

# Brain Tumor Segmentation of MRI Images Using SVM Classifier

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**Abstract:** Brain tumor segmentation of medical images is an important field in image processing and to obtain the similar images. The main aim of this paper is to detect the input query image is normal brain image or abnormal brain image. In this paper, in this paper four phases are used and they are pre-processing, converting an input image from RGB to HSV, segmentation and last is SVM classifier. Three segmentation techniques are discussed like Threshold based, Edge based, and Region based segmentation. Threshold based segmentation is based on HSV that convert to binary image from gray scale image. Edge based segmentation is based on canny edge detection algorithm and region based segmentation is based on detecting the regions of medical images globally. SVM classifier is used that is based RBF (Radial Basic Function) to classifying the brain images on normal image and abnormal image. Database consists of 20 brain medical images combination of both normal and abnormal tumor images. Experimental results show that selected query image is normal or abnormal brain tumor image.

**Keywords:** Magnetic Resonance Imaging (MRI), Segmentation techniques, support vector machine(SVM), Brain MRI Images.

## I. INTRODUCTION

One of the most complicated part in the human body that is difficult to recognize and diagnose is brain part that which start growing abnormal and unwanted tissues in brain and is harmed that is called as tumor meaning its abnormal brain. Main aim is if the tumors are present in MRI images in the brain they are shown accurately. The result is displayed in command window of MATLAB tool as the result will be abnormal image (tumor) and normal image (without tumor). Segmentation will extract the tumor cell which is present in MRI images such as white matter, gray matter in brain. Various segmentation methods used are Thresholding based segmentation on HSV color space, Edge based segmentation that use canny edge detection algorithm and region based segmentation that detects globally in entire image of brain MRI. For classification purpose SVM (support vector machine) is used to classify the normal and abnormal images. MRI stands for magnetic resonance imaging, the images of brain tumor are scanned and diagnosed by MRI scanner. Segmentation plays a very important role in medical images which describes that segmentation will divide the image into some parts or regions or some set of pixels meaning that representation of image is changed to something that is more meaningful and easier to detect and analyze whether it is normal or abnormal brain image. Preprocessing is done by removal of Gaussian noise by applying median filter to the input or query MRI image. Feature extraction is done by color and shape methods, for color feature extraction color moments are used and for shape only boundaries and region are extracted. Segmentation of brain MRI images is done by three methods first is threshold based segmentation for quantizing HSV color space, second edge based segmentation by using canny edge detection algorithm and third is region based segmentation based on global regions. Radial Basic Function kernel is used in SVM classification for finding normal and abnormal brain tumor images. Final result is shown in command window of MATLAB that the selected query image is normal or abnormal image.

## II. RELATED WORK

Priya Vermal et al. [1] the authors described about Gray Level Co- occurrence Matrix is used for texture feature extraction and K-fold Cross validation is used to show accurate result.

Abdullah-Al-Nahid et al.[2] the author describes the edges of brain tumor MRI images are detected by Canny edge detection algorithm and fuzzy logic based algorithm are used.

Dipali B.Birnale<sup>1</sup> et al. [3] the authors described about diagnosing the brain tumor images by SVM and another technique fuzzy c-means algorithm.

P. Kumar and B. Vijayakumar et al. [4], authors described wiener filter is used to remove the noise from query image in preprocessing step and histogram is used for extraction the edges and textures features skewness and standard deviation is applied from MRI brain images and PCA is done by co- occurrence matrix method that reduces some features which is unwanted part.

Mrs. M.C. Mrs. M.C. Hingane, Mr. Satish B. Matkar et al. [5], authors proposed for two contents for image retrieval systems they are first for feature extraction and other for feature reduction method. The feature extraction method is done by GLCM (Gray Level Co-occurrence Matrix) and DWT (Discrete Wavelet Transform) for extracting the main feature from the MRI image and for feature reduction PCA (Principal Component Analysis) method is used.

### III. PROPOSED SYSTEM

The proposed methodology describes about pre-processing phase, feature extraction method that is based on color and shape feature extraction techniques. Segmentation method is based on 3 different techniques that are threshold based segmentation, edge based segmentation and region based segmentation and lastly Radial Basic Function kernel based SVM to classify normal and abnormal images of brain tumor. Step by step explained below.

