BRAIN TUMOR EXTRACTION FROM MRI IMAGES USING MATLAB

JAHNAVI REDDY G – PES1201801127

SURABHI S – PES1201800849

INTRODUCTION

- A brain tumor is a collection, or mass, of abnormal cells in your brain. Your skull, which encloses your brain, is very rigid. Any growth inside such a restricted space can cause problems.
- Brain tumors can be cancerous (malignant) or noncancerous (benign). When benign or malignant tumors grow, they can cause the pressure inside your skull to increase. This can cause brain damage, and it can be life-threatening.
- Brain tumors are categorized as primary or secondary. A primary brain tumor originates in your brain. Many primary brain tumors are benign. A secondary brain tumor, also known as a metastatic brain tumor, occurs when cancer cells spread to your brain from another organ, such as your lung or breast.

MAGNETIC RESONANCE IMAGING(MRI)

- Magnetic Resonance Imaging (MRI) is an advanced medical imaging technique used to produce high quality images of the parts contained in the human body.
- MRI imaging is often used when treating brain tumors, ankle, and foot.
- From these high-resolution images, we can derive detailed anatomical information to examine human brain development and discover abnormalities.

METHODOLOGY

The algorithm has two stages, first is pre-processing of given MRI image and after that segmentation and then perform morphological operations. Steps of algorithm are as following:

1) Give MRI image of brain as input.
2) Convert it to gray scale image.
3) Compute threshold segmentation.
4) Compute watershed segmentation.
5) Compute morphological operation.
6) Finally output will be a tumor region.

1)Grayscale imaging

- MRI images are magnetic resonance images which can be acquired on computer when a patient is scanned by MRI machine. Generally when we see MRI images on computer they looks like black and white images.
- In true black and white, also known as halftone, the only possible shades are pure black and pure white. The illusion of gray shading in a halftone image is obtained by rendering the image as a grid of black dots on a white background (or vice-versa), with the sizes of the individual dots determining the apparent lightness of the gray in their vicinity. The halftone technique is commonly used for printing photographs in newspapers.
- In the case of transmitted light (for example, the image on a computer display), the brightness levels of the red (R), green (G) and blue (B) components are each represented as a number from decimal 0 to 255, or binary 00000000 to 11111111. For every pixel in a red-green-blue (RGB) grayscale image, R = G = B. The lightness of the gray is directly proportional to the number representing the brightness levels of the primary colors. Black is represented by 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 the gray 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 transmission or reflection of light at all visible wavelengths. So because of the above reasons first we convert our MRI image to be pre-processed in grayscale image

2) Threshold Segmentation

- The simplest method of image segmentation is called the thresholding method.
- This method is based on a clip-level (or a threshold value) to turn a gray-scale image into a binary image.
- The key of this method is to select the threshold value. These methods divide the image pixels with respect to their intensity level.
- The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze.
- Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images.
- More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics.

3) 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 in the relief. A drop of water falling on a topographic relief flows along a path to finally reach a local minimum. Intuitively, the watershed of a relief correspond to the limits of the adjacent catchment basins of the drops of water.

Meyer's flooding Watershed Algorithm:

The algorithm works on a gray scale image. During the successive flooding of the grey value relief, watersheds with adjacent catchment basins are constructed. This flooding process is performed on the gradient image, i.e. the basins should emerge along the edges. Either the image must be pre-processed or the regions must be merged on the basis of a similarity criterion afterwards.

1. A set of markers, pixels where the flooding shall start, are chosen. Each is given a different label.
2. The neighboring pixels of each marked area are inserted into a priority queue with a priority level corresponding to the gray level of the pixel.
3. The pixel with the highest priority level is extracted from the priority queue. If the neighbors of the extracted pixel that have already been labelled all have the same label, then the pixel is labelled with their label. All non-marked neighbors that are not yet in the priority queue are put into the priority queue.
4. Redo step 3 until the priority queue is empty. The non-labelled pixels are the watershed lines.

FUNCTIONS USED

1. imgradient
2. label2rgb
3. imopen
4. imclose
5. imreconstruct
6. imregionalmax

4)Morphological Operations

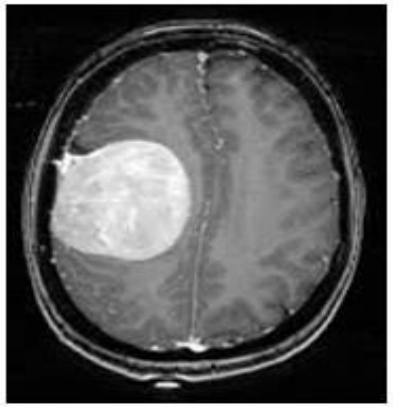
- Morphological image processing is a collection of non-linear operations related to the shape or morphology of features in an image. According to Wikipedia, morphological operations rely only on the relative ordering of pixel values, not on their numerical values, and therefore are especially suited to the processing of binary images.
- Morphological 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 neighborhood of pixels.
- The structuring element is a small binary image, i.e. a small matrix of pixels, each with a value of zero or one:

  1)The matrix dimensions specify the size of the structuring element.

