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Brain tumor detection using fuzzy morphology

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ABSTRACT

Medical image segmentation is a challenging task in fuzzy image processing. Tumor detection is the first phase to solve the segmentation problem. This paper describes the detection of the brain tumor by using fuzzy image segmentation. In this paper we present a novel technique for the detection of tumor in brain using fuzzy morphology and watershed segmentation. The proposed method can be successfully applied to detect the geometrical dimension of the tumor.

KEYWORDS

Fuzzy;
Morphology;
Watershed.

INTRODUCTION

A brain tumor, defined as an abnormal growth of cells within the brain or the central spinal canal. Tumor detection needs to be fast enough as the patient cannot recover if the damage is more than 50%. Now days one of the main cause for increasing mortality among children and adults is brain tumor. A brain cancer is a disease in which cells grow uncontrollably in the brain. Brain tumors are of two main types: (i) Benign tumors (ii) Malignant tumors. Benign tumors in the brain usually do not need to be treated and their growth is self limited. Malignant tumors are typically called brain cancer which spread outside of the brain. Malignant tumors of the brain are most harmful, if not detect early.

Medical image segmentation is an important step for medical image processing. The Accurate measurements in brain diagnosis are quite difficult due to diverse shapes, sizes and appearances of tumors. Almost simultaneously to CT, MRI has been introduced to medicine. It is based on electromagnetic effects of the nucleus[1]. Since the human body consists of about 70% water. Its nucleus is composed of only one proton. As mentioned before, the particles forming the nucleus are continuously moving. For hydrogen, this movement is a self rotation (spin), which has a magnetic moment. 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. Now a days several methodology used in medical field by classifying MR images[2-3]. The classification mainly done by image segmentation[4-7]. Brain tumor cells have high proteinaceous fluid which has very high intensity; therefore fuzzy water segmentation is the best tool to classify tumors of brain.

The idea of fuzzy logic is to extend the binary (TRUE or FALSE) computer model with some uncertainty or blur, which exists in the real world, too. Many of our sensory impressions are qualitative and imprecise and, therefore, unsuitable for accurate measurements. For example, a pixel is perceived as "dark", "bright" or even "very bright", but not as a pixels with the gray scale value "231". Fuzzy quantities are based mathematically on the fuzzy set theory, in which the belonging of an element to a set of elements is not restricted to the abso-

Regular Paper

lute states TRUE (1) or FALSE (0), but continuously defined within the entire interval [0..1].

In general mathematical morphology operation definitions are similar structures set theory and set operations definitions. For this reason fuzzy set theory is easily applied to the mathematical morphology. Mathematical morphology is a collection of operations which produces useful outcomes in image processing area[8]. It is completely based on set theory. For this reason all of the operations in morphology are defined on the simple set operation rules to apply them on image pixels. The basic mathematical morphological operators are dilation, erosion and watershed segmentation[9].

Pre-processing of MRI images is the primary step in image analysis which perform image enhancement, then some morphological operations are applied to detect the tumor in the image. The morphological operations are basically applied on some assumptions about the size and shape of the tumor.

Section 1 introduces the concept of different methods used for brain tumor detection. Proposed algorithm is explained in Section 2. Section 3 will present in detail of the result and discussion. Finally, Section 4 contains some conclusion.

PROPOSED WORK

The proposed work is based mainly on segmentation and extraction of the tumor region for future analysis. The MRI image can be obtained from the patient's data base. Usually MRI images looks like a black and white images. So the Image easily fuzzified to improve the image quality and to reduce the miscalculation[8]. Segmentation is the process where an image is divided into different regions on the some similarity bases. In this paper both gray thresholding[10] and Water shed segmentation are used on the intensity bases[9]. As every pixel has different intensities compared to each other. So the pixels are grouped based on their intensities to separate the tumor from image. After segmentation some of the morphological operations are performed to separate the tumor region from the image. The algorithm for the proposed work comprises of the following steps.

1) Take MRI image of brain as input.

2) Convert it to gray scale image.

4) Fuzzify gray scale image using membership function $r = \frac{d-mn}{mx-mn}$

Where d=double (image) mn=min (min (image)), mx=max (max (image))

5) Apply gray thresholding to compute threshold segmentation.

6) Compute watershed segmentation to find segmented image.

7) Apply morphological operation to find the position of tumor.

