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# Research On Segmentation Techniques

**Sushma B M, Akshatha Prabhu**

**ABSTRACT:** ***Brain cancer is the most dangerous disease in the world and serious leading deaths every day. Early recognition and treatment can save the cancer affected human's life. Identification of brain cells has been a challenging task in medical field. The size and shape of tumor in the brain are different for each patient. Brain is one of the important organs. Brain tumor is the mass or growth of abnormal cells in the human body. Brain tumor can be cancerous (malignant) or non-cancerous (benign). Cancerous tumor might be primary or secondary. Primary brain tumors are tumors where the cancer first grows in the body. Secondary tumors are the tumors where primary cancer spreads to another part of the body. Magnetic Resonance Imaging (MRI) gives the complete images of the human body. MRI technique generates the images using strong magnetic fields and radio waves. MRI scanning technique is the current best scanning technique in the health care industry, MRI images can be used by the doctors to identify the tumor part in the brain. MRI scanning technique is best because it does not use x-rays. Preprocessing step can be used to better the quality of the image, to improve the image, to remove the noise. The goal of the segmentation is to analyze the image, it changes the illustration of the image that is significant and easier to examine. Comparison has been made on Otsu threshold, k means and texture filtering segmentation techniques. Different techniques provide different result. The best and efficient method can be identified by measuring AROC curve.***

**Keywords— Preprocessing, image segmentation, Otsu, k means, texture filtering, AROC Curve, specificity, sensibility.**

## I. INTRODUCTION

brain cancer is the uncontrolled mass or growth of the abnormal cells in the brain. Brain tumor symptoms are mainly depends on the types, location, size and the growth of tumor cells. Symptoms are confusion, vision problem, vomiting, memory problems, difficulties in speech, headaches, the variation of mood, behavior, and personality. Brain tumor can be diagnosed using Neurological exam, Imaging tests, Tests to find cancer in other parts of the body, Collecting and testing a sample of abnormal tissue (biopsy). Brain tumor stages can be four grades such as Grade I, Grade II, Grade III, Grade IV. Benign tumors are harmless and are less aggressive. Malignant tumors spread quickly and are harmful.In this model, the pre-processing of brain MRI image can be done by applying the median filter to remove the noise. Median filter can be applied only for the gray level images hence it can be called as 2D adaptive filter. It removes salt and pepper noise without reducing the sharpness. Then, Implementation of various segmentation techniques has been done.

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Implementation of proposed system is based on the comparison of Otsu threshold, k means and texture filtering segmentation techniques. Different techniques provide different results with different accuracy and efficiency. The main aim of this project is to identify the best technique for segmentation. The best technique can be useful for the further process. The best technique can be identified by applying the AROC Curve. It is an essential task to measure the performance. It can be applicable for the multi-class problem. It represents the capability of the techniques.

## II. RELATED WORKS

The author Nilakshi Devi et.al[1] proposed that, the soft computing tools like fuzzy logic, ANN, genetic algorithm applied to detect the brain tumor. Pre- processing steps like conversion of the image to gray scale, histogram equalization, binarization, edge detection are used to extract some useful information in the input image. Feature extraction can be done by using GLCM. Classification can be done by using ANN (artificial neural network). ANN provides the output with the good efficiency and with less time. The author Spoorthi Rakesh et.al[2] proposed that, survey of various well-known brain tumor image segmentation technique. Artificial bee colony technique for fast segmentation and less noise, Pixel classification for better accuracy, K-means and SVM for better segmentation, Cellular automata based FCM for better performance, Hybrid intelligent algorithm for segmentation result within limited time, Improved FCM and watershed for improved accuracy(FCM: 88.91 and watershed: 93.13), Convolution neural network for more accuracy than the traditional method. The author S.Krithiga et.al[3] proposed that, reduction of noise by applying filters. Then Conversion of RGB into gray. Median filter used for the pre-processing technique to eliminate the noise and other artifacts. Comparison of K means and fuzzy c means are used to detect and tumor region can be segmented. The author Roy.S et.al[4] proposed that preprocessing can be done by using median filter. Median filter removes the noises without reducing the edges, it preserves the edges. High pass filter can be used for edge detection and sharpening the image. Threshold segmentation is applied as the segmentation technique, it performs clustering based segmentation and reduction of gray level image into binary image (consists of black and white pixels). Watershed segmentation is used to segment the tumor. The author Dr.G.Padmavathi et.al[5] proposed that, fuzzy algorithm, c means clustering and threshold algorithm are combined. The combination result into fuzzy c means clustering method with thresholding. Partitioning the data into clusters is the goal of clustering. FCM threshold method provides reliable result than the FCM.