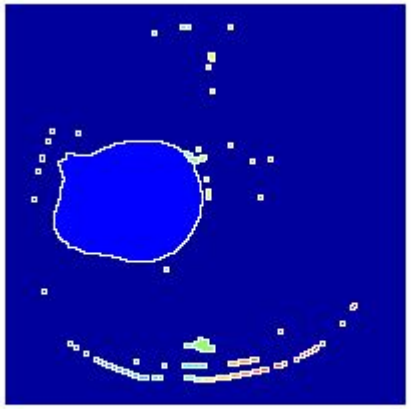
  2)The pattern of ones and zeros specifies the shape of the structuring element.
- An origin of the structuring element is usually one of its pixels, although generally the origin can be outside the structuring element

OUTPUT

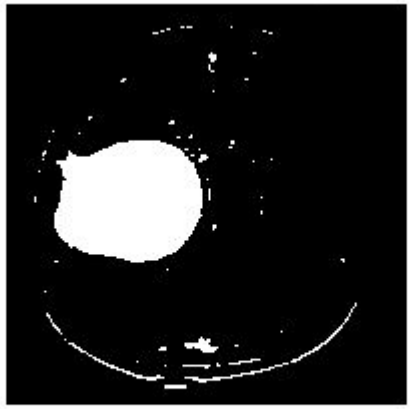
Brain MRI Image



Watershed segmented image

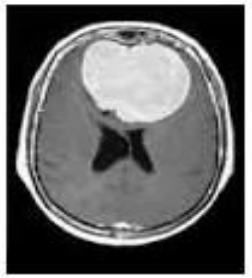


Thresholded Image

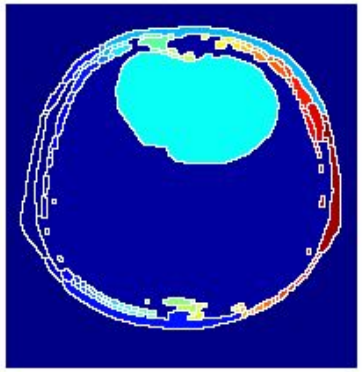


only tumor

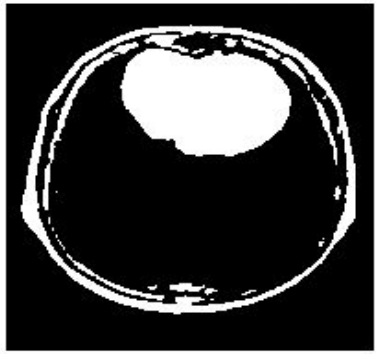
Brain MRI Image



Watershed segmented image

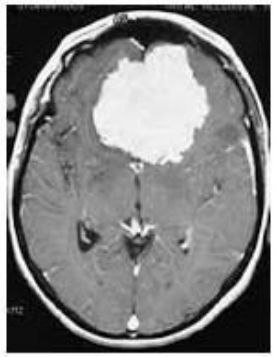


Thresholded Image

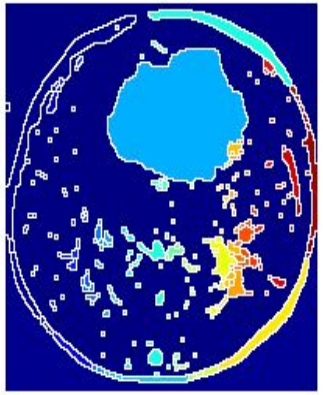


only tumor

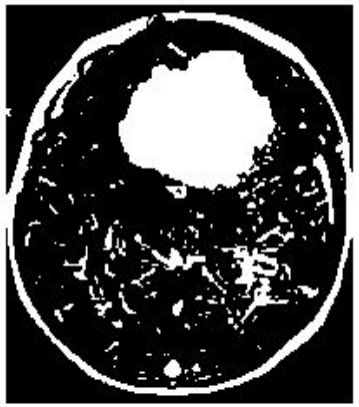
Brain MRI Image



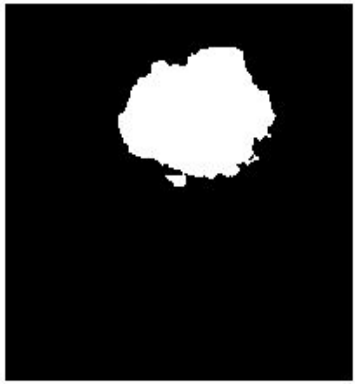
Watershed segmented image



Thresholded Image



only tumor



RESULT

From the results we can intervene that these process can be used to identify the location of tumor from an MRI. As we can see the processing time of code from MRI image to image containing tumor is very less we can use this application in real time system which will very helpful in field on medicine.

APPLICATION

From this processed image we can create a database and use it for training an artificial neural network or deep learning algorithm which can identify even more details of tumor such as whether it is malignant of Benign .this can change the future of identification tumor. This scope will be revolution in field of medical science.

REFERENCES

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

2) Brain Tumour Extraction from MRI Images Using MATLAB ,Rajesh C. Patil, Dr. A. S. Bhalchandra, International Journal of Electronics, Communication & Soft Computing Science and Engineering ISSN: 2277-9477, Volume 2, Issue 1

3)https://www.mathworks.com/help/images/marker-controlled-watershed-segmentation.html