

# Optimizing Problem of Brain Tumor Detection Using Image Processing

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**Abstract** - Tumor is the one of the most common brain disease and this is the reason for the diagnosis & treatment of the brain tumor has vital importance. MRI is the technique used to produce computerized image of internal body tissues. Cells are growing in uncontrollable manner this results in mass of unwanted tissue which is called as tumor. CT-Scan and MRI image which are diagnostic technique are used to detect brain tumor and classifies in types malignant & benign. This is difficult due to variations hence techniques like image preprocessing, feature extraction are used, there are many methods developed but they have different results. In this paper we are going to discuss the methods for detection of brain tumor and evaluate them.

**Key Words:** Magnetic Resonance Image (MRI), Brain Tumor, Benign, Malignant, Preprocessing, Feature extraction

## 1. INTRODUCTION

Brain tumor is one of the most common brain disease. The brain tumor is unwanted growth of cells inside human brain growing in uncontrollable manner. There are two types of tumor Malignant and Benign. Malignant tumor contains cancerous cells and grows rapidly. Benign tumor are least aggressive their growth are self limited and they don't spread into other tissues. Tumors are classified by the location of tumor's origin and its malignancy as benign and malignant. Primary brain tumors originate in the brain. Secondary brain tumor the tumor expansion into the brain results from other parts of the body. Malignant tumor contain cancerous cells and they cannot be removed easily which may lead to death hence malignant tumors are more harmful than benign. In the MRI is the widely used imaging technique in neuroscience and neurosurgery for these applications. MRI gives computerised view of internal body tissues. There are various techniques used for detection of human brain tumor

## II. LITERATURE SURVEY

Swati Ghare, Nikita Gaikwad[1] proposed an approach for detection of shape and range of tumor in brain consisting of the implementation of Simple Algorithm with the help of MRI images. They used segmentation techniques to detect brain tumor in their work. For extracting tumor from MRI image denoised image was used in k-means. Fuzzy C means was used for segmentation to extract accurate shape of malignant tumor. The algorithm has two stages, first is preprocessing of MRI image and second is segmentation and performing analytical operations. In their work they detected all the edges present in the brain and considered only important edges. It showed dangerous area by color red and less effected by yellow. The results showed that fuzzy c mean is more accurate than others.

Dina Aboul Dahab, Samy S. A. Ghoniemy[2] proposed modified Probabilistic Neural Network (PNN) model based on learning vector quantization (LVQ) for the brain tumor classification using MRI-scans. Various image segmentation techniques are applied on MRI for detection of tumor. For brain tumor classification there are four steps: The firstly ROI segmentation was done where the boundary of the tumor in an MR image was identified, feature extraction from ROI was second step the third step was the feature selection, the last step was the classification process in which learning a classification model using the features. Comparing conventional PNN system with LVQ-based PNN, it will decrease processing time by 79%.

V.P.Gladis, Pushpa Rathi and Dr.S.Palani[3] introduced method for classification of MR Images into normal and abnormal one. This approach combined the various features and classifies the tumor into matter & area. The Support Vector Machine classifier used for comparison of linear techniques Vs nonlinear techniques. For data classification and dimensionality reduction Principal Component Analysis and Linear Discriminant Analysis are used. In PCA, when original dataset is transformed to a different space the shape and location of the original data sets change whereas LDA provide more class reparability but doesn't change the location The number of features

selected or features extracted by PCA and the classification accuracy by SVM is 98.87%.

Rohini, Paul Joseph, C. Senthil Singh[4] proposed segmentation of brain MRI image using K-means clustering algorithm then applying morphological filtering avoiding the misclustered regions that can be formed after segmentation of MRI image for detecting the tumor location. The algorithm was used on the brain MRI images. In morphology, after defining the structuring element it is passed over section of input image, this section was defined by the neighbouring window of the structuring element and the structuring element either fitted or not fitted the input image. Morphological operations erosion used for thinning of the objects and dilation is used for thickening of the objects in the image.

