likewise spread (metastasize) to the cerebrum, causing metastatic brain tumor. These gatherings of growth cells would then be able to single territory or in various parts of the brain.

## Types of Tumors
### Primary Brain Tumor

Tumors which instigates in the brain cells are called as primary brain tumors. In this case, sometimes they blowout to other parts of the brain or to the spine. But spreading to other organs occurs only rarely.

### Metastatic Brain Tumor

Metastatic or secondary brain tumors are those which originate in other parts of the body and then spread to the brain. These tumors are named according to the location which they originate.

Segmentation of MR brain pictures is the initial step of quantitative investigation. In medical imaging investigation field, segmentation is extremely trying for both ordinary and strange tissues of the brain that have entangled structures. While segmentation strategies have been fruitful on ordinary

Tissues, however in the irregular tissues hypothetical and exploratory work still remains. Cerebrum tumor shift extraordinarily in size and position, assortment of shape and appearance properties, powers covering with typical brain tissue. Throughout the last 15-16 years, scientists has been centered around self-loader and completely programmed strategies for distinguishing and sectioning cerebrum tumors from MRI examines.

The precise and programmed segmentation of cerebrum MRI picture is of awesome enthusiasm for evaluating tumor development and improving PC helped surgery, arranging radiation treatment, and building tumor development models.

Challenges in segmentation of cerebrum MRI: the issues of MRI incorporate Noise, Intensity in homogeneity, Shading relic, Partial volume.

There are still a few difficulties, for example, precise and reproducible segmentation and portrayal of variations from the norm utilizing astute calculations because of the assortment of shapes, areas and picture forces of various brain tumors.

## Problem Statement:

Brain tumor is most extreme ailment; the vast majority of populaces in world influenced because of brain tumor. Presently day demise rate since brain tumor bit by bit increments. For that thought, most conspicuous strategy actualized for brain tumor recognition and division. At the point when most ordinary cells develop, old cells kick the bucket or harmed and new cells have their spot. Now and again this procedure turns out badly. New cells frame when the body does not require them, and old or harmed cell don't bite the dust as they should .The development of additional items cells regularly shapes a mass of tissue called a development or tumor. Prior identification, conclusion and appropriate treatment of brain tumor are basic to avert human passing. A successful brain tumor recognition and division utilizing MR image is a basic errand in medicinal field. Discovery of brain tumor whether it is malignant or non-carcinogenic is just conceivable after tasks of suspicious piece of Brain. Be that as it may, 90% patients lose their life amid this task. So we are going to find out type of brain tumor using genetic algorithm without any operation.

## Objectives

1. To detect the suspicious part of the brain from MRI images. Segmentation and clustering of the tumor.
2. To implement the Genetic Algorithm that would be used to detect the tumor accurately.
3. Suggest the type of tumor that it is cancerous or non-cancerous.

