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# Review Brain Tumor Detection Using Image Processing Techniques

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**ABSTRACT**- Brain Tumor is a cluster of irregular cells which grows inner side of the brain by abandoned growth in tissues of the brain. Which wants to be treated, if left unprocessed it extent over a wide area in other parts of the brain too? It is very complicated and tough to detect the brain tumor in primary phase as there are very few or no symptoms in the beginning stages. Medical image processing and its segmentation is an active and attractive area for researchers. It has reached at the incredible place in diagnosing tumors after the discovery of CT and MRI. MRI is a valuable tool to detect the brain tumor and segmentation is performed to carry out the useful portion from an image. Detecting Brain tumor using Image Processing techniques involves four stages namely Image Pre-Processing, Image segmentation, Feature Extraction, and Classification.

***Keywords:*** *Brain tumor, segmentation, MRI*

## I. INTRODUCTION

Brain tumor is the most unsafe diseases over past couple of decades. The number of persons die because of brain tumor has been increased every day that information is gathered by NBTF (National Brain Tumor Foundation). Pie chart is given below, which shows rate of tumor diagnosis in a number of countries [1].

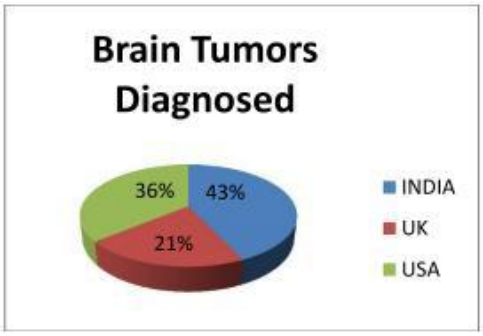



Fig.1

Malignant Tumors are rapid increasing cancerous tissues. Benign are slow growing, stagnant cancerous tumor. The majority of the tumors are life threatening, brain tumor being one amongst them. Primary brain tumors originate in the brain itself [2]. In the Secondary type of brain tumor the tumor develop into the brain results from other parts of the body. Imaging tumors with lot of accuracy plays important role in the diagnosis of tumors. It involves high resolution techniques like CT, PET, MRI, etc [3].

Magnetic Resonance Imaging (MRI) is incorporate for the detection of abnormalities in brain,
Computed Tomography (CT), MRS (Magnetic Resonance Spectroscopy), Electroencephalogram (EEG) Positron Emission Tomography (PET) Positron Emission Tomography (PET) is a widely used medical imaging technique. It mainly helps radiologists to identify abnormalities in tissues[4]. and Medical Imaging, for example, Magnetic Resonance Imaging (MRI) or Computed Tomography (CT) is an essential device in patient determination [5].

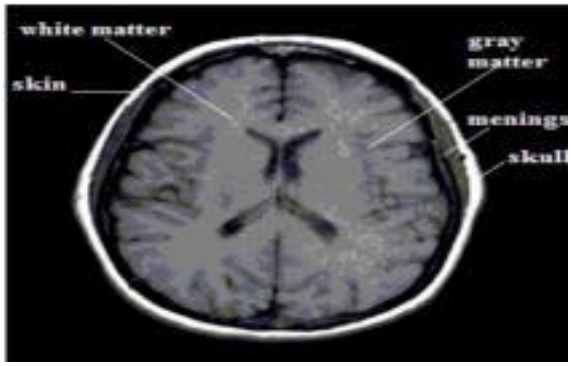



Fig.2 Brain MR Image

Magnetic resonance imaging is a greatest popular medical imaging technique. This is because MRI is non-invasive (using no ionization radiation), and competent of showing a variety of tissues at high resolution with high-quality contrast. An additional benefit of MRI is to produces

number of multiple images of the identical tissue region with diverse contrast visualization capabilities by means of applying diverse image acquisition protocols and parameters. These multiple images give extra anatomical information regarding the similar tissue region. Corresponding in succession from dissimilar contrast mechanisms helps researchers study brain pathology added accurately. For a variety of applications clustering is an important. [6] . Clustering is a distribution of data into groups of alike objects. Every group consists of objects that are alike between themselves and dissimilar to objects of other groups.