Sunil L. Bangare, Madhura Patil [5] calculated Brain Tumor area to define the Stage or level of seriousness of the tumor. Various techniques were looked into for area calculations and for tumor position calculation Neural Network algorithms were used. Their work consisted of following Stages Image PreProcessing, Feature Extraction, Segmentation using K-Means Algorithm and Fuzzy CMeans Algorithm, Tumor Area calculation & Stage detection, Classification and position calculation of tumor using Neural Network. In their proposed work K-Means and Fuzzy C-Means were used effectively to calculate the area and stage of brain tumor. Initial and Critical stages of the tumor were identified along with its position and shape. Neural Network and Image processing was used for the implementation

Khalil Tarhini, Soha Saleh[6] proposed to create a segmentation program to extract an injured area in the brain with minimal user contribution. A Matlab algorithm was developed with a graphical user interface (GUI) to easily identify a lesion, highlight a voxel in it and choose to extract it and display it as a three dimensional image. The algorithm used a sequence of morphological image processing steps (contour closing) followed by region growing segmentation. The results of the developed program demonstrated successful extraction of lesion from MRI data of patient with ischemic stroke.

Robert Velthuisen and Lawrence Hall[7] proposed an approach using genetic algorithm. Their study was to discover optimal feature extractors for MRI to increase segmentation accuracy. A chromosome was evaluated by decoding it into a linear transformation matrix A, applying the transformation to the original feature vectors resulted

in extracted feature vectors. FCM was applied to the data using other feature. The partition was labelled by matching the clusters with the true class labels, and the number of correctly classified pixels was counted resulting in the fitness measure. Ground truth for MRI was obtained using manual labelling. Using a fitness function depending on how accurate a tumor cluster is Three new features were discovered, The true positive rate for tumor pixels on this training slice increased from 85.9% with the original data to 95.7% on the discovered features

Arun Tom and P.Jitesh [8] proposed geometric transformation invariant method for detection of tumor in various positions orientations and scales, at a better rate compared to the other methods. The method combined three features (texture, shape and position) for formation of feature vector, for detection of infected parts in image. They used a Shape analysis, shape signature, texture analysis, shape retrieval techniques for improving the accuracy of detection process, they employed a preprocessing step to denoise and enhance the images. The analysis and results of the method and highlights on the accuracy of the method to properly identified the tumor parts in an MRI.

Anupurba Nandi[9] proposed a method for improving the classification of brain tumor by using Clustering and morphological operators used for biomedical image segmentation as it is used in unsupervised learning. She used K-Means clustering where the detected tumor showed some abnormality which was then rectified by the use of morphological operators to meet the goal of separating the tumor cells from the normal cells. along with basic image processing techniques The disadvantage of watershed algorithm is that it is very sensitive to local minima. The image with noise, this will influence the segmentation hence it cannot be directly used as input image.

Jin Wang, Can Feng[10] proposed a fully automatic technique for brain tumor segmentation from multispectral human brain MRIs. for representation of normal and abnormal tissues and generating a dictionary for classification of tissues they used intensities of different patches in multispectral MRIs. To classify the brain tumor and normal brain tissue in the whole image the sparse representation classification was applied. At last, the Markov random field regularization introduced spatial constraints to the SRC. The brain tumor segmentation results of their algorithm for a real patient

and simulated 3D data. By comparing the results it was found that Jaccard scores of SRC are higher than those of MLR classifier and efficiency was increased from 82 to 93%.

Zaw Zaw Htike, Shoon Lei Win[11] proposed an automatic brain tumor detection and localization framework that could detect and localize brain tumor in MRI. Their proposed framework comprised of five steps: image acquisition, preprocessing, edge detection, modified histogram clustering and morphological operations. They used 50 neuroimages for optimization of their system and 100 out-of-sample neuroimages to test the system. The proposed system was able to accurately detect and localize brain tumor in MRI. The results showed that a simple machine learning classifier showed that classification accuracy was very high and efficiency of this approach is very high.. The proposed system achieved an error rate of 8% in identifying and localizing tumors and the accuracy was calculated to be 92%

J.Selvakumar and A.Lakshmi[12] proposed the Brain Tumor Segmentation and Its Area Calculation in Brain MR Images using K-Mean Clustering and Fuzzy C-Mean Algorithm. It dealt with the implementation of Simple Algorithm for range detection and shape detection in MRI images. The MRI image was examined by the physician. The proposed system consists of four modules: preprocessing, segmentation, Feature extraction, and approximate reasoning. The proposed method was a combination of two algorithms. Then for accurate tumor shape extraction segmentation is done by using fuzzy C-means. At last position calculation and tumor shape calculation were done. By comparing existing algorithms with this technique more accurate results were obtained.

