International Journal of Electrical and Electronics Engineers
Vol. No. 9, Issue No. 01, January-June 2017
ISSN (O) 2321-2055
ISSN (P) 2321-2045

BRAIN TUMOR DETECTION AND LOCATION FROM MRI IMAGES USING MATLAB

Sanjay Kumar Singh[1], Sujeet Kumar Soni[2], Dr. Manish Khemariya[3]

[1]M.Tech Scholar, [2]Assistant Professor, [3]Professor

Dept. of Electrical & Electronics Engineering, LNCT Bhopal (India)

ABSTRACT

In the field of Medical image processing the Extraction of brain tumor from magnetic resonance image (MRI) has become one of the most profound and active research nowadays. This paper describes the proposed strategy about detection, extraction and location of brain tumor from MRI scan. This system comprises of noise removal functions, segmentation and morphological operations which are the basic concepts of image processing. The experimental results indicate that the proposed method efficiently detect and locate the tumor region from the brain image using MATLAB Tool.

Keywords: ***MRI, Segmentation, Morphology, Direction,MATLAB.***

I. INTRODUCTION

A brain tumor is an abnormal growth of tissue in the brain or central spine that can cause improper brain function. Brain tumor is classified into two types benign and malignant where benign is non-cancerous and less harmful whereas malignant is cancerous and spreads rapidly reaching to other brain tissue with lethal nature. Further malignant tumor is classified into two types as primary and secondary. Primary tumors are those that originate in the brain. Secondary tumors are those that originate in some other part of the body finally reaching the brain through the process of metastasis.

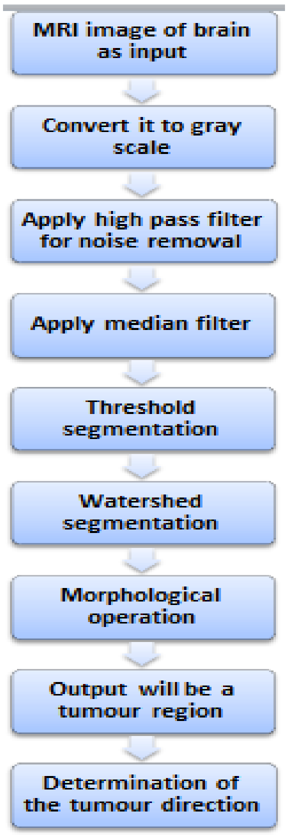
In order to properly diagnose and examine the brain tumor it is important to identify and detect the exact location of its existence. There are various method like CT Scan, X-ray, MRI etc. available in present era for brain tumor detection but MRI (Magnetic resonance imaging) is a non-invasive method and uses powerful magnet and radio waves to provides visual details about the anatomy and the overall structure of the brain and can be used to examine the blood supply inside the brain for detecting abnormality also tracking the progress or growth of the disease.

Normally an MRI image is unclear having noise which leaves the medical practitioner uncertain about the precise proximity of the brain tumor. This paper mainly deals with enhancement of the MRI image using noise removal functions, segmentation and morphological operations which will provide the clear contour about the brain tumor.

II. PROPOSED METHOD

The algorithm has two stages, first is pre-processing of given MRI image and after that segmentation and then performs morphological operations. Steps performed in the algorithm are depicted in the flowdiagram below.

International Journal of Electrical and Electronics Engineers
Vol. No. 9, Issue No. 01, January-June 2017
ISSN (O) 2321-2055
ISSN (P) 2321-2045



All above steps of flow diagrams are explained here in detail.

A. Grayscale Imaging

MRI images are magnetic resonance images which can beacquired on computer when a patient is scanned by MRImachine. We can acquire MRI images of the part of the bodywhich is under test or desired. Generally when we see MRIimages on computer they look like black and white images.In analog practice, gray scale imaging is sometimes called"black and white," but technically this is a misnomer. In trueblack and white, also known as halftone, the only possibleshades are pure black and pure white. The illusion of grayshading in a halftone image is obtained by rendering theimage as a grid of black dots on a white background (or vice versa),with the sizes of the individual dots determining theapparent lightness of the gray in their vicinity. The halftonetechnique is commonly used for printing photographs innewspapers and as MRI image is taken on computer then Inthe case of transmitted light (for example, the image on acomputer display), the brightness levels of the red (R), green(G) and blue (B) components are each represented as anumber from decimal 0 to 255, or binary 00000000 to11111111. For every pixel in a red-green-blue (RGB)grayscale image, R = G = B. The lightness of the gray isdirectly proportional to the number representing thebrightness levels of the primary colors. Black is representedby R = G = B = 0 or R = G = B = 00000000, and white is represented by R = G = B = 255 or R = G = B = 11111111.Because there are 8 bit s in the binary representation of thegray level, this imaging method is called 8-bit grayscale. Grayscale is a range of shades of gray without apparent color. The darkest possible shade is black, which is the total absence of transmitted or reflected light. The lightest possible shade is white, the total

International Journal of Electrical and Electronics Engineers
Vol. No. 9, Issue No. 01, January-June 2017
ISSN (O) 2321-2055
ISSN (P) 2321-2045

transmission or reflection of light at all visible wavelengths. So because of the above reasons firstwe convert our MRI image to be pre-processed in grayscaleimage.

