

# An Automated Approach for the Detection & Analysis of Brain Tumor using Detailed MRI through MATLAB

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**Abstract** - It's very challenging and emerging in modern day's to deal with the Medical image. In this province, detection and analysis of brain tumor [1] from MRI brain image have turn out to be most challenging problems, due to the complex assembly of the brain, A computer-assisted diagnostic technique has been proposed here for detecting and analysis of the brain tumor. This is an effort built which expresses the proposed scheme for detection of tumor in the brain with the support of segmentation techniques in MATLAB; which includes preprocessing phase incorporates conversion of MRI into grayscale image, median filtering for noise removal, image enhancement and edge detection (such as canny edge and Sobel edge detection) [2]. Processing phase involves segmentation like intensity, morphological operation and applying k-means clustering than thresholding to obtain the area of unwanted cells from MRI. Here algorithms are also proposed to calculate Features extract of the different component (such as Mean, Variance, Smoothness, etc.) using the GLCM.

opportunity for physicians to support and save lives by identifying the disorder earlier and perform necessary actions.

Types of picture processing method are existing to be utilized on some image detection for tumor finding that will detect certain characteristics of the tumors such as the border, shape, calcification and appearance. These characteristics will create the detection procedures extra precise and easier as there are some normal characteristics of each feature for a specific tumor.

Magnetic Resonance Imaging (MRI) is an innovative medical imaging method used to produce high-quality images of the organs present in the human body, MRI imaging is frequently used when treating brain tumors. By utilizing these high-resolution MRI images, we can collect in-depth anatomical data to observe human brain's abnormalities.

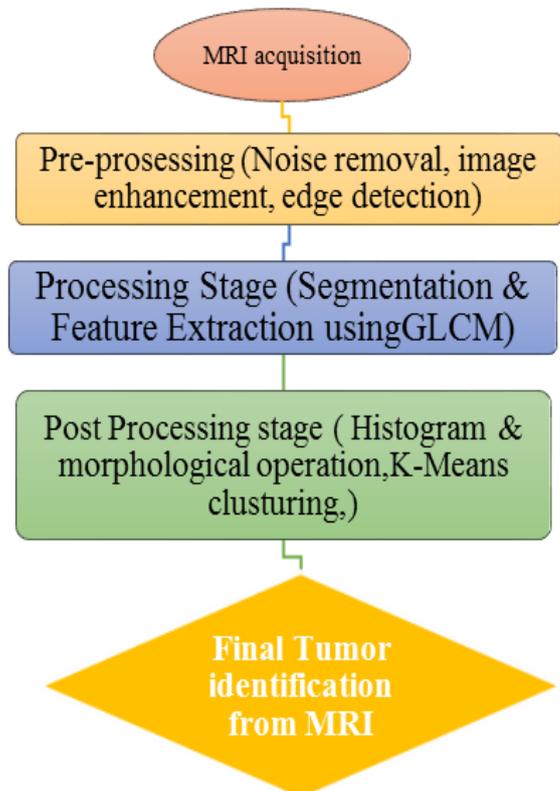
**Key Words:** GLCM, MRI, Segmentation, MATLAB

## 1. INTRODUCTION

A brain tumor is an irregular growth of cells in the brain, which can be cancerous (malignant) or noncancerous (benign). is named as a intracranial tumor produced by irregular and discarded cell partition, classically in the brain itself (neurons, glial cells (astrocytes, oligodendrocytes, ependymal cells, myelin-producing Schwann cells), lymphatic tissue, blood vessels blood) in the cranial nerves, in the brain coverings (meninges), skull, pituitary and pineal gland, or spread from cancers mostly positioned in other body part tumors (metastases). Brain tumors (true) are predominantly established in the subsequent fossa in children and in the forward two-thirds of the cerebral hemispheres in adult human being, although it can influence any motive of the brain.

Based on statistics, tumors are the second source of cancer-allied deaths in kids (both genders) whose are under the age of 20 and in males whose age 20 to 39 the disarray is also the fifth well-known source of cancer- allied deaths in females ages 20-39. This evidence increase the importance of the studies on the tumor recognition and this will represent the

**Fig -1:** Flow Chart of Brain Tumor detection



In this paper, Pre-processing of input MRI is the First step which accomplish image enhancement and noise reduction [3] using median filtering techniques which are used to enhance the image quality, then edge detection (canny edge and Sobel edge) to decide the boundaries of the object.