## Literature review

R.Preetha and G.R.Suresh [1]: In brain MR images, the boundary of tumor tissue is extremely asymmetrical. Deformable models and Region based techniques are broadly used for medical image segmentation, to locate the boundary of the tumor. Issues related with non-linear distribution of real data, User interaction and poor convergence to the boundary region limited their usefulness. Clustering of brain tumor images, with the use of Fuzzy C means is strong and efficient for tumor localization. Amitava Halder, Chandan Giri and Amiya Halder[2]: proposed a well-organized brain tumor detection technique, which can identify tumor and establish it in the brain MRI images. This technique extracts the tumor with the use of K-means algorithm developed by Object labeling algorithm. It has also been found that some preprocessing steps (median filtering and morphological operation) are used for the purpose of tumor detection. Ankit Vidyarthi and Namita Mittal[3]: a new bi-clustering algorithm has been recommended to cluster out the maximum abnormality area from the brain MR image without any predefined threshold. For tumor segmentation, algorithm is on the basis of CLAP i.e. closely link associated pixel mechanism. Kailash Sinha and G.R.Sinha [4]: presents a relative research of three segmentation technique carried out for tumor identification. The technique involves k-means clustering with watershed segmentation algorithm, optimized k-means clustering with genetic algorithm and optimized c- means clustering with genetic algorithm. Ahmad Chaddad et al[5]: paper involve new features type of Glioblastoma (GEM) detection on the basis of Gaussian Mixture Model (GMM). Koushik Pal and Subhajit Koley[6]: The arrangement of Region Growing Algorithm, Cryptography and Digital Watermarking are used to detect the infected area of brain. This is the very new technique used here to detect brain tumor. Kimmi Verma and Rituvijay[7]: The main goal of this work is to authenticate a quantitative method to extract various attributes from MR images. A technique known as hybrid segmentation that associate threshold segmentation, watershed segmentation, edge detection and morphological operators is considered jointly. This joined method is experimented with MR scanned images of human brains to detect tumor. Chaiyanan Sompong, Sartra Wongthanavasu [8] The suggested technique advanced the well-known Grow-cut algorithm with the use of the advanced local transition rule. The correlation of the well-known grow-cut and tumor-cut algorithms use the dice similarity coefficient (DSC). Due to this, the suggested technique gives better results by reporting DSC of 84.17 % higher than Grow-cut and Tumor-cut with 80.81% and 80.14%, respectively. Deepthi Murthy T.S. and G.Sadashivappa [9]: Various methods were developed to identified and segment the brain tumor. With the use of thresholding and morphological functions effective brain tumor segmentation is

implemented. This is the efficient algorithm where segmentation of tumor is carried out and its features such as centroid, perimeter and area are calculated from the segmented tumor. Heena Hooda et al[10]: discuss the performance analysis of image segmentation methods, viz., K-Means Clustering, Fuzzy C-Means Clustering and Region Growing for detection of brain tumor from sample MRI images of brain. G. Kharmega Sundararaj and Dr. V. Balamurugan[11]: a tumor classification system has been considered and developed for MRI systems. The suggested technique composed of three stages namely pre-processing, feature extraction and classification. In their profound system classification has two divisions: i) training stage and ii) testing stage.

## Proposed system

The proposed system consist of the software part to detect the brain tumor using genetic algorithm. The description of block diagram given as follows.
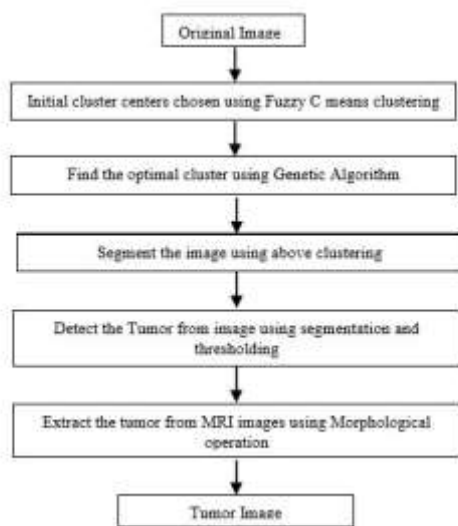


