Research Paper Computer Science

BTS (Brain Tumor Segmentation)Based on Otsu Thresholding

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ABSTRACT

Segmentation of human brain from MRI scan slices without human intervention has become one of the most active research areas in the field of medical image processing. Brain segmentation has various important applications in diagnosing a number of disorders. The main aim of this research work is to recognize a tumor and its quantifications from a specific MRI scan of a brain image and compute the area of the tumor by fully automated process and its symmetry analysis. Thresholding approach segment scalar images by generating a binary partitioning of the image intensities. Otsu's technique is used to automatically carry out histogram shape-based image thresholding. The quantitative analysis of MRI brain tumor allows obtaining useful key indicators of disease progression. Segmentation is done on basis of a threshold, due to which whole image is converted into binary image.

Keywords: Otsu thresholding, Tumor segmentation, MRI.

INTRODUCTION

Brain cancer can be counted among the most deadly and intractable diseases. Tumors may be embedded in regions of the brain that are critical to orchestrating the body's vital functions, while they shed cells to invade other parts of the brain, forming more tumors too small to detect using conventional imaging techniques. Brain cancer's location and ability to spread quickly makes treatment with surgery or radiation like fighting an enemy hiding out among minefields and caves. In recent years, the occurrence of brain tumors has been on the rise. Unfortunately, many of these tumors will be detected too late, after symptoms appear [1].

The past few years had witnessed a rapid and multi directional increase in the applications of image processing. In today's digital era, capturing, storing and analysis of medical image had been digitized [2].

The challenge stands tall especially in regions with abnormal color and shape which needs to be identified by radiologists for future studies. The key task in designing such image processing and computer vision applications is the accurate segmentation of medical images. Image segmentation is the process of partitioning different regions of the image based on different criteria [3].

Surgical planning, post-surgical assessment, abnormality detection, and much other medical application require medical image segmentation [4].

Brain image segmentation from MRI images is complicated and challenging but its precise and exact segmentation is necessary for tumors detection and their classification, edema, haemorage detection and necrotic tissues. For early detection of abnormalities in brain parts, MRI imaging is the most efficient imaging technique [6].

The part of the image that has the tumor has more intensity in that portion and we can make our assumptions about the radius of the tumor in the image, these are the basic things considered in the algorithm [7].

The morphological operations are basically applied on some assumptions about the size and shape of the tumor and in the end the tumor is mapped onto the original gray scale image with255 intensity to make visible the tumor in the image. The algorithm has been tried on a number of different images from different angles and has always given the correct desired result [8].This research work focuses on a method to identify tumor in brain disorder diagnosis in MR images.

LITERATURE SURVEY

Ahmed et al suggested that fractal texture feature is useful to detect pediatric brain tumor in multimodal MRI [9]. In this study, we systematically investigate efficacy of using several different image features such as intensity, fractal texture, and level-set shape in segmentation of Posterior-Fossa (PF) tumor for pediatric patients. The author explored effectiveness of using four different feature selection and three different segmentation techniques, respectively, to discriminate tumor regions from normal tissue in multimodal brain MRI. We further study the selective fusion of these features for improved PF tumor segmentation. In multimodality fused MRI (T1, T2, and FLAIR), mBm feature offers the best PF tumor segmentation performance. We use different similarity metrics to evaluate quality and robustness of these selected features for PF tumor segmentation in MRI for ten pediatric patients.

Image segmentation is an indispensable process in the visualization of human tissues, particularly during clinical analysis of magnetic resonance (MR) images. A robust segmentation technique based on an extension to the traditional fuzzy c-means (FCM) clustering algorithm is proposed by Shan Shen et al., [10]. A neighborhood attraction, which is dependent on the relative location and features of neighboring pixels, is shown to improve the segmentation performance dramatically. The degree of attraction is optimized by a neural-network model. Simulated and real brain MR images with different noise levels are segmented to demonstrate the superiority of the proposed technique compared to other FCM-based methods.

Unsupervised fuzzy algorithms were visually observed to show better segmentation when compared with raw image

data for volunteer studies [11]. For a more complex segmentation problem with tumor/edema or cerebrospinal fluid boundary, where the tissues have similar MR relaxation behavior, inconsistency in rating among experts was observed, with fuzz-c-means approaches being slightly preferred over feed forward cascade correlation results.