The second phase of the proposed method [4] includes features extraction of MRI (such as Mean, Variance, Smoothness, Entropy, contrast, Correlation, Energy,

Homogeneity, RMS) and some tumor extraction operations which includes morphological operation, K-means Clustering, Histogram operation and Thresholding.

## 2. PROPOSED METHODOLOGY

The key objective of this research is to expose or extract the tumor part or abnormal cells from the MRI by using image segmentation method and different neural network algorithm as well few filters. In this, the algorithm has 2 phases, an Initial stage is pre-processing of given MRI image and after than perform segmentation operations. Parts of the algorithm are as following:

- Select MRI of the brain as input.
- Transform it to grayscale.
- Use high pass filter (HPF) for noise elimination.
- Use the median filter to boost the quality of under processed image.
- Compute Features Extraction through Gray-Level Co-occurrence Matrix (GLCM)
- Compute canny edge and Sobel edge segmentation.
- Apply Histogram & morphological operation K-means clustering algorithm.
- Compute threshold segmentation.

Finally, the output will be a tumor region.

## 3. SIMULATION RESULTS

The given below in Fig -3 MRI of Human Skull we take as an input in the proposed algorithm

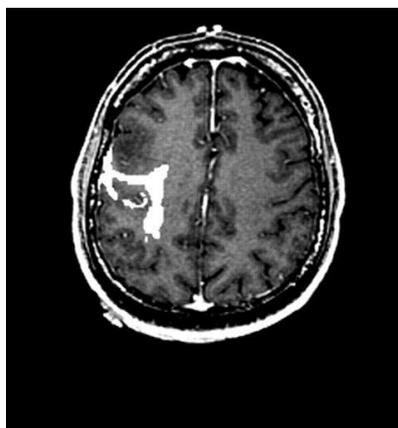


Fig - 3: Input Image for Proposed Algorithm

### 3.1 Median filtering

It is a non-linear technique utilized for noise removal. This filter is applied to subtract salt and pepper noise [5] from the transformed gray scale image. It substitutes the value of the center pixel through the average of the intensity values in the nearest of that pixel. Median filters are mostly effective in the existence of impulse noise. Impulse noise is also termed as salt and pepper noise for its look as black and white dots involved on the image. Here filter is used to remove salt and pepper noise from MRI images is shown in fig-3.1

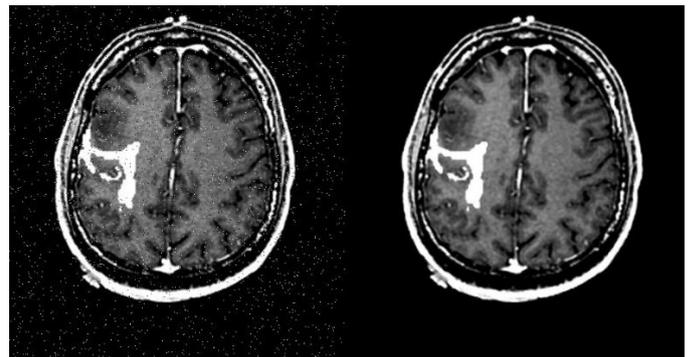


Fig -3.1: Median Filtering (Left hand image is with Salt & pepper noise while right hand image is after processing median filter)

### 3.2 Edge Detection

This technique is used for finding the boundaries and edges of objects involved in images. It operates by detecting cut-offs in brightness. It is operated for image segmentation and information extraction in areas for example image processing, computer vision. Common edge detection method consists methods like Sobel, Canny, and Edge detection methods are used for locating object boundaries from MRI images and the results are shown in fig- 3.2