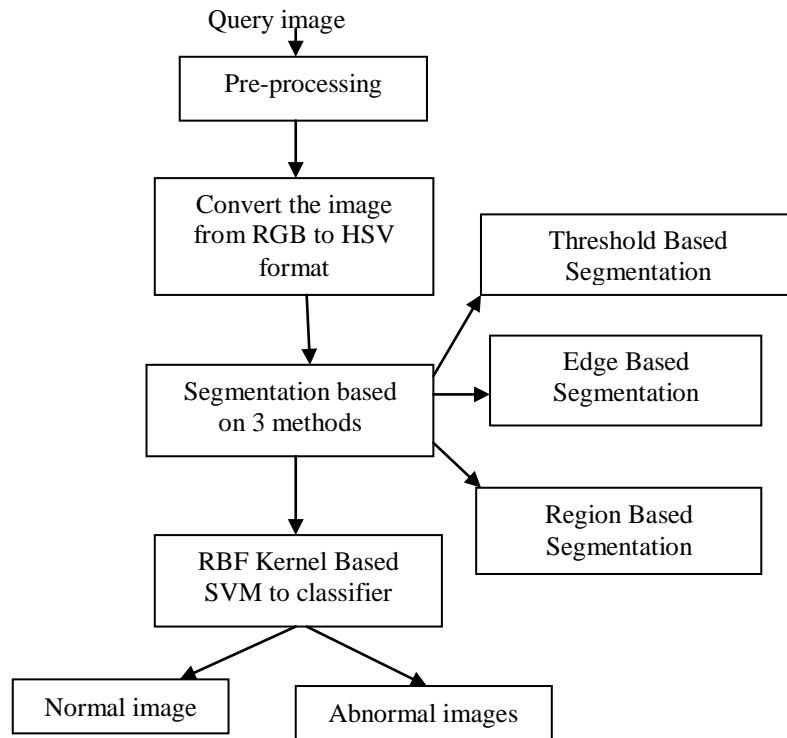


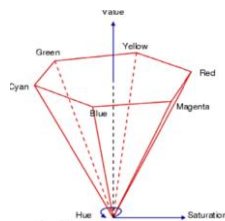
Figure shows the flow diagram of the system

#### A. Pre-processing

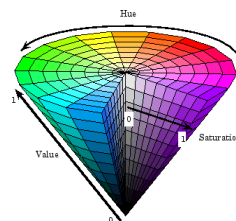
Here median filter is used to remove the noise in image and in median filtering the pixels have some neighboring pixels, these neighboring pixels are placed according to their numerical values or brightness. Center pixel have the median filter value.

#### B. Convert the image from RGB to HSV format

HSV represents color models for 3 features are hue represented in hexcone model that has three dimension. Hue describes for which color it belong to, Saturation describes how much purity the color is for an image and also saturation represents grayness of image, Here purity means measures only white color throughout an image.



Fig(a) HSV Coordinate system



(b) HSV color model

The formula to convert from RGB to HSV is given as

$$H = \begin{cases} \theta & \text{if } B \leq G \\ 360 - \theta & \text{if } B > G \end{cases}$$

$$\text{With } \theta = \cos^{-1} \left\{ \frac{\frac{1}{2}[(R-G)+(R-B)]}{\sqrt{[(R-G)^2+(R-B)(G-B)]^{1/2}}} \right\}$$

$$S = 1 - \frac{3}{(R+G+B)} [\text{Min}(R, G, B)]$$

$$I = \frac{1}{3} (R + G + B)$$

R,G,B consists of Red, Green and Blue values that ranges from 0-255. The input brain tumor image is converted to HSV model (Hue, Saturation and Value). Histogram quantization is applied for all 3 values and edges are detected using canny edge detection algorithm.

### C. Segmentation

Segmentation means it will divide the image into more than one parts such as set of pixels. The main aim of segmentation is the representation of image is changed in to something different that is more easy to analyze and easier to understand. Segmentation consists of 3 steps, Thresholding based segmentation (grayscale image is converted to binary image of brain MRI image). Edge based segmentation (to detect edges canny edge detection algorithm is used for brain MRI images). Region based segmentation (Based on similar matching character present in image they are divided into different regions and is based on similar characters)

Level-1 Threshold Based Segmentation: This is simplest method of image segmentation. From a grayscale brain MRI image, thresholding is used to create a binary image meaning input grayscale image is converted to binary image of brain MRI image.

Level-2 Edge Based Segmentation: Edge occurs on boundaries of brain MRI images. Edge based segmentation represents only the information about edges present in brain images.

