DETECTION AND SEGMENTATION OF BRAIN TUMOR FROM MRI IMAGES

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Abstract

Brain tumor is an abnormal intracranial growth caused by cells reproducing themselves in an uncontrolled manner. Curing cancer has been a major goal of medical researchers for decades. The early detection of cancer can be helpful in curing the disease completely. While most of the natural cells are getting old or damaged, they disappear and new cells are replaced with them. Sometimes, this process goes wrong and new cells are produced when body does not need them and the old and damaged cells don't disappear. Therefore, the illimitable and incontrollable increase of cells causes the brain tumor creation.

Normally, the anatomy of brain tumor can be examined by MRI scan. MRI provide accurate visualize of anatomical structure of tissues. MRI is a one type of scanning device, which use magnetic field and radio waves. Now a days, image segmentation play vital role in medical image segmentations. The segmentation of brain tumor from magnetic resonance images (MRI) is an important task. Manual segmentation is one of the techniques for finding tumor from the MRI. In segmentation method first is pre-processing level where the extra parts which are outside the skull and don't have any helpful information are removed and then by applying the fast bounding box (FBB) algorithm, the tumor area is displayed on the MRI images. We are developing a project on Brain tumor which detects and segments the MRI images which help us to understand the tumor present in the brain.

Keywords: Magnetic Resonance Imaging (MRI).

I. INTRODUCTION

Brain tumor is caused by an abnormal growth of cell in brain. Normally brain tumor emerges from brain cells, blood vessels or nerves that are present in the brain. Early detection of brain tumor is necessary as death rate is higher among humans having brain tumor . Techniques for brain tumor detection using image processing has been present for few decades. Researchers have proposed many semi-automatic and automatic image processing techniques to detect brain tumors but most of them fail to give effective and precise results due to the presence of noise, inhomogeneity, poor images contrast that occur usually in medical images. Brain tumor segmentation is very difficult due to complex brain structure but early and accurate detection of tumors, edema and necrotic tissues is very important for diagnostic system. Tumors can damage normal brain cells by producing inflammation, exerting pressure on parts of brain and increasing pressure within the skull . Automatic brain tumor detection and segmentation face many challenges. Brain tumor segmentation requires the efficient knowledge of pathology and understanding the intensity and shape of MRI image. The main problem in tumor segmentation arises due each tumor being of different shape, size, location and intensity. Manual detection of brain tumor requires human interaction and is time consuming. Also it depends on the ability of the observer to locate the location, shape and size of the tumor. Thus, a need of completely computer aided system for brain tumor detection is inevitable.

Radiologists examine the patient physically by using Computed Tomography (CT scan) and Magnetic Resonance Imaging (MRI). MRI images showed the brain structures, tumor's size and location. From the MRI images the information such as tumors location provided radiologists, an easy way to diagnose the tumor and plan the surgical approach for its removal.

MRI's use radiofrequency and magnetic field to result image's human body without ionised radiations. Imaging plays a central role in the diagnosis of brain tumors. The parts on which immediate changes in grey tones occur in the images are called edges. Edge detection techniques transform images to edge images benefiting from the changes of grey tones in the images. As a result of this transformation, edge based brain segmentation image is obtained without encountering any changes in physical qualities of the main image. By applying the fast bounding

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box algorithm (FBB),the tumor area is displayed on the MRI image with a bounding box and the central part is selected as sample points.

II. STRUCTURE OF BRAIN

Generally, human brain includes three major parts controls different activity.

2.1 Cerebrum:

The cerebrum controls learning, thinking, emotions, speech, problem solving, reading and writing. It is divided into right and left cerebral hemispheres. Muscles of left side of the body control by right cerebral hemispheres and muscles of right side of the body control by left cerebral hemispheres.

2.2 Cerebellum :

The cerebellum controls movement, standing, balance and complex actions.