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The author Prof.A.S.Bhide et.al[6] proposed new segmentation algorithm to detect the region of the tumor by using fuzzy c mean algorithm. Filter techniques are applied for smoothing, sharpening, edge detection. Median filter is applied to remove noise. Fuzzy c mean is one of the clustering technique use to for different types of clusters based on the properties of homogeneity and heterogeneity. It produces the segmented image and finally measuring the diameter of the tumor region. The author Mredhula.L et.al[7] proposed that detection of kidney tumor from the CT images. Gabor filter is used for the edge detection. Unsupervised learning technique that is FCM is used for the clustering based on the property of similarity. Classification is done by using artificial neural network. Finally it classifies that the image is belong to which type of the tumor. types are Chromophobe Renal Cell Carcinoma, Renal Cell Clear Cell Carcinoma, Papillary Renal Cell Carcinoma The author Er.Nirpjeetkaur et.al[8] proposed that comparison of different thresholding approaches. Global, local, dynamic are the techniques of the thresholding. Thresholding methods calculate the pixel is either fall in foreground or background, calculation of local thresholds using neighbours. Then Comparison aiming at removal of background and also advantages of global and local thresholding are combined. The author Miss. Shital S Patil et.al[9] proposed 2 stages of implementation. The first stage is till detection of the tumor which is normal or cancerous. The second stage is if the tumor is cancerous then second stage is applied to show the tumor region and calculate the tumor region. The author Pankaj Sapra et.al[10] proposed that the detection and identification of the tumor. By applying various filters such as Gaussian filter to the original image and average filter to remove the noises. It provides the region of interest and edge detection is done by using canny edge detection. It gives the result as normal or abnormal cell. The author V.Prema et.al[11] proposed that mean filter and median filter are applied to remove noise so that it enhances the quality of the input image. Marker-controlled watershed segmentation and Otsu's thresholding method are used for segmentation. Watershed segmentation provides good result, better accuracy and better quality than the threshold method. Morphological operations are carried out to eliminate the unnecessary parts. Features are extracted based on the formulas to classify the type of the tumor. The author N.Shobha Rani et.al[12] proposed the comparative study of fruit image segmentation techniques. Edge detection is applied to visualize the enhanced fruit image. K means clustering algorithm to create the different clusters using the Euclidean distance. FCM is the clustering technique to divide the data into clusters. Watershed segmentation is used as the segmentation technique. It is applicable for the color images. Segmentation technique leads to detect the regions with different attributes. The author P.Sudharshan Duth et.al[13] proposed that, robust spatial kernel FCM separate the classes having same characteristics. Level set method to track the shape. Lattice Boltzmann method provides the framework for the modeling Boltzmann particles on 2D or 3D. This can be used to solve time consumption problem. The level set method has 2 disadvantages such as results depend on the initialization of controlling parameters and time complexity. The proposed method overcomes these two drawbacks.

## III. PROPOSED METHOD

### *A. Image acquisition*

Image acquisition is one of the processes in Digital image processing. Image acquisition can be defined as the process of receiving the image or data from the various sources.

### *B. Image Pre-processing*

In image pre-processing median filters is used to remove the noise. Median filter can be used to remove the salt and pepper noise. It can also be called as 2d adaptive filter because it can applicable for gray scale image. It removes the noise without reducing the sharpness. The aim of image pre-processing is to improve the quality of the image in order to detect the tumor.

### *C. Segmentation*

I. **Otsu threshold** technique is one of the simplest methods of image segmentation. The input image is converted into binary image. It is one of the best methods to segment the image and to separate the tumor part in the image. This method is completely based on the threshold value. A grayscale image is converted into a binary (black and white) image by first choosing a grey level T in the original image, and then converting every pixel black or white according to whether its grey value is greater than or less than T.

$$g(x,y)=\begin{cases}1 & \text{If } f(x,y)\geq T\\ 0 & \text{If } f(x,y)<T\end{cases}$$

II. **K-means technique** is one of the unsupervised clustering because it has no training phase. Each cluster is represented by mean value in the cluster. It is an iterative process.
Two phases:

- First phase is select k centroid randomly or manually and
- The second phase is to measure the distance between each object and cluster centroid.

The distance is the difference between a pixel or a cluster center. The difference is based on the pixel color, intensity, texture and location or combination of these factors.

III. **Texture filtering** is concerned with automatically to determine the boundaries between various textured regions in an image.

