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Brain Tumor Area Calculation in CT-scan image using Morphological Operations

Mohammed Y. Kamil
(College of Sciences, AL–Mustansiriyah University, Iraq)

Abstract: *Brain tumor is serious and life-threatening because it found in a specific area inside the skull. Computed Tomography (CT scan) which be directed into intracranial hole products a complete image of the brain. That image is visually examined by the expert radiologist for diagnosis of brain tumor. This study provides a computer aided method for calculating the area of the tumor with high accuracy is better than technique within CT scan device. This method determines the extracted the position and shape tumor based on morphological operations (dilation and erosion), enhancement filters and thresholding. Then, automatically calculate of tumor area for the area of interest.*

Keywords: *medical image, brain tumor, morphological processing.*

I. Introduction

Image scanner devices such as magnetic resonance imaging (MRI), computed tomography (CT), and positron emission tomography (PET) are now a standard tool for diagnosis. Among these devices, CT-scanners are today commonly used in radiotherapy departments all over the world it holds various advantages. The primary advantages of a CT-scanner are to obtain physical information, as size, condition and in homogeneities [1]. The tumor of brain is uncontrolled growth of mass created by undesired cells, either usually found in the different portion of the brain, like neurons, glial cells, lymphatic tissue, and blood vessels, or spread from cancers at most located in other organs [2].

Different brain tumor detection algorithms have been developed in the past years. K. Somasundaram and T. Kalaiselvi [3] proposed a method for automatic detection of brain tumor by using maxima transform. Amir Ehsan Lashkari [4] proposed an abnormality detection method by using neural network and morphological operations likes filling holes and connected component algorithms. As well the tumor position is found by measuring the initial and final points coordinated and then calculate the length and width for evaluating the volume of tumor. S. Patil, et al. [5] discussed different techniques for pre-processing by using median filter and morphological techniques for MRI and CT scan. S. Roy et al. [6] discussed a pre-processing technique to remove non-brain tissues or skull from MRI image based on thresholding and computational geometry like Convex Hull. Anam Mustaqeem et al. [7] proposed a tumor detection algorithm based on watershed and thresholding methods. M. K. Kowar and S. Yadav [8] proposed a technique to detect the contour of the brain tumor and its physical dimension by using segmentation and histogram thresholding. K. Thapaliya and G. Kwon [9] proposed an efficient algorithm to detect and extraction the brain tumor from MRI image using thresholding value by calculating the mean and standard deviation for image, and based on a combination of the morphological operations. B. K. Saptalakar et al. [10] proposed another tumor detection method based on modified watershed segmentation. R. G. Selkar and M. N. Thakare [11] proposed the segmentation and detection of brain tumor by using watershed and a thresholding algorithm based morphological operators while boundary extraction to find the tumor size.

II. Morphological Processing

The expression morphology denotes the study of structure. In medical image processing us use mathematical morphology by means of identify and extract significate image descriptors by using properties of the shape in the image. Morphological operations are the logical transformation established on comparison of the pixel neighborhood with a specified pattern that is known as a structural element [12].

The standard morphological operations are dilation and erosion. Dilation permit objects to extend, hence possibly filling in small holes also connecting disjoint objects [13]. Erosion contract objects by turn away their borders. The composition of the main operations is dilation and erosion, it can product more complex gradation [14]. Opening and closing are the widely utilitarian of these for morphological filtering. An opening process is definite as erosion followed by a dilation by using the similar structuring element for together. A Closing process is definite as dilation followed by erosion (reverse opening) by using the similar structuring element for together [15].

III. Proposed Methodology

The proposed methodology can be split up into ten steps.

Step 1: input image from ST-scan device, RGB image, size 1099×650 and JPEG format.

Step 2: image cropping to remove the unfavorable portions from the input image such as personal information of patients.

Step 3: convert RGB image to gray level image.