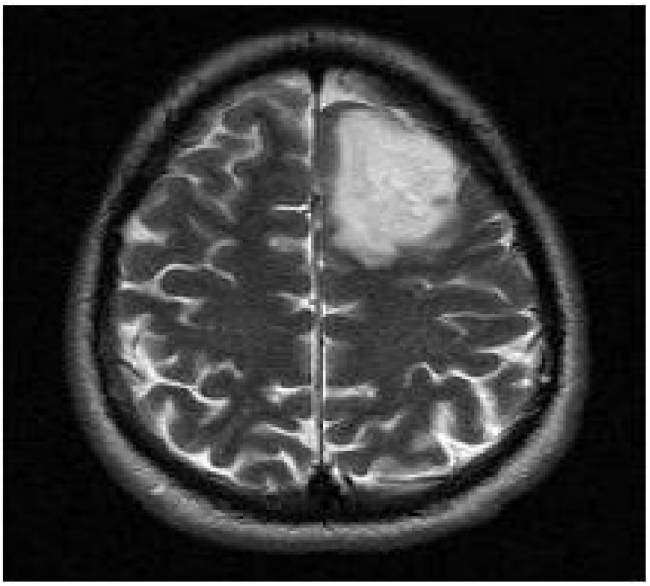

Figure 1 : (Original Tumor)

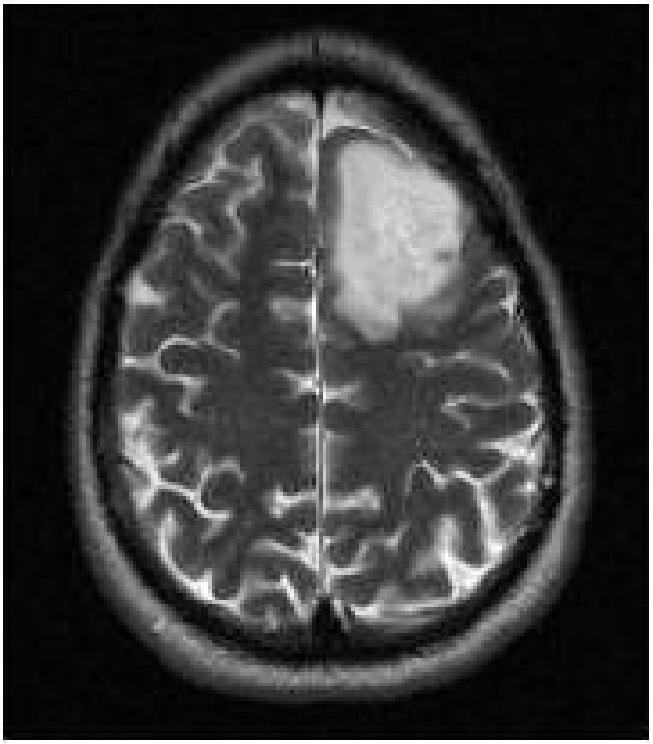

Figure 2 : (Fuzzified Tumor)

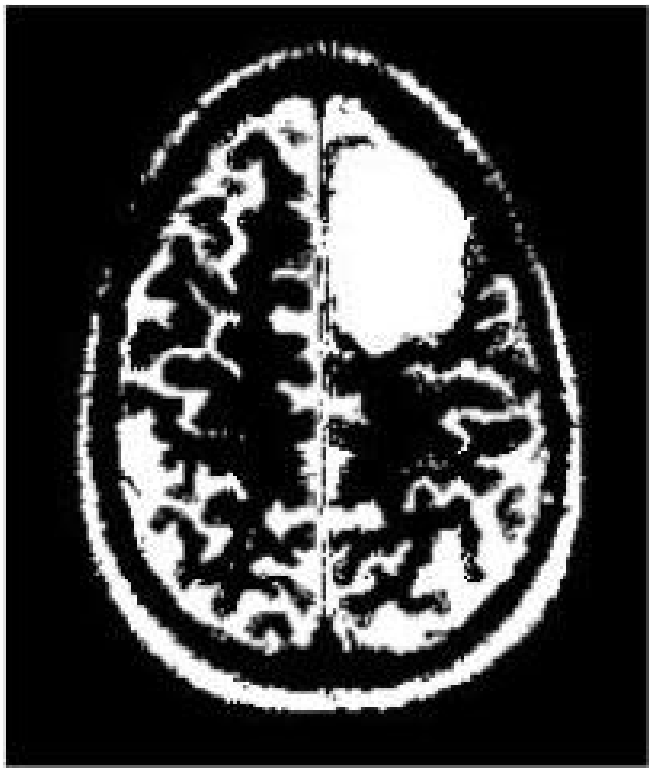

Figure 3 : (Thresed Tumor)

