Original Article

Brain tumor detection using segmentation of MRI images

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ABSTRACT

In recent years, MRI imaging has been used more widely for examination and detection of brain tumors than other medical imaging techniques. Detecting and segmenting the brain tumor area from these images is a time-consuming and boring task, and automated systems are required to overcome it. Thus, the present study aims to obtain areas of brain tumors with acceptable and reliable accuracy by using multi-stage morphological methods. To obtain reliable and valid accuracy, three datasets are used here. The accuracy of differentiation of brain tumor areas was obtained with an accuracy of %98 and 95.65% for the first and second groups, respectively. The results show that the proposed method is reliable for segmenting brain tumor area for this data group and can be generalized to other data sets.

Keywords: segmentation, MRI images, morphology, brain tumor

Introduction

There are various medical imaging methods, including MRI, computed tomography (CT), ultrasound, and segmentation. Its detection and treatment are usually done manually by specialist physicians [1]. Brain tumor is one of the most common causes of increased mortality among children and adults around the world. A brain tumor is a group of abnormal cells that grow inside or around the brain. There are many different types of brain tumors. Some brain tumors are non-cancerous (benign), and some brain tumors are cancerous (malignant) [2]. The standard MRI method is a non-invasive imaging inside the body that uses radio frequency signals for stimulation [2]. MRI method provides high-quality images of various tissues of the body, so it has a valuable structure of information and allows the detection and segmentation of tumors along with their sub-regions [3]. Since manual segmentation of the tumor area is very time consuming, development of powerful automated segmentation methods to provide an accurate and targeted segmentation method has become a popular research approach in recent years [4]. Thus, a method for segmenting tumor area with high quality and accuracy is a necessity.

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Materials and Methods

Our focus in the present study is to examine and obtain the area of the brain tumor with acceptable accuracy and we use several data sets to achieve this. The first group of data: 50 images of data [5, 6] were used. The second group of data in [7] in which 50 images of this group were used. This brain tumor dataset contains 3064 T1-weighted contrast-enhanced images with three kinds of brain tumor.

Processing

In this section, several processing steps were used to reach the tumor area with an acceptable accuracy. To obtain the best possible detection, acute and noise-free medical image is needed. In this work, the noise is removed using the middle filter. For this reason, the variance of the intensities in the image is reduced and it is also used to maintain the edge forms and site of the edges. Median filter is also used to remove the noise like salt and pepper and weighted average filter is the variation of this

filter and can be implemented easily and give good results [8]. After removing the possible noise, we move to step of main processing. The steps to reach the tumor area is shown in Figure 1.

First, the image is converted to grayscale and then the image becomes binary and the skull is removed before it is segmented. Then, by binary staging and morphological examination [5, 8-10], we marked the tumor area and finally, with the final segmentation, we reached the desired result with an acceptable accuracy.

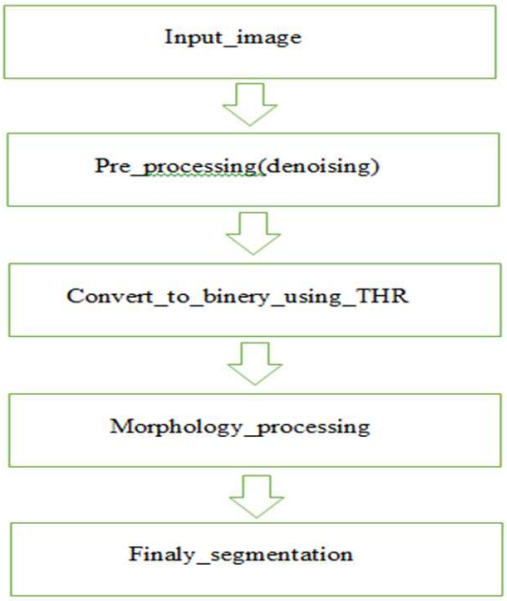

Figure 1- Steps of segmentation

Results and Discussion

Here, by reviewing the articles, we obtained the results that have acceptable accuracy and low computational time. They were performed for two data sets and the results were reported. Figure 2 shows the results of segmentation of tumor areas into two data sets using the proposed method.

