Detection and area calculation of brain tumour from MRI images using MATLAB

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Abstract: The main objective of our task is to recognize a tumour and its quantifications from a particular MRI scan of a brain image using digital image processing techniques. The motivation of our work is to provide an efficient algorithm for detecting the brain tumour and calculating its growth. This research describes the proposed strategy to detect & extraction of brain tumour from patient's MRI scan images of the brain. This method incorporates with some noise removal functions, segmentation and morphological operations which are the basic concepts of image processing. Detection and extraction of tumour from MRI scan images of the brain is done by using MATLAB software.

Keywords: MRI, Brain Tumour, digital image processing, segmentation, morphology, MATLAB.

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1. Introduction

In recent years a great effort of the research in the field of medical imaging was focused on brain tumour segmentation. Despite the undisputed usefulness of automatic tumour segmentation, this is not yet a widespread clinical practice; therefore the automatic brain tumour segmentation is still a widely studied research topic[1]. The principle of our task is to detect the brain tumour from the MRI image of the brain and then calculating the area of the tumour. A brain tumour is an abnormal growth of tissue in the brain. Unlike other tumours, brain tumours spread by local extension and rarely metastasize (spread) outside the brain [2]. All types of brain tumours may produce symptoms that vary depending on the part of the brain involved. These include headaches, problem with vision, vomiting, and mental changes. More specific problems may include difficulty in walking, speaking and with sensation. Each year, more than 17,000 brain tumours are diagnosed in the United States [3].

A brain tumour is an abnormal growth of tissue in the br ain shown in figure 1. Unlike other tumours, brain tumour spread by local extension and rarely spread outside the brain [4]. It is generally caused by abnormal and uncontrolled cell division, normally either in the brain itself (neurons, glial cells (astrocytes, oligodendrocytes, ependymal cells), lymphatic blood vessels), in the cranial nerves (myelin-producing Schwann cells), in the brain envelopes (meninges), skull, pituitary and pineal gland, or spread from cancers primarily located in other organs (metastatic tumours) [5].
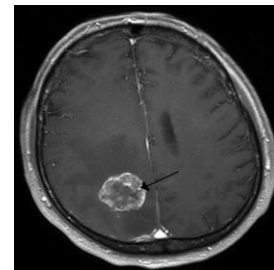

Fig 1: Brain tumour.

The majority of investigations in developed countries demonstrate that the amount of people who develop brain tumours and depart this life from them has greater than before maybe as much as 300 over past three decades. Doctors diagnose brain tumours by doing a neurologic exam and tests including an MRI, CT scan, and biopsy [6]. Treatment options include watchful waiting, surgery, radiation therapy, chemotherapy, and targeted therapy. Targeted therapy uses substances that attack cancer cells without harming normal cells. Many people get a combination of treatments.

A. Malignant brain tumour

Malignant tumours can be divided into primary tumours that started within the brain and those that spread from somewhere else are brain metastatic tumours. Malignant brain tumours are generally more serious and often are a

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threat to life. They are likely to grow rapidly and crowd or invade the nearby healthy brain tissue. Cancer cells may break away from malignant brain tumours and spread to other parts of the brain or to the spinal cord. They rarely spread to other parts of the body [7].

B. Benign brain tumour

A benign brain tumour is composed of non-cancerous cells and does not metastasize beyond   the part of the brain where it originates.   Benign tumours can be removed, and they seldom grow back. Benign brain tumours usually have an obvious border or edge. They don't spread to other parts of the body. However, benign tumours can press on sensitive areas of the brain and cause serious health problems[8].

2. ALGORITHM FOR DETECTING BRAIN TUMOUR

Input: MRI of brain image.

Output: Tumour portion of the image.

Step 1:- Read the input grayscale image.
Step 2:- Resize this image in to 200×200 image matrix.
Step 3:- Filters the multidimensional array with the multidimensional filter. We show salt and pepper noise in our image using *imnoise* command.
Step 4:- Now we are reducing the noise in our image using *imfilter* command i.e. by using median filter to get the resultant enhanced image.
Step 5:- Computes a global threshold that can be used to convert an intensity image (Step 4) to a binary image with a normalized intensity value which lies in between range 0 and 1.
Step 6:- Compute the morphological operation by two mat lab command imerode and strel with arbitrary shape.
Step 7:- Store the size of the step 6 image into var1 and var2 i.e. no. Of rows and column in pixels   by:

 [var1 var2]=size(step 6 image)
Step 8:- For i=1:1:var1
Step 9:- For j=1:1:var2
Step 10:- If step 6 image (i,j) == 1
Step 11:- step 1 image (i,j) = 255
Step 12:- Else
Step 13:- step 1 image (i,j) = step 1 image (i,j) * 0.3
Step 14:- End
Step 15:- End
Step 16:- End
Step 17:- Convert in to binary image and traces the exterior boundaries of objects, as well as boundaries of holes inside these objects, in the binary image and into an RGB color image for the purpose of visualizing labeled regions.
Step 18:- Compute edge detection using sobel edge detection technique.