Step 4: morphological gradient using difference of gray-scale dilation from gray-scale erosion with flat 9×9 structuring element.

Step 5: Enhancement the image by using Contrast-limited adaptive histogram equalization method.

Step 6: Using filter region of interest (ROI) in an image by Specify polygonal in order to select the bounded region of the tumor.

Step 7: Subtract original image from final image.

Step 8: Convert final image to binary image based on thresholding.

Step 9: Using Morphologically closing image (dilation followed by erosion).

Step 10: calculated the area for all the remaining portions including the tumor by measure properties of image regions.

IV. Results and Discussion

The CT-scan image are collected for this study from the Al-Kindy Teaching Hospital in Baghdad. The proposed method is applied on different types of tumor CT scan images. The shape and area of the tumor is various. Test example for abnormal case to patient name: Sanaa Daowd, Age: 1973, Date:23-3-2015. Figures (1-6) shown the progress of the proposed algorithm (step by step) from the original image to area calculate of brain tumor. We introduce algorithm approaches for CT scan images and investigate its implemented to the detection of region of interest. The area of tumor appears distinguishing regions such relatively brightest from the surrounding background. To calculate the Area of tumor by measure properties of image regions, which can be calculated from total number of the pixels present (white color) multiplying inverted horizontal and vertical resolution for image.

After the tumor area calculation we can compare the results obtained with the results obtained by the expert radiologist, the results obtained from the CT scan device with large relative error because the device only measures the distance, and the expert radiologist supposed to the tumor shape like a ball and calculates the area through diameter the tumor. Table (1) review the results of the different shape of tumors (non uniform shapes) obtained by the expert radiologist through the CT scan device and the results obtained through the proposed algorithm, compared through the diameter of the tumor, which large relative error performed by expert radiologist shows if the tumor area is calculated by taking measure the distance to any diameters of the tumor.

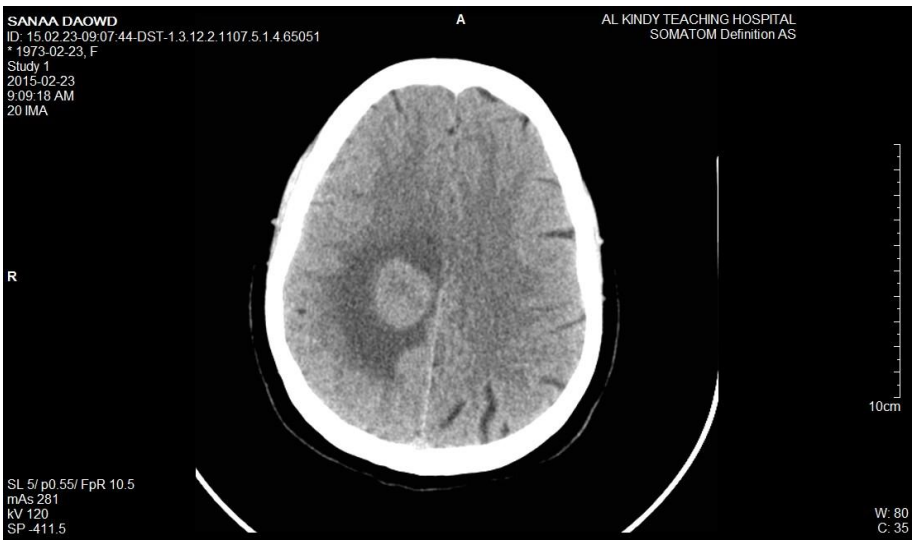

Fig.1. CT-scan image of brain tumor.

Fig.2. after cropping for gray image.

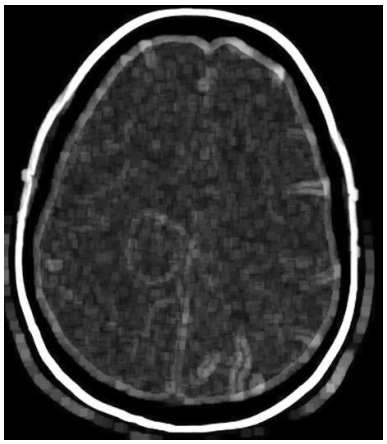

Fig.3.after using morphological gradient.

