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Brain Tumor Segmentation using Berkeley Wavelet Transform

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Abstract: *Segmentation of image in MRI is becoming very important in image processing. The division of image into segments is known as image segmentation. It is used in the application of object detection, content based image retrieval, machine vision, and medical imaging including volume rendered images from computed tomography and Magnetic Resonance Imaging, Recognition task and many others. It is mostly used in the application of image compression or object recognition. Image segmentation includes various segmentation technique based on the shape, size and intensity of the image. In this paper we have discussed about the BWT segmentation, feature extraction using GLCM and feature selection using SVM for segmenting the tumor image, the accuracy level is increased up to 90% compared with the existing algorithm*
Key Word: *Image Processing, MRI, BWT, Feature extraction, Segmentation Technique.*

I. INTRODUCTION

School Detecting the location of tumor in MRI image is very difficult. MRI and CT scan gives wide information and plays a major role in finding tumor. Brain cancer is the fifth cancer type with high mortality rate where 18020 adults are dying in a year because of brain tumor.

Different types of tumor occur for different places some related to genetically and some are unknown, a new scare is the exposure to radiofrequency waves from mobile phones, the WHO notice that radiofrequency electromagnetic field, linked to phones are carcinogenic and the risk is increased with increasing use of mobile phones. More than millions of people are dying due to brain tumor.

The order of tumor is classified based on the mortality

1. Stomach cancer
2. Uterine cancer
3. Breast cancer
4. Oesophageal cancer
5. Brain cancer

The World Health Organization classify 120 variety of brain tumor based on the region, tissue, cancerous or noncancerous cells, primary or secondary cells and finally based on the essential factors, Generally the brain tumor is classified as benign or malignant (Clark et al., 1998; Cobzas et al., 2007), benign is a noncancerous cells which seldom grows and does not spread immediately to the neighboring tissue of the brain. Malignant is a cancerous tissue, which spread immediately to the neighboring tissue. Automatic segmentation say whether it is benign or malignant hence automatic segmenting algorithm is used, early detection helps to find whether it is benign or malignant.

II.LITERATURE SURVEY

The segmentation algorithm is classified into four they are

i) Threshold based segmentation
ii) Edge based segmentation
iii) Region based segmentation
iv) Clustering based segmentation.

III.SEGMENTATION BASED ON EDGE DETECTION

Edge based segmentation: Edge detection is one of the important steps, in an object edge define the boundary. The edge detection identify the points in which the brightness of the pixel changes suddenly, edge detection are used in the area of feature detection and extraction.

The algorithm used in the segmentation of edge detection is mainly used for the accuracy of detecting the edges and to reduce the noise.

The two most edge detection algorithm is
1. Gray histogram
2. Gradient based method

1. **GRAY HISTOGRAM**: based on the threshold value foreground is separated from background; selection of the threshold value is difficult due to the presence of noise. Segmentation occurs by selecting a threshold value T. Gary histogram technique separate foreground to background. The disadvantage in this technique is the presence of noise, so that selecting the threshold value is very hard.

2. **GRADIENT BASED METHOD**: derivative of digital image f(x,y) occurs when there is difference in the intensity of neighboring edge. The closed boundaries are formed when the maximum value of gradient magnitude was pointed with difference in the intensity. The maximum value of gradient magnitude is called edge pixels (Aswathy et al., 2014). Various type of operators are used in gradient based method, the operators are sobel operator, Laplace operator, canny operator, Laplacian of Gaussian Operator(LOG) etc., sobel operator take minimum time when compared with canny operator, but canny operator is mostly used. In image processing, machine vision

THRESHOLD BASED SEGMENTATION
Threshold based method is classified into two
i) global thresholding
ii) Local thresholding.

In global thresholding the value is same throughout the image, it is faster when compared with local thresholding example of global thresholding which is mostly used is otsu method .In local threshold, the threshold value is not same, local threshold methods is a simple statistical thresholding.

IV.CLUSTERING BASED SEGMENTATION

The generally used clustering techniques are k-means clustering, fuzzy c-means clustering and hierarchal clustering. In k-means clustering (Ahmed et al., 2002) the grouping occurs because of the properties of the pixels, k-means cluster is also known as hard clusters because of the cluster membership in the individual pixels. Each pixels in an image has the cluster membership, the cluster membership depends on the centre of the cluster