B. High Pass Filter

After that image is given as an input to high pass filter. Ahigh pass filter is the basis for most sharpening methods. Animage is sharpened when contrast is enhanced betweenadjoining areas with little variation in brightness or darkness.A high pass filter tends to retain the high frequencyinformation within an image while reducing the lowfrequency information. The kernel of the high pass filter isdesigned to increase the brightness of the centre pixel relativeto neighbouring pixels. The kernel array usually contains asingle positive value at its centre, which is completelysurrounded by negative values.

C. Median Filter

In signal processing, it is often desirable to be able toperform some kind of noise reduction on an image or signal.The median filter is a nonlinear digital filtering technique,often used to remove noise. Such noise reduction is a typicalpre-processing step to improve the results of later processing(for example, edge detection on an image). Median filtering isvery widely used in digital image processing because, undercertain conditions, it preserves edges while removing noise.The main idea of the median filter is to run through thesignal entry by entry, replacing each entry with the median ofneighbouring entries. The pattern of neighbours is called the"window", which slides, entry by entry, over the entire signal.For 1D signals, the most obvious window is just the first fewpreceding and following entries, whereas for 2D (or higher dimensional)signals such as images, more complex windowpatterns are possible (such as "box" or "cross" patterns). Notethat if the window has an odd number of entries, thenthe median is simple to define: it is just the middle value afterall the entries in the window are sorted numerically. For aneven number of entries, there is more than one possiblemedian. This filter enhances the quality of the MRI image.

D. Threshold Segmentation

The simplest method of image segmentation is calledthe thresholding method. This method is based on a clip-level(or a threshold value) to turn a gray-scale image into a binaryimage.The key of this method is to select the threshold value (orvalues when multiple-levels are selected). Several popularmethods are used in industry including the maximum entropymethod, Otsu's method (maximum variance), and etall. K-means clustering can also be used. In computervision, Segmentation is the process of partitioning a digital
image into multiple segments (sets of pixels, also known as super pixels). The goal of segmentation is to simplify and/orchange the representation of an image into something that ismore meaningful and easier to analyze.[1] Image segmentationis typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation isthe process of assigning a label to every pixel in an imagesuch that pixels with the same label share certain visualcharacteristics.The result of image segmentation is a set of segments thatcollectively cover the entire image, or a setof contours extracted from the image (see edge detection).Each of the pixels in a region are similar with respect to somecharacteristic or computed property, such as color, intensity,or texture. Adjacent regions are significantly different withrespect to the same characteristic(s).[1] When

International Journal of Electrical and Electronics Engineers
Vol. No. 9, Issue No. 01, January-June 2017
ISSN (O) 2321-2055
ISSN (P) 2321-2045

applied to astack of images, typical in Medical imaging, the resultingcontours after image segmentation can be used to create 3Dreconstructions with the help of interpolation algorithmslike Marching cubes.

E. Watershed segmentation

A grey-level image may be seen as a topographic relief,where the grey level of a pixel is interpreted as its altitude inthe relief. A drop of water falling on a topographic reliefflows along a path to finally reach a local minimum.Intuitively, the watershed of a relief corresponds to the limitsof the adjacent catchment basins of the drops of water.In image processing, different watershed lines may becomputed. In graphs, some may be defined on the nodes, onthe edges, or hybrid lines on both nodes and edges.Watersheds may also be defined in the continuous domain. There are also many different algorithms to computewatersheds.

Meyer's flooding Watershed Algorithm

One of the most common watershed algorithms wasintroduced by F. Meyer in the early 90's.The algorithm works on a gray scale image. During thesuccessive flooding of the grey value relief, watersheds withadjacent catchment basins are constructed. This floodingprocess is performed on the gradient image, i.e. the basinsshould emerge along the edges. Normally this will lead to anover-segmentation of the image, especially for noisy imagematerial, e.g. medical CT data. Either the image must be pre-processedor the regions must be merged on the basis of asimilarity criterion afterwards.