Fig.4. after using Enhancement.

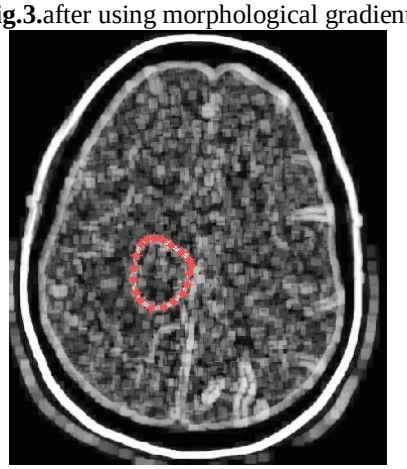

Fig.5. using region of interest.

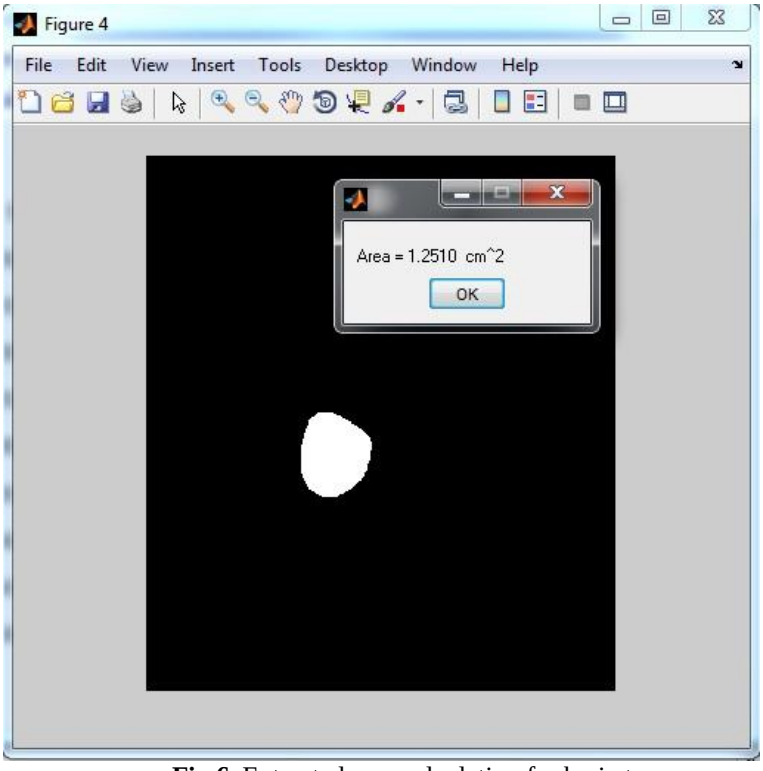

Fig.6. Extracted area calculation for brain tumor

Table 1: Comparison of tumor diameter with an expert radiologist for non uniform shapes

Patient No.	Proposed Method Diameter (cm)	Expert radiologist Diameter (cm)	Relative Error (%)
1	1.26	2.13	40.8
2	1. 21	2.09	42.1
3	1.16	1.97	41.1
4	1.12	1.91	41.3
5	1.05	1.80	41.7

V. Conclusion

In this paper, we present a preprocessing and segmentation to a region of interest that are available for area calculation for brain tumor. Processing of brain tumor CT scan images are more interesting and difficult process than MRI images. The proposed algorithm results showed the ease of physician in the selection of the affected area after automatically highlighted, also the accuracy of the calculate of the tumor area; better than the method of CT scan device , which takes calculated only distance (straight line), this accuracy in tumors that are of non uniform shapes.

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