3. ALGORITHM FOR AREA CALCULATION

Input: Tumor portion of the image.
Output: Area of the tumor.

Step 1:- Read the input grayscale image.
Step 2:- Resize this image in to 200×200 image matrix.
Step3:- Compute numbers of rows and column in pixels by: [r2 c2] = size (J)
Step 4:- Initialize a variable a=0
Step 5:- For i=1:1: r2
Step 6:- For j=1:1:c2
Step 7:- If I (i,j)==255
Step 8:- a=a+0
Step 9:- Else do
Step 10:- a=a+1
Step 11:- End
Step 12:- End
Step 13:- End
Step 14:- Display the area a.

4. RESULTS AND DISCUSSION

a.   DETECTION OF BRAIN TUMOR

Using MATLAB program we got the following images as results in brain tumour detection
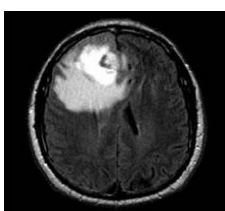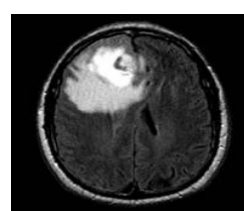
 Step 1   Step 2
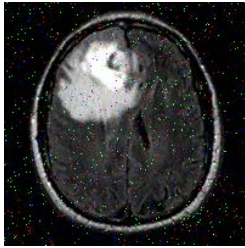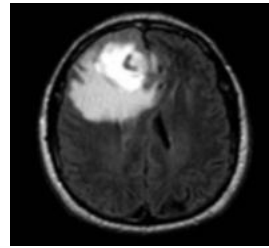
FIG.2:GRAYSCALE IMAGE

FIG 3: RESIZE IMAGE

Step 3

Step 4

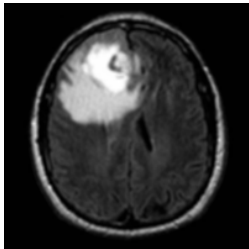FIG 4: SALT AND PEPPER NOISE

FIG 5: HIGH PASS FILTER IMAGE
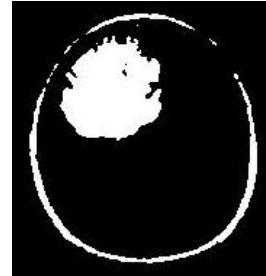
Step 5

Step 6

FIG 6: ENHANCED IMAGE

FIG 7: THRESHOLD SEGMENTATION
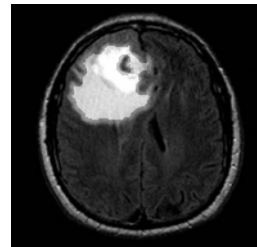
Step 7

Step 8

FIG 8: MORPHOLOGICAL OUTPUT

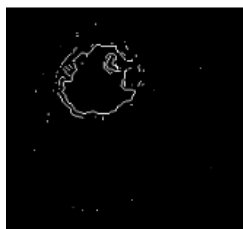FIG 9: OUTPUT WITH TUMOR LOCATION

Step 9

FIG 10: SOBEL EDGE DETECTION

b. AREA CALCULATION OF TUMOUR REGION

Fig 11: Area of above detected brain tumour is 2473 pixels.

Fig 12: Area of above detected brain tumour is found 1593 pixels.

Fig 13: Area of above detected brain tumour is found 1713 pixels.

Fig 14: Area of above detected tumour is found as 3054 pixels using the mat lab program.

5. CONCLUSION

We proposed an interactive segmentation method that enables users to quickly and efficiently segment tumours in MRI of brain. It is a new method that in addition to area of the region and edge information uses a type of prior information also its symmetry analysis which is more consistent in pathological cases. Its application to several datasets with different tumours sizes, intensities and locations shows that it can automatically detect and segment very different types of brain tumours with a good quality. We are able to tell what type of brain tumour is found in the patient and the area of the tumour so that the patient can be treated according to the severity as soon as possible.

In this paper, the extraction of the tumour and the size of the interested tumours successfully obtained through a few steps in the MATLAB coding for image processing. We were also able to segment the different part of the brain from the brain CT mages. By calculating the area, we can know that there are slight differences between the sizes of the tumour for different slice of brain images.

The tumour was successfully extracted from the image using segmentation processing algorithm.

6. References

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