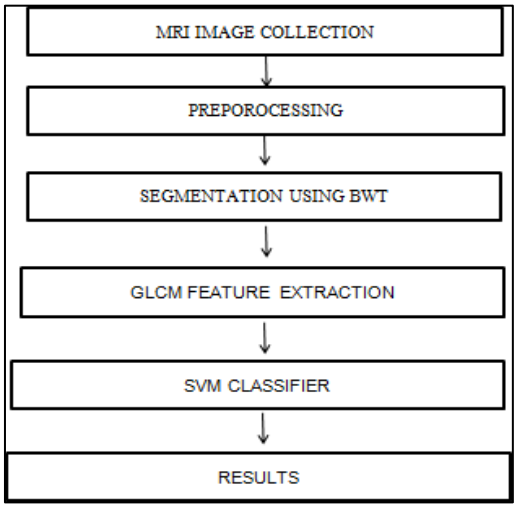
EXISTING WORK

Generally the brain tumor segmenta\tion has the following three steps they are

- Preprocessing
- Region of interest
- Optimization

The MRI image contains the unwa\nted noise and distortion these can be removed by using median filter before The image contains the essential feature such as edge information, median filter is used because it does not affect the edge information and reduce the distortion. Region of interest is used forsegmenting the tumor image; the optimization gives the segmented results.

V.PROPOSED WORK



Block diagram

The proposed methodology includes the following steps

i) Read the input image
ii) Pre-processing of the image
iii) Perform the two levels of morphological reconstruction
iv) Perform BWT algorithm
v) For further segmentation GLCM feature extraction
vi) Analyze the accurate region selection
vii) Measure the accuracy, sensitivity and specificity

MRI IMAGE COLLECTION

The data collected are grouped into two kinds—healthy brain images and unhealthy brain images. Among the 66 patients, 22 patients have normal MRI brain images and the rest 44 collect in the abnormal MRI brain image category from the Harvard Medical School website (http://med.harvard.edu/AANLIB/). The MRI brain image obtained from the database were in the form of an axial plane T2-weighted, and 256 × 256 pixels

PREPROCESSING

The input MRI image consists of distortion and artifacts, for segmentation the input MRI image should be free from noise and artifacts, hence median filter is used. Median filter reduce the distortion without affecting the essential features of the image

MEDIAN FILTER

Median filter is used as an non linear filter. The pixel value in the neighbourhood is calculated and the neighbourhood middle pixel value is replaced by the calculated value. The expression for calculating the median filter

$f(x,y)= \text{median}\{g(s,t)\}$ where (x,y) belongs to Sxy

Sxy is the set of coordinates in a rectangular sub image window at (x,y) center

SEGMENTATION USING BWT

Segmentation is used to identify the tumor infected area from the MR images. The Berkeley wavelet transformation uses two-dimensional triadic wavelet transformation and a complete, orthonormal basis, and hence it is very ideal for the identification of the area of interest from the MR images. The BWT converges repetitively from one level to n number of levels and decomposes the other part of the image at a very fast rate. In the initial stage, the enhanced brain MRI image is transformed into a binary image with a cut-off level of 117. Pixels with values larger than the defined level are converted to white, whereas the remaining pixels are marked as black, resulting in the development of two distinct regions around the infected tumor tissues. In the second stage, the morphological erosion procedure is used to remove white pixels. Finally, the region is divided into destruction and identical areas, and the area of the omitted black pixels of the erosion process is counted as the MR image mask for the brain. BWT consists of eight major mother wavelets grouped into four pairs, each pair having different 0, 45, 90, and 135 degrees aspects. Inside each pair of wavelet transforms, some wavelet has odd symmetry, while another wavelet also has symmetry.

BWT ALGORITHM STEPS

i) Initially calculate scaling and translation process
ii) Convert spatial form to temporal domain form
iii) Simplification of image conversion
iv) Calculation of mother wavelet is partially fixed
v) Apply the morphological technique
vi) Rescheduling the pixels
vii) Removing artifacts on the edge of the image

GLCM FEATURE EXTRACTION

GLCM stands for Gray Level Feature extraction, It obeys two measures for the characteristics of images, GLCM feature is initiated and Texture characteristics of the image is determined. Many texture feature are available, the proposed system used in this is Entropy, Energy, Correlation, Contrast, Homogenesity

COMPUTER CODE SPECIFICATION

MATLAB stands for matrix laboratory. it's a numerical computing setting and high performance language for technical computing. It integrates computation, visual image, associate degreed performance in an easy-to-use setting wherever issues and solutions area unit expressed in acquainted notational system. Typical uses embody mathematics and computation algorithmic rule development, information acquisition modeling, simulation and prototyping information analysis, exploration and together with graphical computer programmed building.

Its associate degree interactive system whose basic information component is associate degree arrays this doesn't need orientating. This permit you to resolve several technical computing issues, particularly those with matrix and vector formulations, in an exceedingly fraction of the time it might fancy write a program in an exceedingly scalar non-interactive

language like C or algebraic language .The feature of MATLAB may be a family of add-on application specific solutions referred to as toolboxes. Vital to most users of MATLAB, tool case permits America to find out and apply specialized technology. Areas within which toolboxes area unit offered embody signal process, management systems, neural networks, symbolic logic, wavelets, simulation, and lots of others. In business, MATLAB is that the tool of selection for higher productivity analysis, development, and analysis.