Fig1. Flow of Proposed System

Here in this system brain tumor is detected from MRI images, the MATLAB code is executed; in the MATLAB, following procedure is done. First the dataset of various images of the defected portion of the brain are trained in MATLAB and then the pre-processing of the dataset is done in pre-processing the enhancement of the image is done, after enhancement the segmentation of the done using MATLAB. After segmentation of the image, the feature extraction is done using the texture and colour so in this we are dealing with the colour. The feature is extracted. After the extraction the extracted part is given to the classifier for the disease classification here, we are using SVM for the classification purpose. It is very efficient and supervised method of classification. After the classification, the GUI shows the tumor, tumor classification and number of clusters are find out. Genetic Algorithm implemented after clustering. Non-invasive classification of tumor is done.
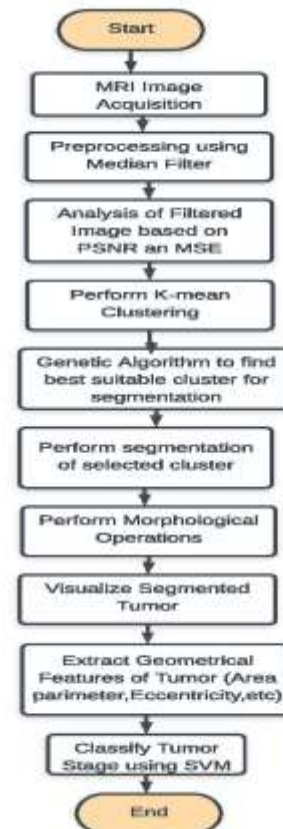
## Proposed system execution flow



Fig2. Experimental Flow

## Experimental Results



PSNR= 26.8034(db)   MSE=134.135
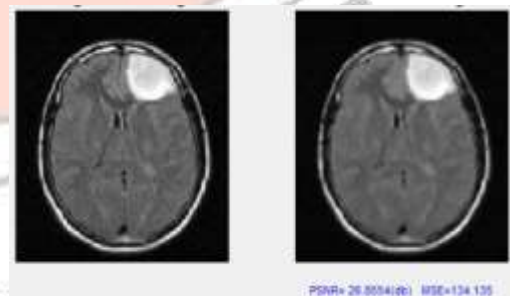
Fig3. a) Original image        b) Filtered MRI image



Fig4. a) Clustered image        b) Optimal cluster by GA
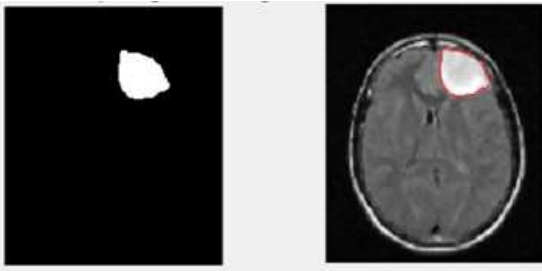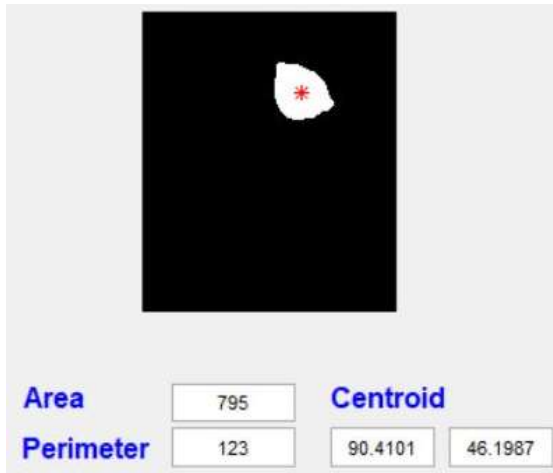
Fig5. a) Morphological filtering b) Segmented Output



| Area | 795 | Centroid | | |
|------|-----|----------|---|---|
| Perimeter | 123 | | 90.4101 | 46.1987 |

Fig6. Detected tumor with its parameters.

**Conclusion**

To reduce brain tumor growth in a sustainable manner, there is a need to move from input intensive to technology intensive and skill intensive medical field. This helps to cure the tumor by properly consulting patient with details of treatment and their requirements at very early stage. The techniques and method used during detection of brain tumor is MRI image segmentation. The paper mainly focuses on developing an automated segmentation and brain tumor detection system. This will improve the visualization and detection of brain tumors with the help of output of MRI scans. A series of filters will be used including Gaussian, linear and average filters to remove noise The MATLAB ANN Toolbox is the software domain in which the GUI is built and then Algorithm is implemented. Most important advantage of using this method is that tumor can be identified at early stage or the initial stage.

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