The idea behind writing this paper is to plan some research work to identify the brain tumor in early stage following special imaging techniques are used to detect brain tumor section I contains the introduction. Section II contains various imaging techniques are used for diagnosis like CT, MRI, Angiography, Brain Scan, Biopsy and Skull X-Ray. In section III, some preprocessing techniques are used noise removal, image sharpening. Section IV concludes a detailed review work of the brain tumor detection has been performed here using image processing segmentation and other methods.

## II. IMAGING TECHNIQUES USED FOR BRAIN TUMOR DETECTION

To help in early diagnosis and detection of Brain Tumor a various techniques are used such as CT scan, MRI, Angiography, Brain scan, Skull X-rays. Biopsy. These techniques are explained below in the detail.

**a. Computed Tomography**

CT scan gives more definite output of our body than an X-ray machine. CT scan is a safe, non-intrusive test that is used for an X-ray beam and a PC to create 2-dimensional images of the brain. It examines the brain layer-by-layer, taking an image of each slice of a brain, as compare to MRI. A coloring (differentiation operator) force be infused throughout our body flow. CT is mainly helpful for review change in tough structures.

**b. Magnetic Resonance Imaging**

Commonly MRI is used in the medical field for visualization and recognition of details of inside arrangement of our body. As compared to computed tomography (CT), it is significantly improved technique which is used to detect the differences in our body tissues. Thus this technique is very useful for brain tumor detection and cancer imaging. To provide a point to point perspective of the slight tissues of the brain. X-ray scan is a non-intrusive test that uses a striking field and radiofrequency effect.

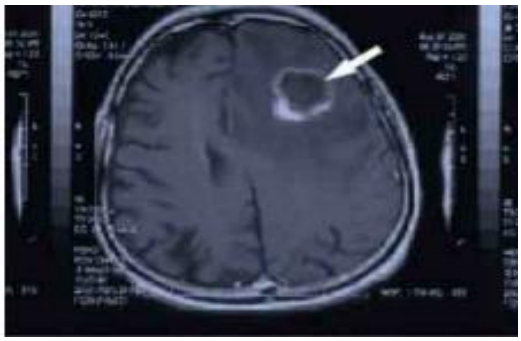


Fig.3Brain MRI with Tumor

**c. Angiography**

Angiography is a medical imaging technique used to visualize inside our blood vessels and organs of our body, inside our veins and the heart chambers. It is done by injecting a radio dense contrast agent into the blood vessel and imaging using X-ray based techniques such as fluoroscopy. A dye is infused into the supply route. It goes to the conduits of brain. It permits the high-quality to recognize what the blood supply of the tumors resembles. This data is supportive at the time of surgery.

**d. Brain Scan**

Brain scan is very useful to generate scan images of the brain, for the diagnose of tumors. A brain scan is used for secure radioactive color that is infused in a vein. An image is taken, when the dye experiences the veins in the tumor. A special dye is used for different types of brain scans, called a contrast, to show areas of concern in better way. Before the scan starts Contrast dye is usually injected into the body.

**f. Biopsy**

In our body a biopsy is a method to eliminate a piece of tissue or a sample of cells, so that it can be analyzed in a laboratory. During a biopsy a tiny bit of the tumor is gotten. The biopsy will distinguish the tumor cells into benign or malignant. It observes that malignancy originated in our brain or from another piece of our body.

**e. Skull X-Rays**

A skull x-ray is a photograph of the bones, including the facial bones, the sinuses, and the nose. Skull x-rays can show breaks or cracks in the bones. X-ray can obtain calcium stores, which are present in inner part of our tumor. If our body expansion has moved towards the bones calcium stores possibly will be in the circulatory system of our body.