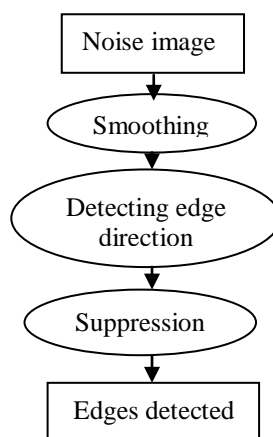


Figure shows the Canny edge detection procedure

Edge detection method plays important role in medical image application for detecting the objects. In industry, one of the standard edge detection technique used is Canny edge detection method. In MRI( Magnetic Resonance Imaging) brain images, the pixels having intensity values means numeric value that have edges which are discontinuities( changing the intensity values for each pixels). All pixels in brain images does not represent same intensity values they differ from one pixel to another pixel in an brain images. The following diagram represents the procedure of Canny edge detection algorithm

Level-3Region Based Segmentation: Two different representation of same object are the boundary and the region. Based on similar matching character present in image are divided into different regions and is based on similar characters.

### D. Support Vector Machine

Radial Basic Function (RBF) kernel is used in SVM classification for finding normal and abnormal brain tumor images. Support vector machine is called state-of-the art classification method. The main aim of using SVM is to classify the tumor and normal brain images. Aim of SVM is in between two datasets (collection of data, each data point represents some collected features of each data) intermediate hyper plane is present, this hyper plane indicates that for which class it belongs to weather the image is normal image or abnormal image. SVM is used for analyzing the data.

### E. RBF Kernel Based SVM

RBF kernel is a real-value function and that value depends on the distance from the origin so that  $\phi(x) = \phi(\|x\|)$  is the distance from the center  $c$  is given as  $\phi(x, c) = \phi(\|x - c\|)$ . any function  $\phi$  which satisfy this equation  $\phi(x) = \phi(\|x\|)$  is called radial function. So this RBF is used as kernel in SVM to classify the normal and abnormal image of brain tumor.

### F. Graphical User Interface

Graphical User Interface uses the icons that contains and make interactions with electronic device, windows and menus that will make use of commands instead of text that is displayed in computer monitor. GUI operating

system will take use of keyboards, mouse and also arrow keys. The examples of GUI are all users using Microsoft Windows, Chrome OS in day today life.

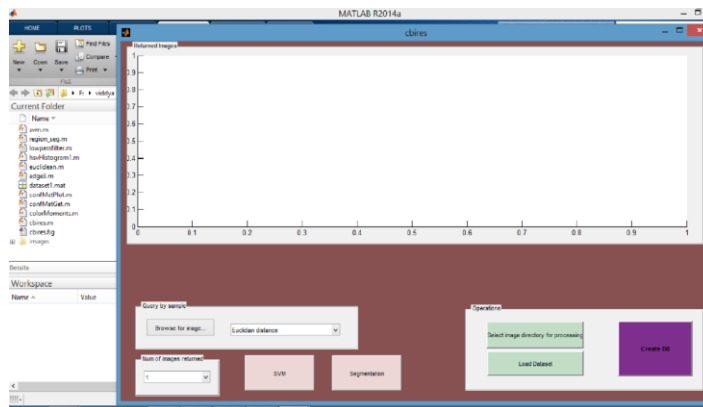
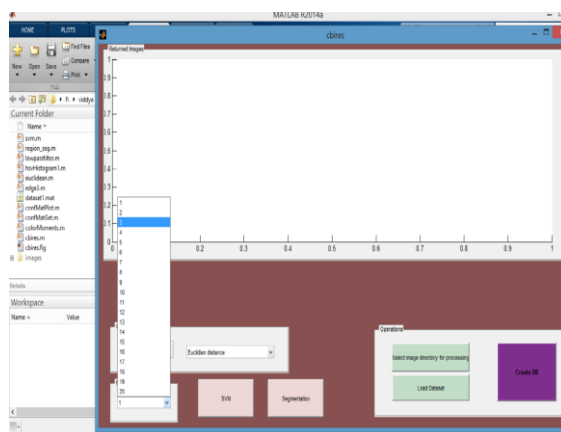


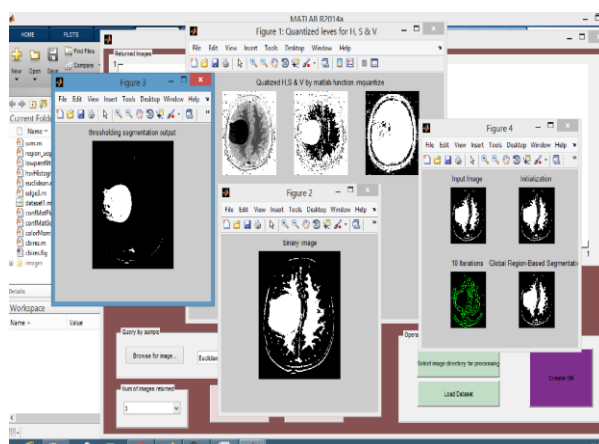
Figure shows that GUI was designed that contains control panel, inside control panel push buttons are added. Control panel consists of Query by sample, inside push button that includes browsing of image, to display the output axes are used that contains returned images that were retrieved from the database. Axes range from 0 to 1 from both horizontal and vertical axes.