MATLAB options a family of application specific solutions referred to as toolboxes. Vital to most users of MATLAB, toolboxes permit you to find out and apply specialized technology. Toolboxes area unit comprehensive assortment of MATLAB functions that reach the MATLAB setting to resolve specific categories of issues.

MATLAB was originally written to supply quick access to matrix computer code developed by the LINPACK and EISPACK comes, that along represent the state of the art in computer code for matrix computation. MATLAB has evolved over a amount of years with input from several users. In university environments, it's the quality educational tool for introductory and advanced courses in arithmetic, engineering and science.

The image process tool case in MATLAB provides a comprehensive set of reference-standard algorithms and graphical tools for image process, analysis, visualizations, and algorithmic rule development. The individual will perform image sweetening, image declaring, feature detection, noise reduction, image segmentation, spatial transformations, and image registration. several functions within the tool case area unit multithreaded to require advantage of multicore and pc} computer

- Introduction and key options
- Importing and exportation pictures
- Displaying and exploring pictures
- Preprocessing and post process pictures
- Analyzing pictures

MATLAB TOOL CASE

The matlab system consists of 5 main components

- Development setting
- MATLAB function library
- MATLAB language
- Graphics
- MATLAB computer program interface(API)

DEVELOPMENT SETTING

This is the set of tools that facilitate to use MATLAB functions and files. Several of those tools area unit graphical user interfaces. It includes the MATLAB desktop and command window, a command history, associate degree editor and computer program, and browsers for viewing facilitate the space, files, and also the search path.

MATLAB FUNCTION LIBRARY

This is a massive assortment of machine algorithmic rule starting from elementary functions, like sum, sine, cosine, and complicated arithmetic. The foremost subtle functions like matrix inverse, matrix Eigen values and quick Fourier rework.

MATLAB LANGUAGE

This is a high level matrix/array language with management flow statements, functions, information structures, input/output, and object-oriented programming options. It permit each programming within the little to speedily produce fast and dirty throw array program and “programming within the massive” to make complete large and complicated application programs.

HANDLE GRAPHICS

MATLAB has in depth facilities for displaying vectors and matrices as graphs, also as expanding upon and printing these graphs. It includes high level functions for 2 dimensional and 3 dimensional information visual image, image process, animation, and presentation graphics. It conjointly includes low-level functions that permit to completely customise the looks of graphics also on build complete graphical user interfaces on MATLAB applications.

MATLAB COMPUTER PROGRAM INTERFACE (API)

This is a library that enables writing C and algebraic language programs that move with MATLAB. It includes facilities for career routines from MATLAB (dynamic linking), career MATLAB as a machine engine, and for reading and writing MAT-files

KEY OPTIONS

- Image sweetening, filtering, and deblurring
- Image analysis, together with segmentation, morphology, feature extraction, and activity
- Spatial transformations and image registration
- Workflows for process, displaying, and navigating randomly massive pictures
- Modular interactive tools, together with ROI choices, histograms, and distance measurements

VI.EXPERIMENTAL RESULTS AND CONCLUSION

The input MRI image is shown

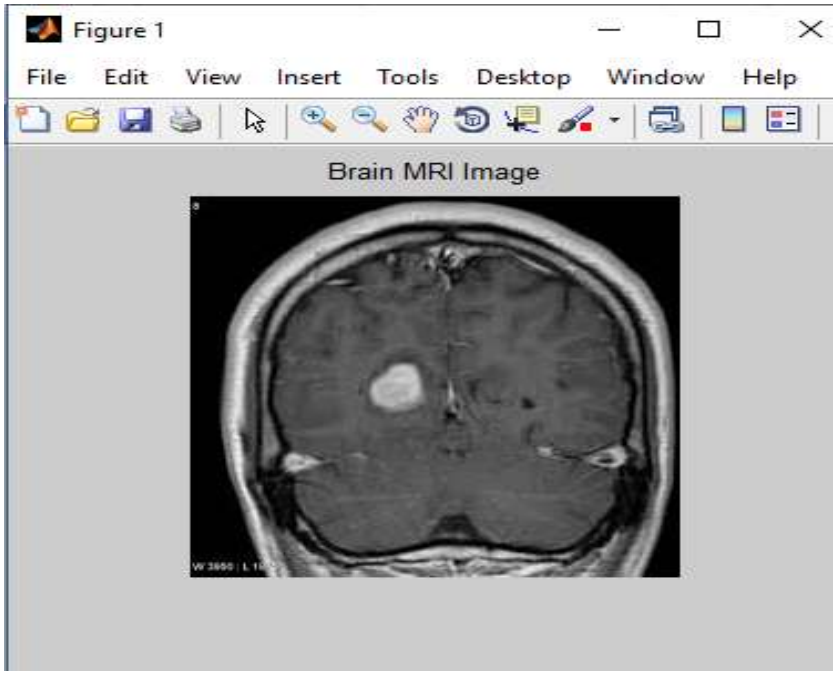


Fig Input image

STEP 2

The output of background minimized image is segmented using the thresholding method and the output is shown