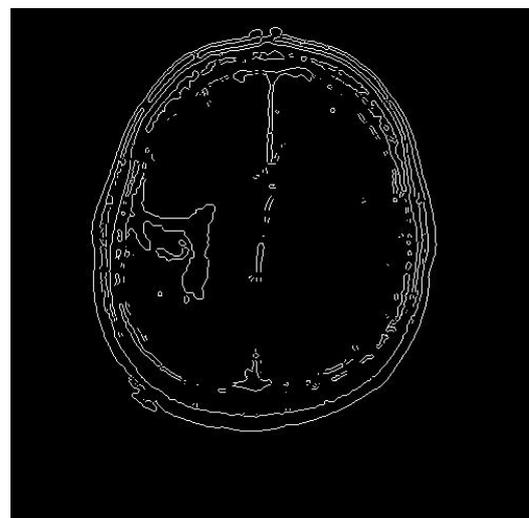


Fig -3.2 (a): Canny Edge Detection



Fig -3.2 (b): Sobel Edge Detection

### 3.3 Histogram Operation

The histogram is nothing but the graphical representation of an image. The histogram of any digital image through gray levels in the range 0 to L-1 is a discrete function. Image with histogram mainly denotes the reasonable frequency of a number of gray levels in the image. It applies on input MRI image and result shown in fig -3.3.

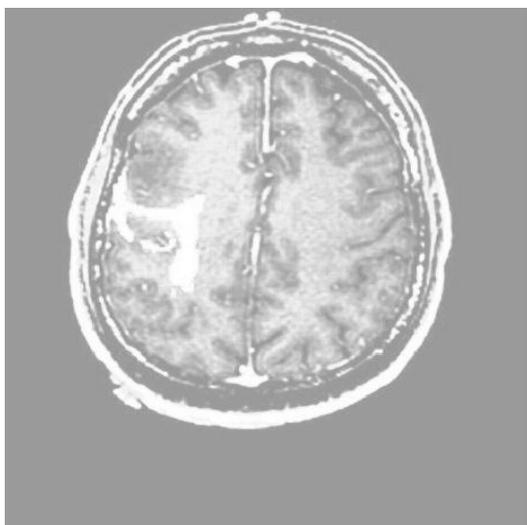


Fig -3.3: Histogram Segmented Image

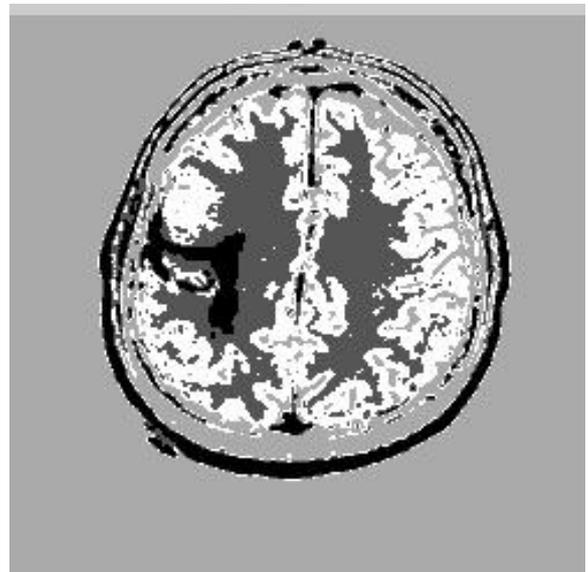
### 3.4 K-Means Clustering

This is popular and commonly considered clustering algorithms to split the input MRI data in the Euclidian space. It is a nonhierarchical method that develops an easy way to organize a given input dataset through a selected number of clusters (make a guess for parameter k) which are known a priori.

The K-Means algorithm is constructed by means of an iterative framework where the components (elements) of the data are swapped between clusters in turn to satisfy the standards of minimizing the variation surrounded by each cluster and expanding the variation between clusters. [7] At an instant when no elements are a swap over between clusters, the process is stopped. The 4 parts of this algorithm are described here.

K-means Clustering presents pixel-based segmentation of multi-band images. An image stack is taken as a set of bands equivalent to the same image. As we all aware RGB color images consists 3 bands: red, green, and blue. Every pixel is denoted by an n-valued vector, here n tells about a number of bands, every cluster is termed using its centroid in an n-dimensional plane.

Fig- 3.4: Tumor detection while applying k-means algorithm



### 3.5 Thresholding

It is one of the key methods for image segmentation and useful in separating foreground from the background. By picking an acceptable threshold value T, the gray level image can be changed to the binary image. While binary image should hold all the necessary data about the position and shape of the objects of notice (foreground). Advantage of achieving first by binary images that it lowers the complication of the data and make easier the process of recognition and division.