1. A set of markers, pixels where the flooding shall start, arechosen. Each is given a different label.
2. The neighbouring pixels of each marked area areinsertedinto a priority queue with a priority level correspondingto the gray level of the pixel.
3. The pixel with the highest priority level isextracted fromthe priority queue. If the neighbours of the extracted pixelthat have already been labelled all have the same label,then the pixel is labelled with their label. All non-markedneighbours that are not yet in the priority queue are putinto the priority queue.
4.Redo step 3 until the priority queue is empty.

The non-labelled pixels are the watershed lines.

F. Morphological Operations

Morphological image processing is a collection of nonlinearoperations related to the shape or morphology offeatures in an image. According to Wikipedia, morphologicaloperations rely only on the relative ordering of pixel values, not on their numerical values, and therefore are especially suited to the processing of binary images. Morphological operations can also be applied to greyscale images such that their light transfer functions re unknown and therefore their absolute pixel values are of no or minor interest. Morphological techniques probe an image with a small shape or template called a structuring element. The structuring element is positioned at all possible locations in the image and it is compared with the corresponding neighbourhood of pixels. Some operations test whether the element "fits" withinthe neighbourhood, while others test whether it "hits" orintersects the neighbourhood:

A morphological operation on a binary image creates a newbinary image in which the pixel has a non-zero value only ifthe test is successful at that location in the input image.The structuring element is a small binary image, i.e. a smallmatrix of pixels, each with a value of zero or one:

International Journal of Electrical and Electronics Engineers
Vol. No. 9, Issue No. 01, January-June 2017
ISSN (O) 2321-2055
ISSN (P) 2321-2045

- The matrix dimensions specify the *size* of thestructuring element.
- The pattern of ones and zeros specifies the *shape* ofthe structuring element.
- An origin of the structuring element is usually one ofits pixels, although generally the origin can beoutside the structuring element.

G. Direction determination

- This step determines the direction of the tumor in theMRI Scan.i.e. whether the MRI scan has tumor in left side of the brain or right side of the brain.
- In case the tumor is located in the middle then the algorithm would display as can't say.

III. RESULT AND DISCUSSION

The following figures shows the input MRI scan is been treated through various process to detect and extract the tumor from MRI Scan.i.egrayscale image, high pass filtered image , threshold image, watershed segmented image, Finally input image and extracted tumor from MRI image. For this purpose real time patient data is taken for analysis. As tumor in MRI image have intensity more than that of its background so it become very easy tolocate and extract it from a MRI image.

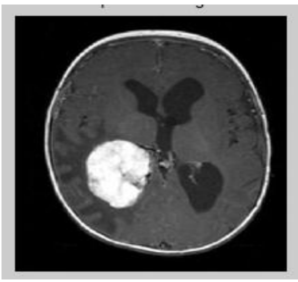
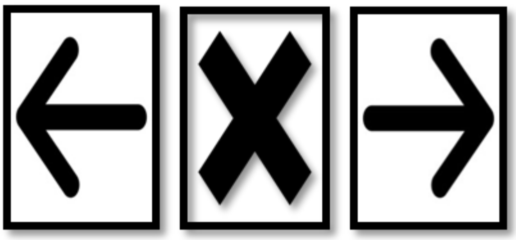


Fig. 1 Input MRI image of tumor affected brain



Left directioncan'tsay Right direction

Fig. 2 Input direction image of the tumor(i.e. left direction, can'tsay and right direction)

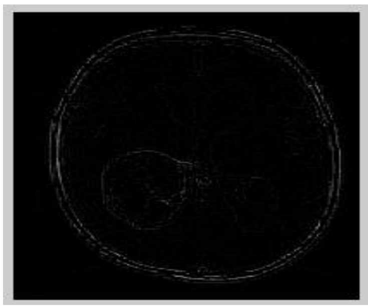


Fig. 3 Grayscale image of the fig. 1 **Fig. 4 HPF output of fig.3 image**

ISSN (O) 2321-2055
ISSN (P) 2321-2045

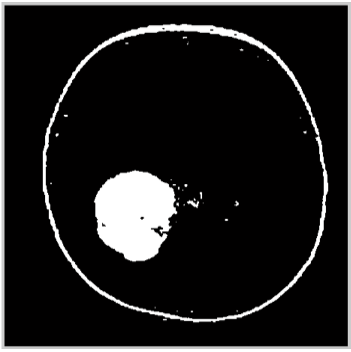


Fig. 5 Enhanced MRI image of fig.4 **Fig.6 Threshold segmented image of i/p image**