2.3 Brain stem :

Brain stem joints the brain with spinal cord. Brain stem controls blood pressure, body temperature and breathing and controls some basic functions

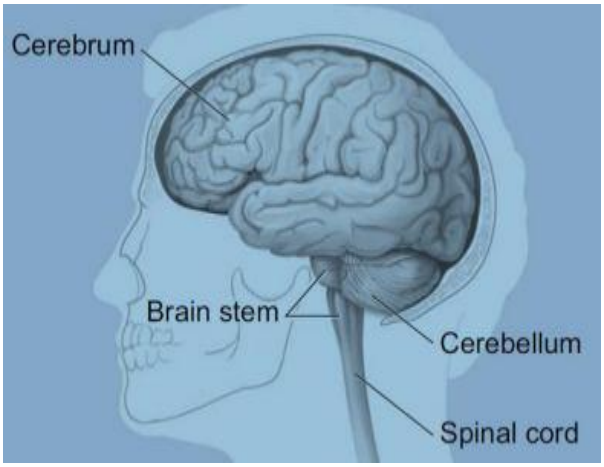

Fig. Structure of Brain

MR image provide details information about human anatomical structure and tissues. Also MR image is safe compare to CT scan and X- Ray Image. It is not affect the human body. MR Image is providing information for use of further treatment and research area. It shows the brain MRI image with the information about different tissues.

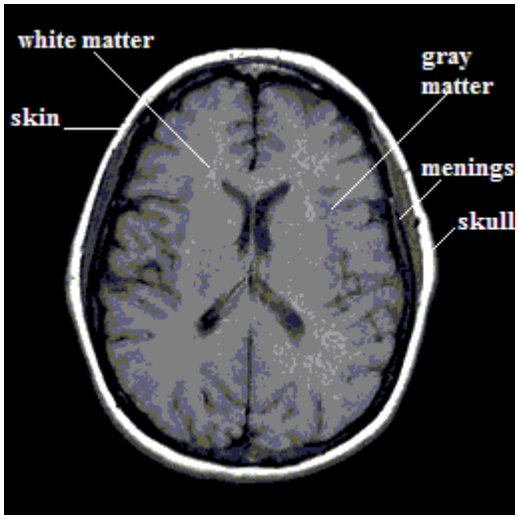

Fig. MRI image of brain

PROPOSED METHOD

Given a brain MRI image, the first step enhances the image, in the second step fast bounding box algorithm is used to detect region of interest and in third step post processing operations are used for segmenting tumor. As the result of above steps, we get a final brain tumor segmented image.

