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Brain Tumor Detection and Segmentation

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Abstract
The complex problem of segmenting tumor from Magnetic Resonance Imaging (MRI) can be successfully addressed by considering modular and multi-step approaches mimicking the human visual inspection process. The tumor detection is often an essential preliminary phase to solve the segmentation problem successfully. The experiments show good results also in complex situations. Segmentation of images embraces a significant position in the region of image processing. The proposed method detects tumor and segment the tumor.

Keywords: Magnetic Resonance Imaging (MRI), Brain Tumor, Image Segmentation, Watershed Segmentation.

1. Introduction
Brain tumor detection from MRI is one of the most challenging tasks in medical imaging technique. It considers being very powerful diagnostic methods to detect any abnormalities in the brain compared to other medical imaging techniques such as computed tomography (CT), X-ray. Processing of MRI images getting more attention and coming closer to clinical acceptance in this part of field as it provides non- invasive (MR) images with high resolution and excellent contrast between the different soft tissues of the body. Several problems like noise, partial volume effect due to overlapping tissues exist in the brain MRI images, needs to be addressed before, for accurate segmentation which is extremely important and essential for the exact diagnosis by computer aided clinical tools. The aim of removing the irrelevant noises and unwanted parts from the background of the MRI images is to improve the image quality. Different type of methods has been developed for segmentation of brain tumor efficiently. The main goal of segmentation process is to extract the different tumor tissues such as active, tumor, necrosis and edema from the normal brain tissue such as white matter (WM), gray matter (GM), cerebrospinal fluid (CSF) [1].

Brain tumors can be cancerous (malignant) or non-cancerous (benign). When benign or malignant tumors grow, they can cause the pressure inside skull to increase. This can cause brain damage and it can be life-threatening. Therefore early detection of brain tumor is necessity for starting the treatment and saving life.
The proposed method tries to combine region and edge information, thus taking advantage of both approaches while cancelling their drawbacks. We first segment the brain to remove non-brain data. However, in pathological cases, standard segmentation methods fail, in particular when the tumor is located very close to the brain surface. Therefore we propose an improved segmentation method, relying on the approximate symmetry plane.

2. Review Works
Image segmentation represents a method of separating a portion of image into separate areas. A great assortment of dissimilar segmentation approaches for images have been developed. The segmentation of an image entails the division or separation of the image into regions of similar attribute. The ultimate aim in a large number of image processing applications is to extract important features from the image data, from which a description, interpretation, or understanding of the scene can be provided by the machine. Among them, the clustering technique have been comprehensively explore and used by T.Logeswari and M.Karnan [2], a clustering support come closer by using a self-organizing map (SOM) algorithm is projected for medical image segmentation. This paper illustrate segmentation scheme consists of two stages. In the opening stages, the MRI brain image is obtained from patient database. In that

film artefact and noise are disconnected. In the subsequent stages (MR) image segmentation is precisely recognize the major tissue arrangement in these image areas. R. Rajeswari et al. [3] proposed a spectral leakage with the effect of the frequency analysis of finite-length signals or finite-length segments of infinite signals. In brain, the tumor itself comprising a necrotic (dead) part and an active part, the edema or swelling in the nearby brain, as all tumor do not have a clear boundary between active and necrotic parts, there is need to define a clear boundary between edema and brain tissues. Hassan Khotanlou et al. [4] recommend a common automatic scheme for segmenting brain tumors in 3D MRI. Our scheme is valid in dissimilar types of tumors with MRI images. Its effect represent the initialization of a segmentation technique based on a mixture of a deformable model and spatial associations, principal to a particular segmentation of the tumors. P.Narendran, V.K. Narendira Kumar, K. Somasundaram [5] proposed a new method for segmentation of pathological brain structures. This method combines prior information of structures and image information (region and edge) for segmentation. The automated brain tumor segmentation method that we have developed consists of two main components: pre-processing and segmentation. The inputs of this system are two different modalities of MR images: CE-T1w and FLAIR that we believe are sufficient for brain tumor segmentation [6]. The Graph Cut [7] method attempts to solve the min cut/max flow problem. Snakes and Level Sets are active contour methods that evolve a curve based upon geometric and image constraints. For the problem of brain tumor segmentation, Lefohn et al. [8] implemented a level set solver on the GPU. Quantitative results of this level set formulation has been compared well with hand contouring results. Kaus et al. [9] used an atlas and statistical information to segment brain tumors. Edward Kim et al. [10] utilized the statistical seed distributions to overcome the local bias seen in the traditional cellular automata framework. Our results show improved accuracy, robustness, and competitive usability. Further, with a GPU implementation, the method produces results at interactive rates.

3. Proposed Method and Results

The purpose of this study is to automatic detection, segmentation and then extraction of the brain tumor region on the MR images which overcome the process of time taking manual segmentation of large data sets. Various methods are used for image segmentation like thresholding, region growing, clustering, classifier, artificial neural network, deformable models, atlas-guided approaches and level set methods.

In pre-processing 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. The basic steps in pre-processing are the following:

In first step image is converted into gray scale. Noise is removed if exist. The obtained image is then passed through a high pass filter to detect edges. Then the obtained image is added to original image to enhance it. Segmentation has been done on basis of a threshold, due to which whole image is converted into binary image.

3.1 Algorithm

Input : MRI Gray Scale Image.
Output : Isolation of Tumor.

Step 1: Convert MRI scan image into grayscale image.

Step 2: Next the image passed through a high pass filter for removing noise and other spike from the image.

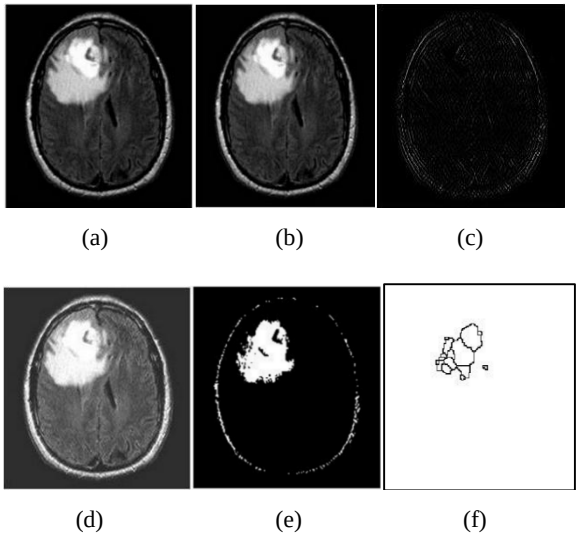
Step 3: Now median filter is used to get the enhance image.

Step 4: Convert the enhanced image (image of step3) in to binary image with a threshold value.

Step 5: Separate the tumor from segmented image by Watershed – Method.

Step 6: 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.

Fig 1 (a) is the original MRI scan image, (b) shows grayscale conversion of the image, (c) represents the high pass filtered image, (b) and (c) images are superpose with a median filter image and get the resultant enhanced image of (d), (e) and (f) show the threshold segmentation with threshold value 0.35.



(a) (b) (c)

(d) (e) (f)

Fig 1: (a) Original Input Image, (b) Grayscale Image, (c) High Pass Filter Image, (d) Enhanced Image, (e) Thresh-hold Segmentation, (f) Watershade Segmentation

4 Conclusions

The quantitative analysis of MRI brain tumor allows obtaining useful key indicators of disease progression. This paper explores a method to identify tumor in brain disorder diagnosis in MR images.

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