N. NandhaGopal, Dr. M. Karnan[13] designed a system to diagnose brain tumor through MRI using image processing clustering algorithms such as Fuzzy C Means along with intelligent optimization tools, such as Genetic Algorithm and Particle Swarm Optimization (PSO). The detection of tumor was performed in two phases: first stage consisted of preprocessing and then enhancement and in second phase segmentation and classification was performed. There were three Techniques are used for detection of brain tumor such as Hierarchical Self Organizing Map with Fuzzy C-Means, Genetic Algorithm with Fuzzy C-Means and Ant Colony Optimization with Fuzzy C-Means. Each of these techniques performance analysis and the pixel and

position accuracy was calculated for 120MRI images. Accuracy of this technique is 92%.

Sneha Khare and Neelesh Gupta[14] proposed a system that has been implemented using Genetic Algorithm, Curve Fitting and Support Vector Machine. Genetic Algorithm has been used to create segments of the image. To improve the segmenting curve fitting is used. After segmenting the image, the features have been extracted from the segments. These features are then classified using Support Vector Machine. Here training had been performed using Support Vector Machine on few sets of images. The method then segments the input MRI brain image. The GA has been applied to segment the images by assigning the entropy as optimization parameters. Curve Fitting has been employed. And features are extracted. Based on the parameters authors determine the efficiency of the proposed method with the Mahalanobis Distance. The proposed method gives 16.39% accuracy and 9.53% precision than the Mahalanobis Distance.

Anis Ladgham and Anis Sakly[15] proposed a novel optimal algorithm for MRI brain tumor recognition. they used the Modified Shuffled Frog Leaping Algorithm and fitness function. The fitness function calculations were linked to the image. The process of evolution to the best particles in each memplex was limited to the evolution to the global best solution. The stage of evaluation of particles by the fitness function was replaced by the evaluation of the memplexes. Each memplex contained 8 frogs generated arbitrarily. Each frog was coded on 8 bits. The algorithm was coded in Matlab 7.9 and it was executed on a Personal Computer. The two meta-heuristics used their proposed fitness function. It was found that MSFLA maintained more details of the tumor regions compared to the original SFLA.

Olfa Limam and Fouad Ben Abdelazizwe[16] proposed a fuzzy clustering approach having multiple objectives producing a set of Pareto from which to be the final clustering solution the best solution was chosen. They conducted an experimental study on two brain image datasets. they compared their method to four fuzzy clustering algorithms, The FCM, the multiobjective genetic algorithm, the multiobjective variable genetic algorithm, by computing a performance measure namely percentage classification accuracy. For MS lesion brain images data, they applied the same fuzzy clustering algorithms for these five Z planes Z2, Z40, Z90, Z125 and Z140, chosen randomly. Results reported the %CA index scores for FCM,

MOGA.MOVGA and M-MOVGA for these images. The evolved number of clusters for each algorithm was represented for each image.

Haoyu Zhang, Tughrul Arslan[17] investigated the use of Discrete Wavelet Transform (DWT) based signal processing to improve the noise performance of an UWB based microwave imaging system for brain cancer detection. Firstly, white noise was added to the pulse received in a microwave imaging system, so that SNRs were 60dB and 45dB, respectively. These noisy signals were then processed and de-noised using the DWT. The de-noised signals were used to create cross-sectional images of a cancerous brain model. These resulting images demonstrated the validity of a DWT based de-noising method for brain cancer detection. The results showed the accuracy of DWT for microwave imaging based brain cancer detection.