## III. ANALYSIS TECHNIQUES USED FOR TUMOR DETECTION

In this paper segmentation techniques are discussed and analyze listed below is Feature Enhancement, Pre-processing and Segmentation techniques. MRI scans of the

human brain forms the input images for our body system where the grayscale MRI input images are given as the input. The preprocessing stage will convert the RGB input image to grayscale. Noise present if any, will be removed using a median filter. The image is sharpened using Gaussian filtering mask. The preprocessed image is given for image segmentation using K-Means clustering algorithm.

**Image Acquisition**

Using MRI scan images are obtained and these scanned images are displayed in a two dimensional matrices having pixels as its elements. These matrices are dependent on its field of view and matrix size. Images are displayed as a grayscale image and Images are stored in Image file. The entries of a grayscale image are ranging from 0 to 255, where 0 shows total black color and 255 shows pure white color. Entries among these ranges differ in intensity from black to white [7].

**Pre-processing Techniques**

Pre-processing of MRI images is the major step in image Analysis which performs noise reduction and enhancement techniques, which are used to improve the image quality. Image is improved like this way the finer details are enhanced and noise is removed from the image. Noise reduction and enhancement techniques are implemented in brain tumor detection that can provide greatest possible results. Enhancement gives more outstanding edges and a sharpened Image of tumor is obtained, noise will be reduced thus reducing the blurring effect from the image [8].

**Pre-processing stage**

In this stage noise is removed from the image and image is enhanced in the way that better details are improved. Most commonly used noise reduction and enhancement techniques are implemented that can give most excellent possible results. Enhancement will result in more prominent edges and a sharpened image is obtained, noise will be reduced thus reducing the blurring effect from the image. In addition to enhancement, image segmentation will also be applied. The improved and enhanced image will help in detecting edges and improving the quality of the whole image. Edge detection is used to locate the exact position of the tumor.

**Noise Removal:**

To remove noise from the image many filters are used. Linear filters are used to give out the point like Gaussian, averaging filters. Like, average filters are used to remove salt and pepper noise from the image. In this filter pixel's value is replaced with its neighborhood values. Median filter is also used to remove the noise like pepper and salt and weighted average filter is the dissimilarity of this filter and can be implemented simply and provide high-quality results. In the median filter value of pixel is determined by the median of the neighboring pixels.

**Image Sharpening:**

Different types of high pass filters are used to achieve sharpened image. A Noise is being removed by using special low pass filters, to detect boundary of the tumor we require to sharpen the image and need to sharp the edges. Gaussian high pass filter usually used to enhance the finer details of the project and gives high quality results [9].

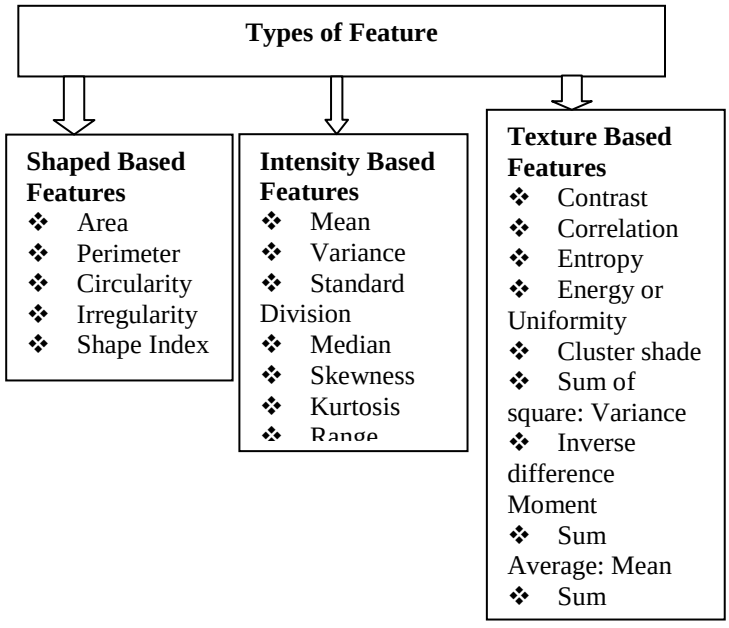
The proposed Optimized Kernel Possibility C-Means algorithm gives improved accurateness between OKPCM and FCM as compared to other preprocessing Techniques. It shows that KFCM is improved influential and accurate than other pre-processing techniques. KPCM describes the basic texture of the dataset, but KFCM is better than other existing techniques.