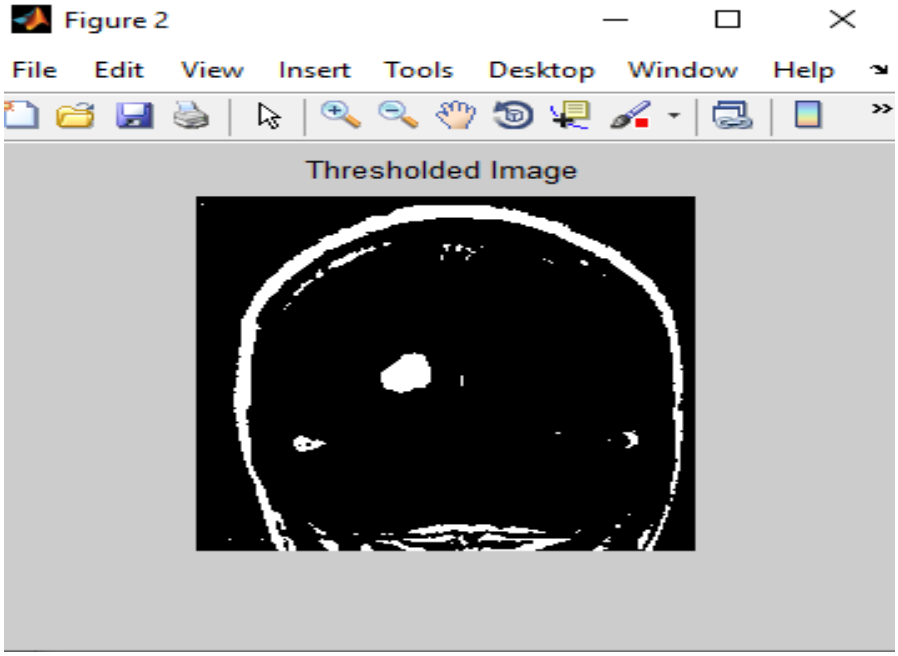


Fig Output of thresholding image

STEP 3

The thresholded image is segmented by using BWT, GLCM feature extraction and SVM classifier and output is shown

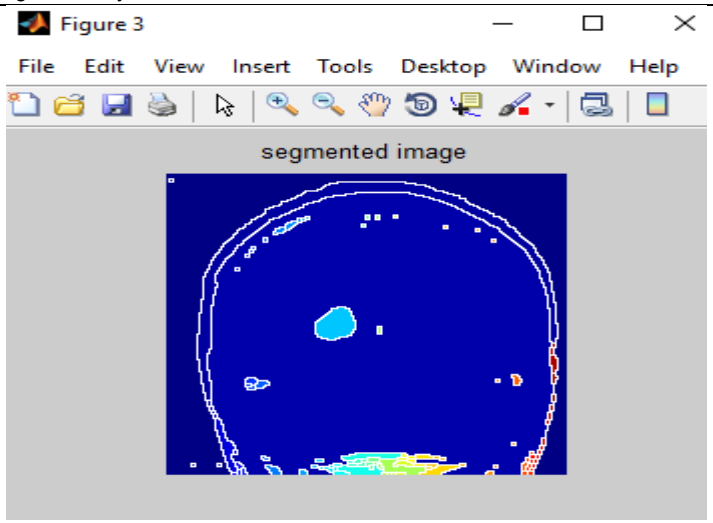


Fig segmented image

STEP 4

The final output shows whether the brain tumor image is benign or malignant tumor

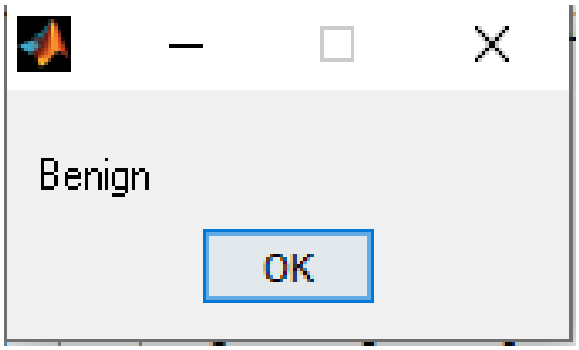


Fig image shows the brain tumor is benign

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