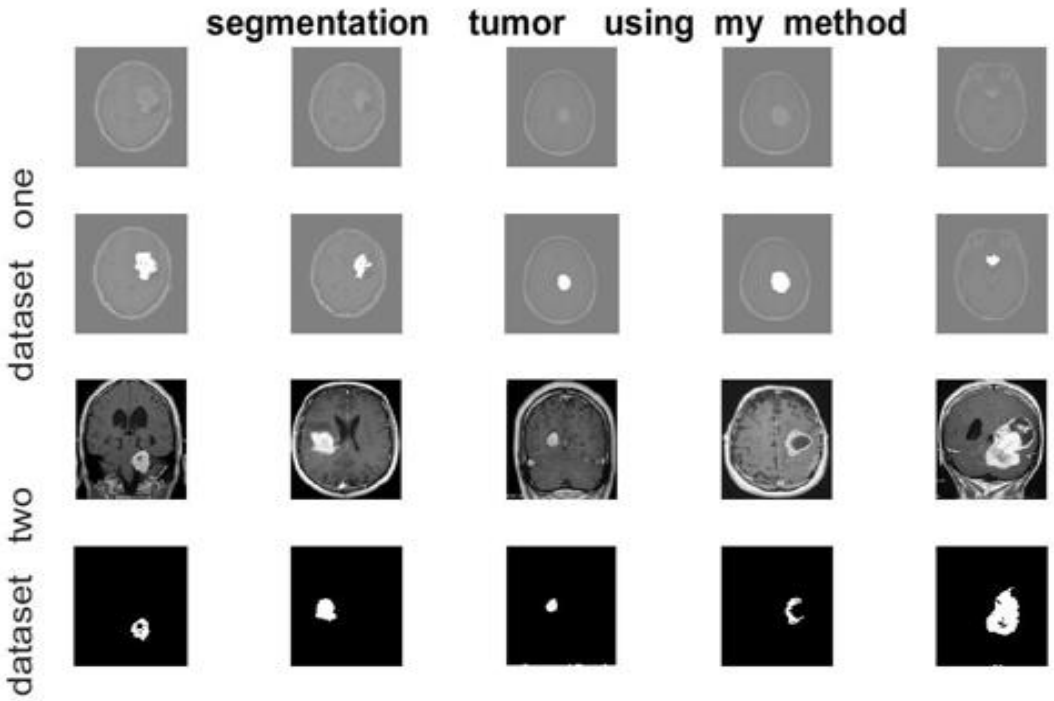

Figure 2- tumor brain segmentation using my method

In figure 2:Third row shows the original MRI image of the second group of databases

Fourth row shows the tumor area extracted from the second group by the proposed method.

Table 1: Accuracy of group 1 segmentation results

title	accuracy of tumor detection	accuracy of tumor area
accuracy	98	94.35

Table 2: Accuracy of group 2 segmentation results

title	accuracy of tumor detection	accuracy of tumor area
accuracy	95.65	92.32

Based on Table 1, out of 100 data simulated, 98 data correctly detected the site of tumor and the value of this tumor with an accuracy of 94.35%.

Also, based on Table 2, out of 23 data examined in group 2, 22 data correctly detected the site of tumor and the value of this tumor was an accuracy of 92.32%. In the present study, based on a research work, we could detect the tumor area by using two groups of data with an acceptable accuracy. Also, this work can be generalized to other groups of databases.

Table 3: Results of segmentation of articles

tumor area	tumor site	number
74	88	[1]
74–85	74–85	[3]
96.51	96.51	[4]
97.23	97.23	[7]
94.35	98	My method

According to Table 3, the proposed method has a higher accuracy than other methods, so it can be selected as the preferred method.

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