**Feature Extraction Technique:**

**FEATURE EXTRACTION**

To represent an image, large amount of data is required which occupies large amount of memory and time. In order to reduce the amount of data, memory and time, the features are extracted from an image. The extracted features contain the relevant information of an image. It can be used as an input to the classifier for image classification and segmentation. The type of features extracted from an image is classified as in Fig. 1

**Classification of** Feature **that can be extracted from an image**



Feature extraction is a process used to take out the significant features of the images, which are used to understand the image easier. Histogram Equalization is applied to enhance the contrast of the image it differentiates the background and the object. In feature extraction the input image is transformed into the squashed form. It extract the features like standard deviation sum of average, sum of variance, contrast , homogeneity, energy, entropy, auto correlation, etc.

In case of brain tumor to extract an exact tumor is a critical task in case of brain tumor detection because of the difficult structure of a brain. Definite parameters are taken into account for feature extraction is shape, size, location and composition of the image. Classification of the tumor is done as per the results obtained from the feature extraction [10].

In some feature extraction technique the input data set images are converted into compressed form. It reduces the work for advance processing such as image classification. GLRLM feature extraction technique is used after the fuzzy c-means algorithm. To obtain the gray level run length matrix (GLRLM) for two level high frequency sub bands are used for discrete wavelet decomposed image with 1 for distance and 0,45,90 and 135 degrees [11].

In another feature extraction technique the relevant features separated which guide to recognize the brain MRI images. To distinguish between normal and abnormal brain tumors gray Level Co-occurrence Matrix (GLCM) features are used. Co-occurrence matrices are constructed in four spatial orientations such as vertical, horizontal, left diagonal and right diagonal [12].

As Compared to other Feature extraction techniques. By using the median estimator the local mean Adaptive DW-MTM filter overcomes the difficulties of using MMSE filter in the precedence of impulsive noise. Using only pixels a new local mean is then estimated inside a small gray level range regarding median. The outliers in the estimation of the mean channel within the sight of outliers productively evacuate, for example, salt and pepper noise.

**3. SegmentationTechnique:**

Image segmentation is the process of partitioning a digital image into sets of pixels also known as super pixels[13]. It is mainly significant stage for analyzing image correctly while it affects the correctness of the following steps. On the other hand, appropriate segmentation is hard because of the huge verities of the lesion sizes, shapes, and colors along with diverse skin types and textures. In addition, some lesions have asymmetrical limits and in a few cases there is flat transition among the lesion and the skin. To deal with this difficulty, numerous algorithms are planned. They can be largely classify as thresholding, edge-based or region-based, supervised and unsupervised classification techniques

- Threshold segmentation
- Water shed segmentation
- K-mean Clustering
- Fuzzy C-means Clustering

In processing segmentation is prepared using following methods:-

*1)* Threshold Segmentation: Threshold segmentation is a simple method of segmentation. The input gray scale image is transformed into a binary format. The technique is based on a threshold value, which will change gray scale image into a binary image format. The most important logic is the assortment of a threshold value. A number of frequent methods used beneath this segmentation contain k- means clustering method and maximum entropy method for segmentation [14].