#### IV. RESULTS AND DISCUSSION

First the database consists of 20 MRI brain images of normal image and tumor image. The final results are obtained in MATLAB R 2014a, operating system used is windows-8, and 4GB RAM.



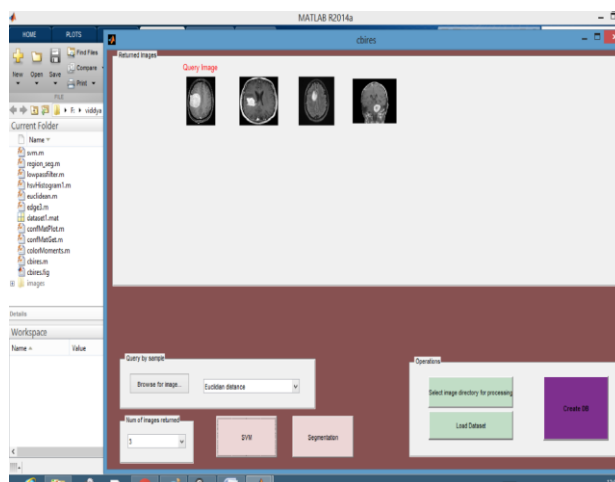
Figure(a)



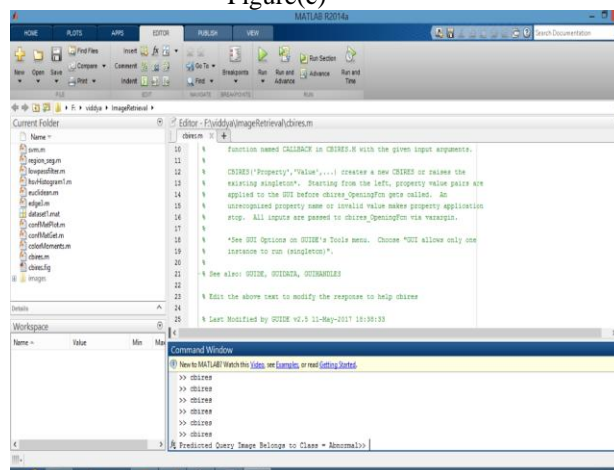
Figure(b)

As in above result figure(a), user select the number representing that how many images user want to retrieve, after that the next step is the user will select the segmentation icon as explained in proposed system the

segmentation has 3 methods that are threshold based segmentation which converts the gray scale image to binary image and RGB image is converted to HSV image. As in above result, figure(b) in that figures 1,2 and 3 are based on threshold based segmentation, the figure 4 is based on edge based segmentation and region based segmentation as they are explained in proposed system. In edge based segmentation only edges are detected with the help of canny edge detection algorithm, green lines showing edges are detected in the image and region based segmentation are detected globally means the whole image is captured and regions are detected to whole image.



Figure(c)



Figure(d)

As in above result figure(c), after segmentation the user clicks the icon on SVM button that is based on RBF kernel based SVM. In this support vector machine the radial basic function is used to classify the normal and abnormal images. After clicking on SVM button the 3 similar images are retrieved based on query image. The result shown in command window that the retrieved image is abnormal image. Results in figure(d) the final output will be displayed in command window showing that user selected query image is normal or abnormal. So here the user selected query image is abnormal image showing final output in command window.

### V. CONCLUSIONS

This paper uses MATLAB R2014 tool to study the medical image dataset values and for segmentation three methods are used they are thresholding based segmentation to convert input RGB image to HSV image and converted to binary image. Edge based segmentation will detect the edges based on canny edge detection algorithm and region based segmentation will detect on entire image that is called as global region based segmentation. To classify the normal and abnormal images SVM classifier is used that is based on RBF Kernel based SVM is used. The final message is displayed in command window as the selected input query image is normal or abnormal tumor brain image.

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