Figure 4 : (Watershed Tumor)

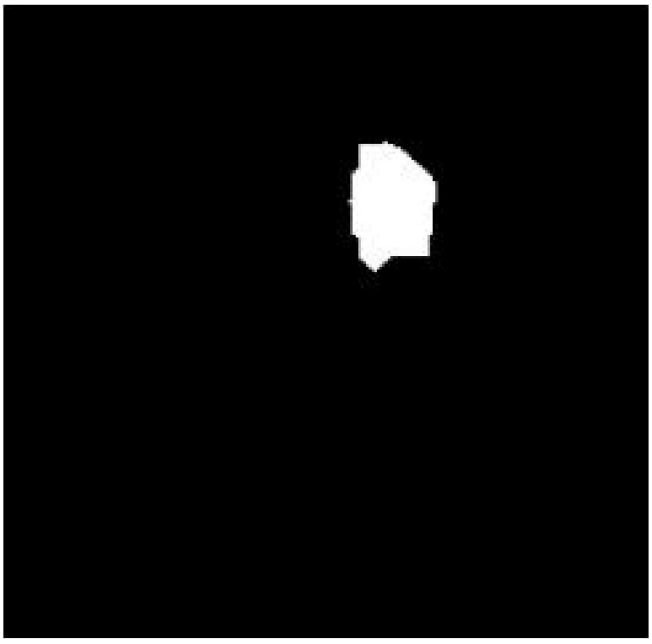

Figure 5 : (Erode Tumor)

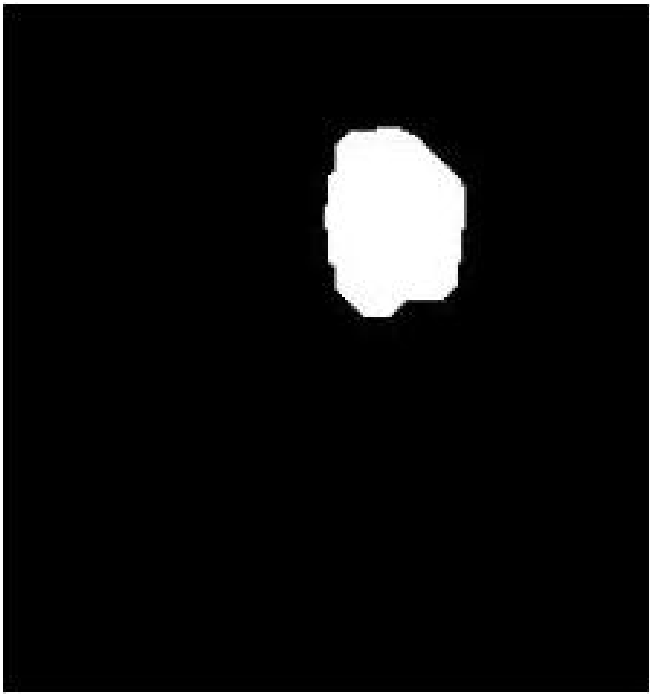

Figure 6 : (Dilate Tumor)

RESULT AND DISCUSSION

In this paper real time patient Tumor is taken for analysis. As tumor in MRI image have an intensity more than that of its background so it become very easy locate it and extract it. The original image considered for our experiment is illustrated in Figure 1 and fuzzified image is illustrated in Figure 2. Our proposed method is depicted in Figure 3-6. The performance of our proposed algorithm using fuzzy prove that the accuracy rate of proposed methodology to be better compared with other methodologies.

CONCLUSION

A fuzzy based segmentation process to detect brain

Regular Paper

tumor was implemented. The target area is segmented and helps the doctors in diagnosis. The output of the images of the image segmentation based on black and white area. Black represented as normal area and the white area represented as tumor area. Simulation results using the new algorithm prove that brain tumor can be detected in shorter time.

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