### *D. AROC Curve*

It is one of the important evaluations to find the different model's performances. ROC represents probability curve. AUC is the degree or measure of separability. It tells us how much the model is able to discriminating between classes. Higher the AUC, predicting ability will be better. The ROC curve can be plotted as: y-axis denotes sensibility and x-axis denotes FPR.


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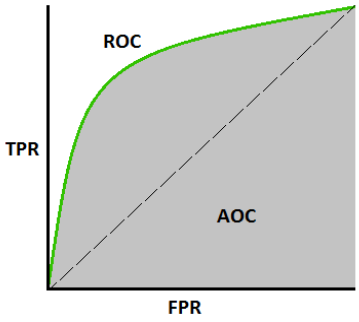


TPR (True Positive Rate) / Recall /Sensitivity:–

$$= \frac{TP}{TP + FN}$$

Specificity:-

$$= \frac{TN}{TN + FP}$$

FPR: -

FPR= 1 - Specificity

$$= \frac{FP}{TN + FP}$$

Either Area under curve region should be lesser or AUC near to 1 indicates the good separability measure. AUC near to 0 represents the worst separability measure. AUC near to 0.5 indicates that has no measure of separability.

## IV. IMPLEMENTATION

### *A. Dataset*

Datasets usually provide raw data for analysis.
The brain tumor dataset contains T1-weighted contrast enhanced images with two kinds of brain tumor. The goal of this dataset is to share in medical images of patients with brain tumors to facilitate the development and validation

## V. IMPLEMENTATION RESULTS

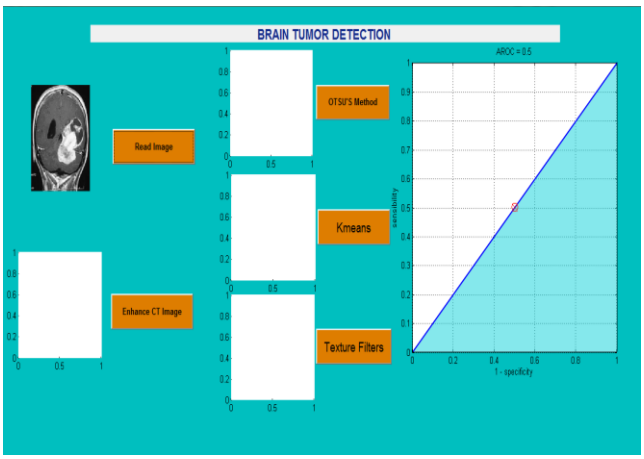


Fig. 1: Original image

Fig 1 defines the original image which is obtained from the MRI scan.

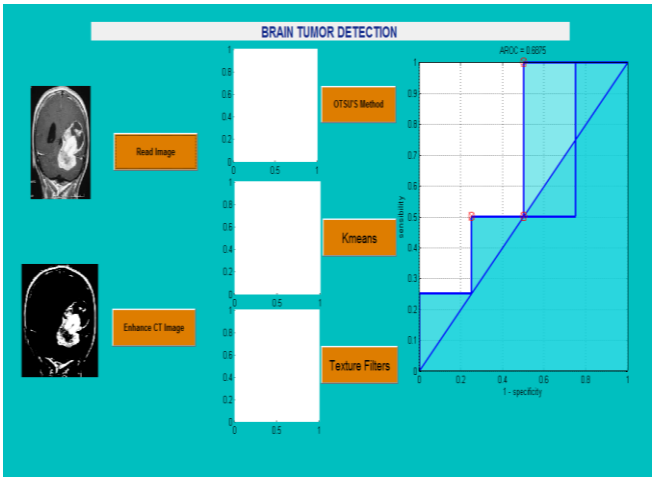


Fig. 2: Enhanced CT image

It is an improved image because it does not contain noise and edges are highlighted.

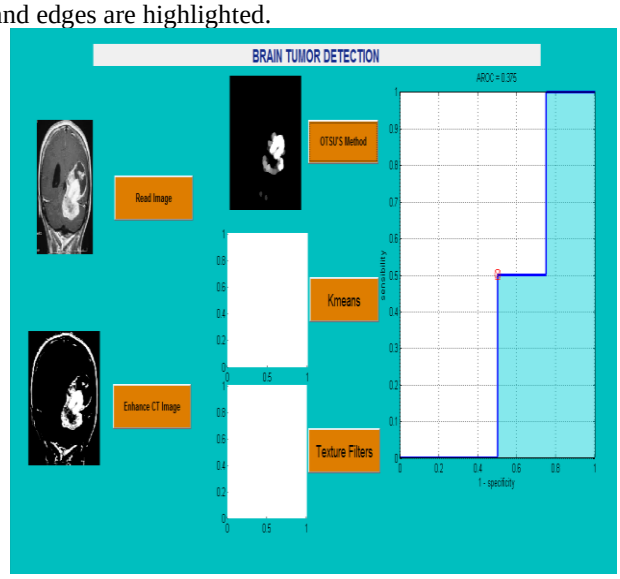


Fig.3: Otsu segmentation with AROC curve (0.375)