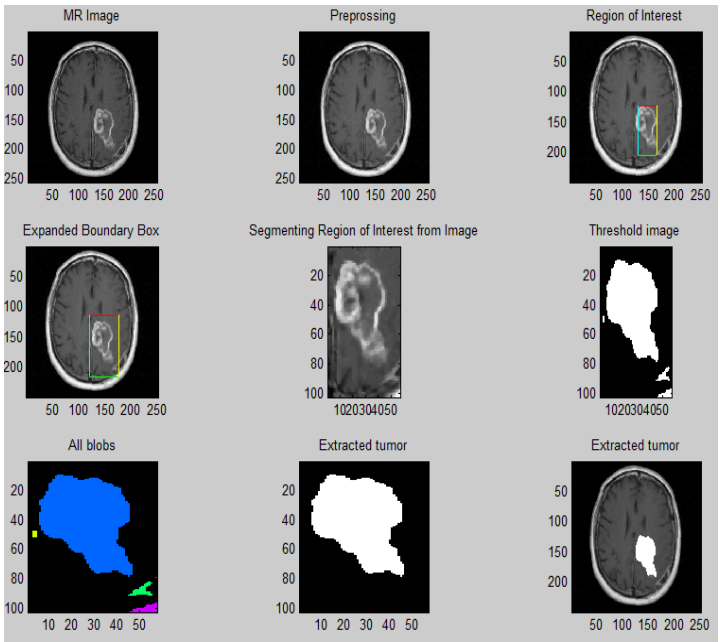

Fig. Overview of brain tumor detection

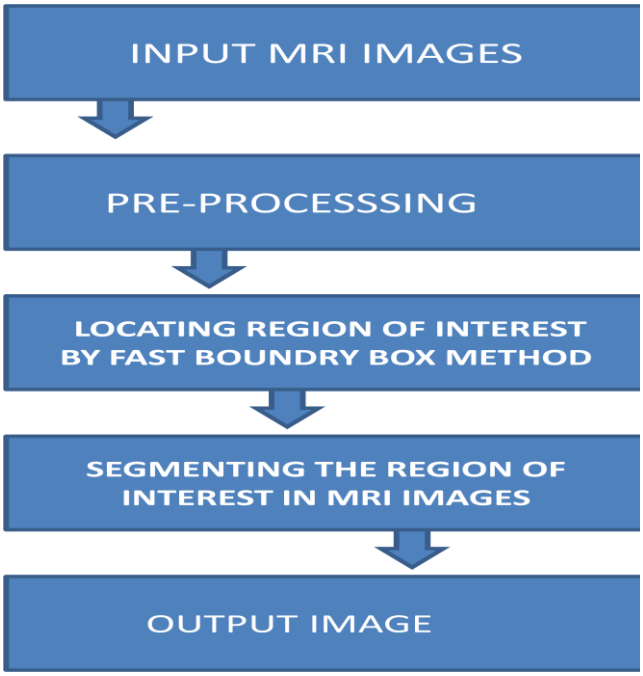

Fig. Flowchart

1) Pre-Processing:

The pre-processing step converts the image according to the need of the next level It performs filtering of noise and other artifacts in the image and sharpening the edges in the image. RGB to gray conversion and Reshaping also takes place here. It includes many filters like Gaussian filter, contourlet transform approch, median filter for noise removal. The possibilities of arrival of noise in modern MRI scan are very less. It may arrive due to the thermal effect. The main aim of this paper is to detect and segment the tumor cells. But for the complete system it needs the process of noise removal. Generally Median filter is used to remove noise. The detected edges are added to the original image to enhance it edges. This makes tumor detection and segmentation easy.

2) Region Of Interest:

Our proposed technique uses Fast Bounding Box algorithm to detect the region of interest (ROI). Bounding Box approach is based on an unsupervised change detection method that searches for the most dissimilar region (axis- parallel bounding boxes) between the left and the right halves of a brain in an axial view MR slice. This change detection process uses a novel score function based on Bhattacharya coefficient computed with gray level intensity histograms. Steps involved in detecting tumor using Bounding Box method are as follows:-

1. Axis of symmetry on an axial MR slice is found which divides brain in two halves left (I) and right (R).

2. One half serves as test Image and the other half supplies as the reference image.

3. Novel score function is used which identify the region of change with two searches – one along the vertical direction and other along the horizontal direction.

4. Novel score function uses Bhattacharya coefficient to detects a rectangle D which represents the region of interest between images I and R.

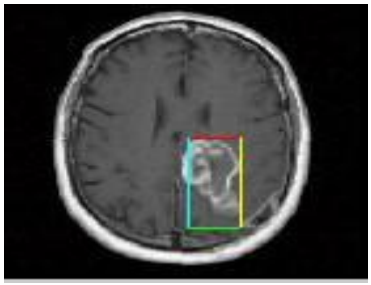

Fig. Region of interest

3) Post processing:

After the ROI is detected, several post processing operations are performed to clearly locate the tumor part in the brain. The basic purpose of post processing is to show only that part of the image D, which has the tumor. Post processing techniques include several mathematical operations and windowing techniques.

The basic steps of postprocessing are as follows:-

1. The rectangle box D, detected by fast bounding box algorithm is stretched so that entire tumor is correctly detected.

2. Mean intensity (M) of pixels in D is calculated.

3. Threshold is applied to D above pixel intensity M.

4. Next blobs are detected in the rectangle D.

5. Finally, windowing techniques are used to obtain brain tumor detected image by selecting the blob with maximum area.

RELATED WORK

From the rigorous review of related work and published literature, it is observed that many researchers have designed detection and segmentation of brain tumor from MRI images by applying different techniques. The image segmentation is entailed with the division or separation of the image into regions of similar features. In this paper, we will discuss an illustrate a number of approaches and show improvements in segmentation performance that can be achieved by combining methods from distinct categories such as techniques in which edge detection s combined

with thresholding. These related works have been mentioned as follows:

Rohan Kandwal and Ashok Kumar [1] uses an easy and completely automated way to detect and segment tumor with good accuracy. Experimental results show that our proposed method produces very good results in enhancing, detecting and segmenting brain tumor from a MRI image. In this paper brain tumor segmentation and detection is done using MR images. The proposed method uses an easy and completely automated way to detect and segment tumor with good accuracy. Experimental results show that our proposed method produces very good results in enhancing, detecting and segmenting brain tumor from a MR image.