III.METHODOLOGY

The part of the image containing the tumor normally has more intensity then the other portion and we can assume the area, shape and radius of the tumor in the image. We have used these basic conditions to detect tumor in our code and the code goes through the following steps. In preprocessing some basic image enhancement and noise reduction techniques are implemented. Apart from that different ways to detect edges and doing segmentations have also been used. The purpose of these steps is basically to improve the image and the image quality to get more surety and ease in detecting the tumor. Image is converted to gray scale image in first step. Noise is removed. The obtained image is then passed through a high pass filter to detect edges. Segmentation is done on basis of a threshold, due to which whole image is converted into binary image. Basic matlab commands for threshold are used for this segmentation. It is the best method to segment an image to separate a tumor but it suffers from over and under segmentation, due to which we have used it as a check to our output.

Morphological operations are applied on the image after converting it into binary form. The basic purpose of the operations is to show only that part of the image, which has the tumor that is the part of the image having more intensity and more area. The algorithm is given below.

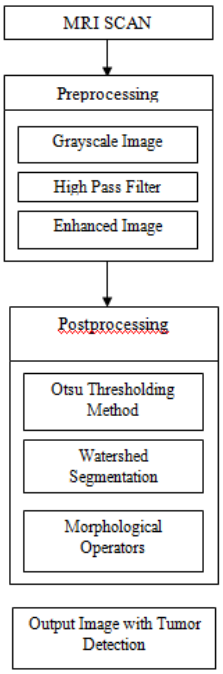

Figure 1: Proposed Methodology Flow

Algorithm Input: MRI Gray Scale Image Output: Isolation of Tumor
Step1:- Convert MRI scan image into grayscale image.
Step2:- Next the image passed through a high pass filter for removing noise and other spike in the image.
Step3:- Now filtered image is added to the grayscale image.
Step4:-Convert the enhanced image (image of step3) in to binary image with a threshold value using Otsu Threshold.

Threshold processing

Thresholding technique segment scalar images by generating a binary partitioning of the image intensities. A thresholding technique tries to find an intensity value, called the threshold, which separates the desired classes.

The segmentation is then obtained by grouping all pixels with intensity greater than the threshold into one class, and all other pixels into another class. In this step, the region between the skull and the brain tissue will be determined. And this region to be segmented has considerable different gray values with other tissues. This proposed approach uses otsu thresholding technique.

Otsu's technique is used to automatically carry out histogram shape-based image thresholding, or, the lessening of a gray-level image to a binary image. Step5:- Separate the tumor from segmented image by Watershed - Method

Step6:- Select only that part of the image from step 4 which has the tumor with the part of the image having more intensity and more area.

Step7:-Obtained image from step6 are added to the original gray scale image from step1 and the resultant image is output.

IV.EXPERIMENTAL RESULTS AND DISCUSSION

Watershed segmentation uses the intensity as a parameter to segment the whole image data set. Moreover, the additional complexity of estimation imposed to such algorithms causes a tendency towards density dependent approaches [12].

Three-dimensional-segmentation is a reliable approach to achieve a proper estimation of tumor volume.

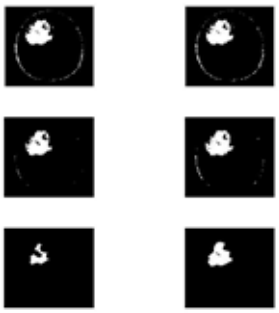

Figure 3: Morphological Operations

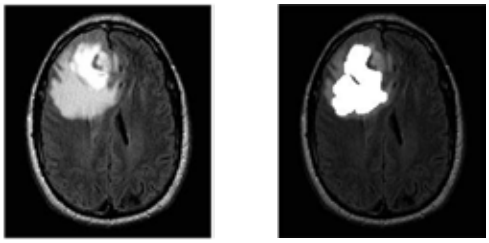

Figure 4: Finalized Output

Classifying regions using their multi parameter values makes the study of the regions of physiological and pathological interest easier and more definable. Here, multi parameter features refer to the following three specific values for the edges (E), gray values (G), and local contrast (H) of the pixels.

As watershed segmentation technique segregates any image as different intensity portions and also the tumerous cells have high proteinaceous fluid, which has very high density and hence very high intensity, therefore watershed segmentation is the best tool to classify tumors and high intensity tissues of brain. The method presented here is user friendly and doctor can select the brain image from the menu screen and find out enhanced image and portion of the tumor.

V.CONCLUSIONS

Magnetic resonance imaging (MRI) provides detailed information about brain tumor anatomy, cellular structure and vascular supply, making it an important tool for the effective diagnosis, treatment and monitoring of the disease. A segmentation approach is proposed in this research work that enables users to quickly and efficiently segment tumors in MRI of brain. This approach uses otsu thresholding technique for better efficiency. The results show that Watershed Segmentation can successfully segment a tumor provided the parameters are set properly in MATLAB environment.

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