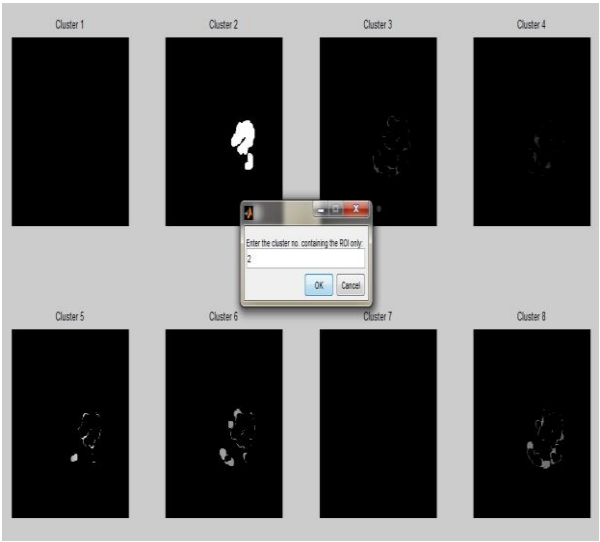


**Fig. 4: k-means clusters (cluster 2)**


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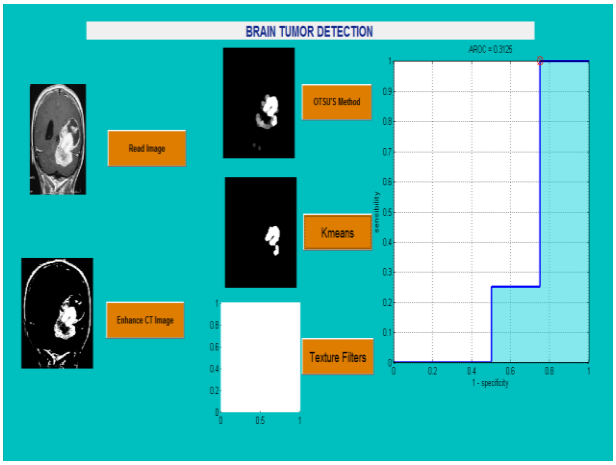


Fig. 5: K-means segmentation with AROC curve (0.3125)

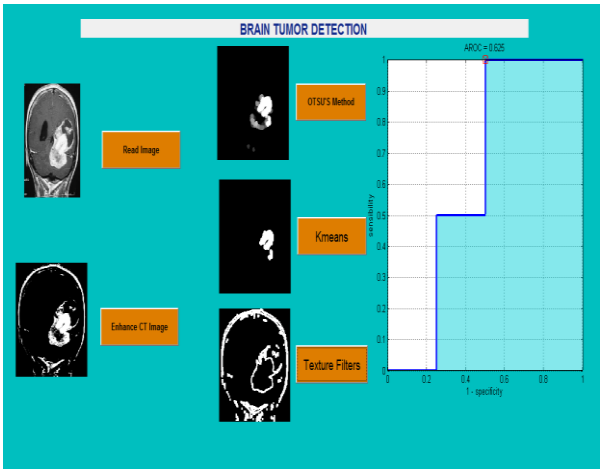


Fig. 6: Texture filtering with AROC curve (0.625)

K means has the lesser value of AROC (0.3125) and lesser region of area under curve when compared with Otsu (0.375) and texture filtering methods (0.625). Hence it has proven that k means has the major advantage over Otsu and texture filtering. K means segmentation technique best and efficient for segmentation.

## VI. CONCLUSION

The purpose of the paper is to study the different methods of segmentation based on the median filter. The proposed methodology has been developed to represent the performance of Otsu, k-means and texture filtering segmentation methods. Median filter is used to remove the noise present in the images and to improve the quality. The filtered image can be effectively used for the segmentation techniques. Otsu segmentation converts the gray level image into binary image so that segmented tumor region can be seen easily. K-means segmentation removes the unwanted portions in the whole image so that tumor region will be formed in a separate cluster. Texture filtering can be used to determine the boundaries. AROC curve can be used to measure the capacity of the model. Identify the best technique for segmentation through AROC curve can be easy and efficient.

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