Jianping Fan,Yau Elmagarmid & Aref's [2] paper described an automatic image segmentation method using thresholding technique. This is based on the assumption that adjacent pixels whose value (gray level, color value, texture, etc) lies within a certain range belong to the same class and thus, good segmentation of images that include only two opposite components can be obtained.

Dzung L. Pham, Chenyang Xu, Jerry L. Prince [3] proposed the basics that thresholding approaches segment scalar images by creating a binary partitioning of the image intensities. It attempts to determine an intensity value, called the threshold, which separates the desired classes. Segmentation is achieved by grouping all pixels with intensity greater than the threshold into one class, & all other pixels into another class. Determination of more than one threshold value is a process called multi thresholding.

Gauri P. Anandgaonkar, Ganesh.S.Sable [4]explained the Histogram thresholding is easiest method of segmentation because thresholding is fast and economical in computation. In thresholding, histogram of an image is subdivided using a threshold which is nothing but a gray level. Band thresholding, local thresholding, multi

thresholding and semi- thresholding are some of the modifications of this technique. Single thresholds that can differ in image elements are known as local threshold whereas Single thresholds that can be applied to the complete image are known as global threshold. Then depending on value of this threshold, image pixels are assigned with two gray level.

Rohini Paul Joseph, C. Senthil Singh has proposed the work "Brain tumor MRI image detection and segmentation in image processing " has explained that Image processing is an active research area in which medical image processing is a highly challenging field. Medical imaging techniques are used to image the inner portions of the human body for medical diagnosis. Brain tumor is a serious life altering disease condition. Image segmentation plays a significant role in image processing as it helps in the extraction of suspicious regions from the medical images. In this paper we have proposed segmentation of brain MRI image using K-means clustering algorithm followed by morphological filtering which avoids the misclustered regions that can inevitably be formed after segmentation of the

brain MRI image for detection of tumor location. Information is conveyed through images. Image processing is a process where input image is processed to get output also as an image. Main aim of all image processing techniques is to recognize the image or object under consideration easier visually .All the images used in today's world are in the digital format. Medical images are images that show the physical attributes distribution. Medical imaging modalities as in MRI, CT scan mostly depend on computer technology to generate or display digital images of the internal organs of the human body which helps the doctors to visualize the inner portions of the body. CT scanner, Ultrasound and Magnetic Resonance Imaging took over conventional x-ray imaging, by allowing the doctors see the body's third dimension.

K.R.Yasodha has proposed the work "Automatic Segmentation of Brain Tumor from MRI Images" explained that Brain tumor detection is one of the most important methods in medical image mining. An automatic segmentation of brain MR images is needed to correctly segment white matter(WM), gray matter(GM) and cerebrospinal fluid(CSF) tissues of brain in a shorter span of time. Magnetic resonance images are used to produce images of soft tissue of human body. This work reviews the various algorithms in medical image mining based on imaging modalities, magnetic resonance imaging and methods for noise reduction and segmentation approaches. In this survey, image mining based brain tumor detection using different methods are discussed and he concluded with Image segmentation is extensively used in numerous biomedical-imaging applications, e.g., the quantification of tissue volumes, study of anatomical structure, diagnosis, localization of pathology, treatment planning and computer-integrated surgery. As diagnosis tumor is a complicated and sensitive task; therefore, accuracy and reliability are always assigned much importance. Hence, an elaborated methodology that

highlights new vistas for developing more robust image segmentation technique is much sought.

FUTURE SCOPE

Future research in the segmentation of medical images will lead towards improving the accuracy, exactness, and computational speed of segmentation approaches, as well as minimising the amount of manual interaction. These can be improved by incorporating discrete and continuous-

based segmentation methods. Computational effectiveness will be crucial in real-time processing applications. Segmentation methods have proved their utility in research areas and are now emphasizing increased use for automated diagnosis and radiotherapy. These will be particularly important in applications such as computer integrated surgery, where envision of the anatomy is a significant component.

CONCLUSION

Relevance of these approaches is the direct medical application for segmentation and edge detection. We have reviewed the techniques of the MRI image enhancement in terms of tumor pixels detected. We have studied several digital image processing methods and discussed its requirements and properties in brain tumor detection .This paper gives enhanced information about brain tumor detection and segmentation. The marked area is segmented and the assessment of this tool from the radiologist, whom the project is concerned with, is positive and this tool helps them in diagnosis, the treatment procedure and state of the tumor monitoring.

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