Region Growing: Region merging / Region growing segmentation technique involves grouping of pixels with related intensities. In this technique, the images are partitioned by organizing the nearest pixel of similar kind pixel of (texture, intensity levels, homogeneity or sharpness) The first step of this technique is to choose a pixel or group of pixels known as seeds belonging to the structure in focus. In the next step Pixels in the neighborhood area are then examined and added to the growing region on the base of a number of homogeneity measure. This step continues until no additional pixels can be adjoined to the growing regions. The object illustration is done, by all added pixels to the growing regions is to be concluded [15].

*2)* Watershed Segmentation*:* In these methods the group of pixels of an image is form on the basis of their intensities. Pixels falling under similar intensities are grouped together. It is a good segmentation technique for dividing an image to separate a tumor from the image. Watershed segmentation is useful for gray scale image segmentation applied on mathematical morphological operating tool. Watershed is normally used for checking output rather than using as an input segmentation technique.

Automatic detection and extraction of tumor part from MR brain image is a difficult and complex task for the doctors. Watershed algorithm and Fuzzy c-Means clustering are the two frequently used strategies for the automatic tumor segmentation.

*3)* Morphological Operators*: To* separate the tumor part from the image is a function of morphological operators. After converting the image into binary format, some morphological operations are used to converted binary image. Now the white color tumor portion of the image is visible. The intensity of a white portion is highest than other regions of the image. After the watershed segmentation morphological operators are applied [16].

*4)* Edge based segmentation: In edge-based segmentation there is a discontinuities in there image attributes as texture, color, Gray level, etc. These discontinuities are known as

edges and are detected with edge detection operators, like Laplace Sobel, Prewitt, etc. Edge based segmentation method cannot be used for partial segmentation output. Because of stray, broken or noise edges. To obtain edges meaningful objects an advanced processing is required. A number of algorithms are introduced for edge-based segmentation; edge-image thresholding is a usually conventional segmentation method, used to wipe out insignificant edges that arise due to the factors such as noise and improper lighting conditions. If the edge properties are resolute with respect to the mutual neighbors stray edges problem can be solved, strength of edges in local neighborhood is substantiated depending on the presence of edges [17].

*5)* Fuzzy C-Means**:** Fuzzy C-Means is a clustering method. In this clustering method, the group is represented by one pixel may belong to two or more clusters. In this algorithm, the predetermined collection of pixels is partitioned into a group of "c" fuzzy clusters. The objective task of this algorithm is defined as the sum of distances between cluster centers and patterns. To identify classes depending on the data and the application in which it is to be used different types of similarity measures are used. Similarity measures such as intensity distance and connectivity are used as an example. [18].

*6)* K-Means Clustering: This technique belongs to the category of unsupervised cluster analysis algorithms. K-means clustering is a type of hard clustering algorithms .In this n observations into k clusters partition by K-Means Clustering in which each pixel belongs to the clusters by minimizing an objective function in a way that sum of squares is get minimized inside cluster [19] . It starts with first K cluster centers and it reassigns the explanation to clusters based on the comparison among the observations and cluster centre[20].

As compared to the other segmentation technique, regression Neural Network provides better segmentation result. In this segmentation process the MR input image is effectively segmented. In this process RNN accurately detect the tumor region. Separating ROI from the backdrop is to preserve edges the major problem. Regression Neural Network calculates the Estimate overlap Score value to preserve the edges in image. Versatile segmentation process is controlled in RNN By calculating this Estimate Overlap Score value.

## IV. CONCLUSION

This paper presents an objective comparison of different algorithms and techniques working in pre-processing, Feature Extraction and segmentation methods. This paper focus on supervised and unsupervised deterministic techniques. As compared to other pre-processing technique - Optimized Kernel Possibility C-Means (OKPCM) algorithm removes the noise effectively from the Magnetic Resonance Image (MRI). The Adaptive DW-MTM filter improves the quality of MR Image. Then Regression Neural Network helps to segment the ROI from the background.

In future the combination methods of imaging such as PET/CT or PET/MRI may also be used as input data. So Brain tumor can be easily detected and diagnosed by using this advanced techniques and algorithms may minimize the time consuming to detect and locate the tumor with accuracy.

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