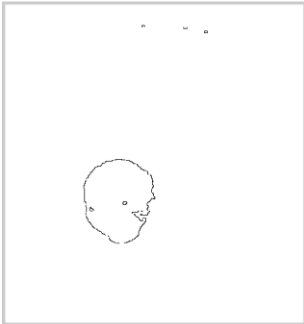


Fig.7 Watershed segmented image of i/p image

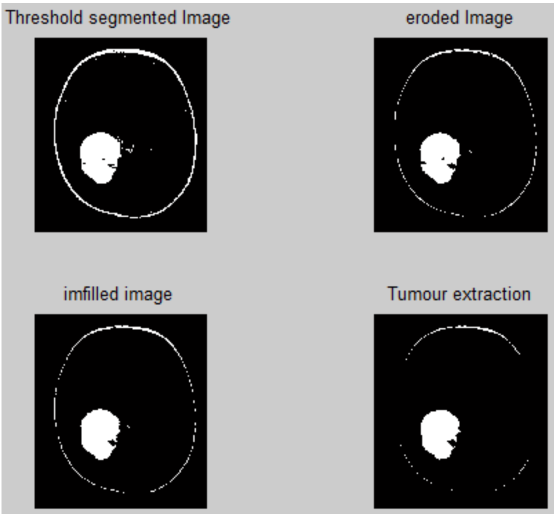
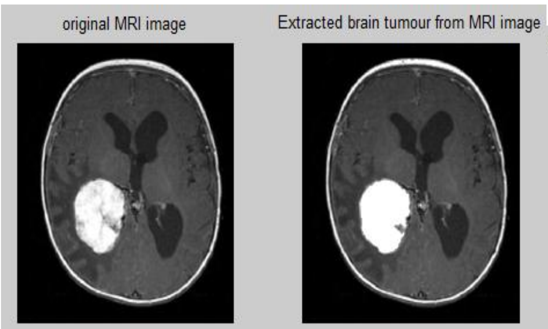


Fig. 8 Morphological operation



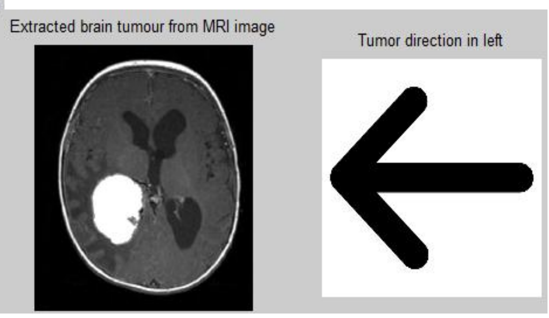


Fig. 9 Final Extracted brain tumor from MRI image **Fig.10 Final the direction of the Extracted brain tumor from MRI image**

IV. FUTUREWORK

In future this programme can be done more advanced so that tumor can be classified according to its type and its mass can be determined.Also can be used to detect anddetermine tumors in several parts of human body such as lungs, bone cancer, and other typesof tumors where the accuracy of tissue edge is profound.

REFERENES

[1] W. Gonzalez, “Digital Image Processing”, 2nd ed. Prentice Hall, Year of Publication 2008, Page no 378.

[2] S. Murugavalli, V.Rajamani, “A high speed parallel fuzzy c-mean algorithm for brain tumorsegmentation”,” BIME Journal”, Vol. no: 06, Issue (1), Dec., 2006

[3] Mohamed Lamine Toure, “Advanced Algorithm for Brain Segmentation using Fuzzy to Localize Cancer and Epilepsy Region”, International Conference on Electronics and Information Engineering (ICEIE 2010), Vol. no 2.

[4] Dr.G.Padmavathi, Mr.M.Muthukumar and Mr. Suresh Kumar Thakur,“Nonlinear Image segmentation using fuzzy c means clustering methodwith thresholding for underwater images”, IJCSI International Journal of Computer Science Issues, Vol. 7, Issue 3, No 9, May 2010

[5] Matei Mancas, Bernard Gosselin, Benoît macq, “Segmentation Using aRegion Growing Thresholding”

[6] T .Logeswari and M.Karnan “An improved implementation of braintumor detection using segmentation based on soft computing” Journal ofCancer Research and Experimental Oncology Vol. 2(1) pp. 006-014,March, 2010

[7] Wankai Deng, Wei Xiao, Chao Pan, Jianguo Liu Key “MRI brain tumor Segmentation based on improved fuzzy c-means” Method. Laboratory ofEducation Ministry for Image Processing and Intelligence ControlInstitute for Pattern Recognition and Artificial Intelligence SPIE Vol.7497, 74972N, 2009