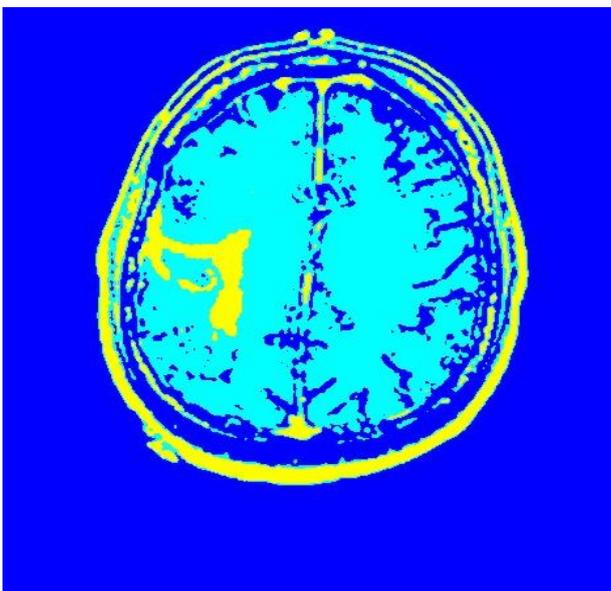
- Later performing thresholding, in one variable, the image with the tumor is stored and in another variable, the image without tumor is stored. [8]
- Then by applying „imssubtract“ MATLAB function, the image without tumor is subtracted from the image with the tumor to get the looked-for result in the variable "tumor."



Fig -3.5(a): Segmented Threshold Image of MRI

Fig -3.5(b): RGB Segmented Threshold Image

### 3.6 Features Extraction from MRI using GLCM



To reduce the features from a too much big set of features we used feature extraction scheme which facilitates extracting the features from the image. The features extracted from big features set contain the relevant information in the form of features such that the desired work can be done not by the whole process.

In this feature extraction part, we need to retrieve the beneficial data from the MRI images after preprocessing. For this feature extraction step, we took Gray-Level Co-occurrence Matrix (GLCM). [9]

GLCM is a matrix that expresses the frequency of one gray level arriving in a particular spatial linear relationship with a

new gray level within the area of inspection. The GLCM computes how frequently a pixel with gray-level (grayscale intensity or tone) value  $i$  occurs either horizontally, vertically, or diagonally to adjacent pixels, with the value  $j$ . By using this method we have extracted two types of features:

(i) Gray scale features: It extracts mean, variance, standard deviation, skewness, and kurtosis.

(ii) Texture features: Total 13 features are extracted in this paper. Few of them are entropy, energy, inverse, contrast, IDM etc.

Serial No.	Features Extracted after Preprocessing from MRI	
	Features Name	Value
1	Contrast	0.1297
2	Correlation	0.0942
3	Homogeneity	0.9691
4	Energy	0.8840
5	Mean	0.0021
6	Standard Deviation	0.0620
7	Entropy	2.4191
8	RMS	0.0620
9	Variance	0.0038
10	Smoothness	0.9740
11	Kurtosis	36.8891
12	Skewness	2.2796
13	IDM	3.142

Table 1: Features Extracted after Preprocessing from MRI

### 4. CONCLUSION

According to the research work conducted in this paper, MRI images are best suitable for brain tumor detection. In this paper, Digital Image Processing method are very important for brain tumor detection [6] from MRI images. The preprocessing techniques include different methods like Filtering, Contrast enhancement, Edge detection (used for image smoothing). The images processed through preprocessing are used for post-processing operations like; threshold, histogram, segmentation and morphological operation, which is used to enhance the images.

This research contributes to the detection of the tumor from Brain MRI by providing an automated method which classifies result of MRI as tumor MRI and non-tumor MRI [10]. While several commercially available software packages exist for assisting medical professionals in making this distinction, but it can make them more precise than before and accurate with the extracted features data values and extracted tumor from the MRI.

In this approach edge detection operator technique will detect the size, shape and boundary extraction. The proposed work provides a new technique for the brain tumor which is more efficient & consumes lesser computational time than existing methods [10]. The accurate and precise detection is necessary else the wrong detection of disease can lead to several penalties. As we know diagnosis of tumor is a difficult job; therefore accuracy and reliability are always allocated much importance.

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