**MATHEMATICAL REPRESENTATION:**

Let S = be a system for Brain Tumor Detection

Where o is successful Tumor Detection

$$S = \{s, e, i, o, f\}$$

Where, s =MRI image

e =Classification

i =MRI Image

o =Tumor Detection

$$F = \{f1, f2, f3, f4\}$$

f1= image preprocessing

f2= image segmentation

f3=KNN algorithm

f4=C-Means algorithm

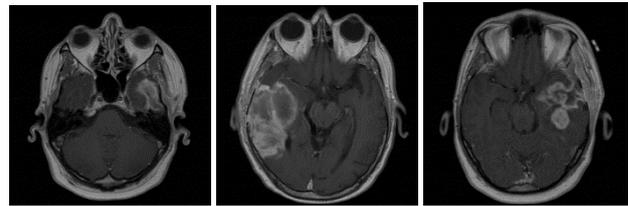
o=classification and detection

Success: When tumor is detected successfully

Failure: When tumor is not detected

$$\text{Accuracy} = (\text{Correctly Predicted Tumors} / \text{Total Testing Cases}) * 100 \text{ percent}$$

Input dataset:



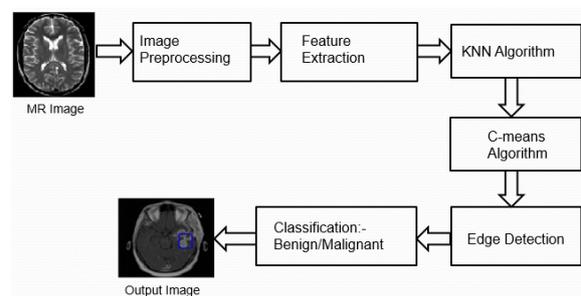
In our proposed work, we use MR image as an input for detecting tumor in human brain. MRI (Magnetic Resonance Imaging) is a diagnostic technique that produces computerized images of internal body tissues

We will use MR images in .bmp format which are black and white in color and we will perform scaling and smoothing operations on it

**IMPLEMENTATION TECHNOLOGY**

- **Feature Extraction:** Feature Extraction is used to obtain most relevant information from original data by using different techniques. It is used when image size is large and feature representation is needed to complete the tasks quickly.
- **kNN Algorithm:** k nearest algorithm combines k nearest points based on their distances and joins them in a cluster and these clusters are then evaluated.
- **C-Means Algorithm:** C-means algorithm removes empty clusters and shows the region of interest only.

**SYSTEM ARCHITECTURE:**



**OBJECTIVES**

- To detect brain tumor using image processing
- To increase accuracy
- To improve the existing work

- To implement KNN(K nearest Neighbor ) and C-mean

**CONSTRAINTS**

- The area restricts the use of software in other fields.
- It will find its application in medical field only

**RESULT ANALYSIS:**

**EXISTING SYSTEM:**

Existing method provides size of tumor and the number of pixels in it but the proposed system will give shape and size as well as type of the tumor The existing system had a limitation that it does not predict the type and shape or size of the tumor,it dealt with number of pixels which is not useful for earlier detection of tumor.

**Table -1:** Existing System Result

Sr. No.	Tumor Detected	Existing Method (no.of Pixels)
1	Tumor 1:Large Sized	195.87
2	Tumor 2:Small Sized	100.25

**PROPOSED SYSTEM**

The existing system was able to determine tumor but it was unable to give shape and size of tumor as well as it was unable to classify tumor and detect it at its earliest stage which was overcome in proposed system.

Proposed System detects the type of tumor by using the value of scaling factor:

Scaling = 0 to 30 Benign Tumor

Scaling = 30 to 40 Benign Tumor

Scaling = 40 to 50 Malignant Tumor

MRI No.	Tumor Type	Scaling	Tumor Count	Tumor Size(mm)
MRI 1	Benign	27	1	27*43
MRI 2	Benign	20	3	31*20 50*56, 26 *84
MRI 3	Malignant	34	1	34*45
MRI 4	Benign	19	2	26*19 26*46
MRI 5	Malignant	32	2	23*16 33*16

**3. CONCLUSION**

In our paper We proposed Brain tumor detection system which combines kNN and C-Means algorithm. Where MR Image is taken as an input and preprocessing is done on it and the results showed that proposed method is an efficient brain tumor detection technique and it enhances the tumor detection done by existing system.

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