

Study on “Brain Tumor Detection Using Image Segmentation”

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Abstract: Study of brain tumor detection and segmentation the MRI Images is very useful in recent years. With the help of MRI Images we can detect the brain tumor. In the recent time, processing of medical images is a developing and important field. It includes many different types of imaging methods. Some of them are Computed Tomography scans (CT scans), X-rays and Magnetic Resonance Imaging (MRI) etc. The several technologies allow us to detect even the smallest defects in the human body. Detection of brain tumor by the help of unusual growth of tissues and blocks of blood in nervous system can be seen in an MRI Images.

Now a day image processing plays an important role in medical field and medical imaging is a growing and challenging field. Many people suffer from brain tumor; it is a serious and dangerous disease. Medical imaging provides proper diagnosis of brain tumor. In the present time period many techniques to detect brain tumor from MRI images. These methods face challenges like finding the location and size of the tumor. Image segmentation is used to detect the tumor from the brain is most important and difficult part. Already, various algorithms are developed for image segmentation. In this review paper we cover the basic terminologies of brain tumor and MRI images, review of various brain tumor segmentation techniques. The Brain Tumor is affecting many people worldwide. It is not only limited with the old age people but also detected in the early age.

Keywords - Brain Tumor, Image Processing, X-Ray, Pre-Processing, Segmentation, Feature Extraction, MRI (Magnetic Resonance Imaging), C.T. Scan Images.

I. INTRODUCTION

The tumors are the growth of cells which are abnormal in their nature that may differ from the normal cells by their uncontrolled characteristics of the tissue grows in brain. We can see the tumor in the radiological image format like X-ray, MRI, and CT scan. There are various methods for brain tumor segmentation. In our project we are using normalization and various preprocessing techniques. It is rare for brain tumors to run during a family. Only a really small number of families have several members with brain tumors. In this reading whether the use of mobile telephones, having had a head damage, or having been uncovered to certain chemical compounds at paintings or to magnetic fields are crucial hazard factors. Studies haven't shown consistent links between these possible risk factors and brain tumors, but additional research is required. In segmentation process we can specify the tumor very comfortably and easily. In this study we get approach for the detection of tumor in brain the usage of segmentation clustering. The proposed method can be successfully applied to detect the contour of the tumor and its geometrical 3 dimension. This technique can be proved to be handy tool for the practitioners especially the physicians engaged in this field. Brain tumor, occurs when abnormal cells from inside the mind.

There are two main sorts of tumors malignant or cancerous tumors and benign tumors. Malignant tumor involves abnormal cell growth with the potential to invade or spread to other parts of the body. Benign tumors do not spread to different parts of the body.

Fig.1 shows the presence of tumor in human brain. Normally brain tumor affects CSF (Cerebral Spinal Fluid). It causes strokes. The physician gives the treatment for the strokes rather than the treatment for

tumor. So detection of tumor is important for that treatment. Medical imaging techniques play an important role in diagnosis and early detection of tumor.

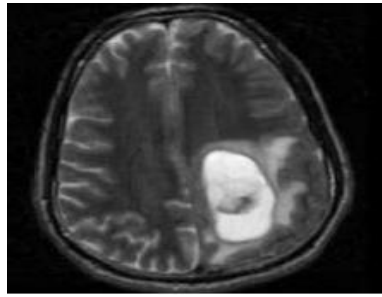


Figure 1. MRI of human brain. Note the Presence of a Tumor towards the Bottom Left

Tumor segmentation from MRI data is a crucial but time consuming manual task performed by doctors. Brain tumor analysis is completed by doctors but its grading gives different conclusions which can vary from one doctor to a different. Also the tumor size, position, texture and appearance are very different in different patient images as shown in fig.2.

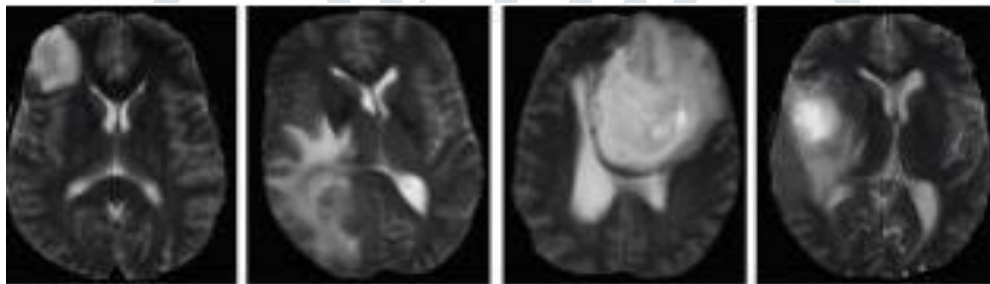


Figure 2. MRI depicting tumors in brain images of different patients.

✓ MRI IMAGES OF BRAIN

This magnetic resonance imaging is a very helpful for the brain tumor detection for cancer imaging. The MRI scan shows a clear view and detailed information inside the human brain which is extraordinary compared to the CT scan and X-Ray.

→ The most common primary brain tumors are :

1. Gliomas
2. Meningiomas
3. Pituitary adenomas
4. Nerve sheath tumors
5. Benign or Malignant tumor

✓ What is Brain?

“Brain is the one of the important part organ that located in human head that composed of neurons.”

✓ What is Brain Tumor?

“Tumor is an anomalous mass which may exist inside or on the brain. Brain tumor is cancerous or non cancerous mass growth of abnormal cells in brain. Two different terms are used for this anomalous and abnormal part in the brain.”

1. Tumor
2. Cancer

→ Tumor and cancer does not have the same characteristics are :-

- **Tumor** is a solid or fluid filled mass of abnormal tissues, tumor is also called neoplasm.
- Tumor can be categorized into primary and secondary tumor.

- Primary tumor is composed of cells of that organ where tumor locates.
 - Mostly primary tumor is supported by nervous system to grow up, and tumors grow this very slow.
 - This type of tumor which is related to nervous system is called gliomas and glias cells of brain are the building-block.
- **Cancer** is a rapid and uncontrollable growth of abnormal tissues which damages the nearby health tissues of brain.

✓ **Structure of Brain**

Usually, human brain consists of three predominant parts controls unique activity.

1. **Cerebrum:** - The cerebrum controls learning, thinking, emotions, speech, problem solving, reading and writing. Its miles divided into right and left cerebral hemispheres. Muscle tissue of left facet of the body manages through right cerebral hemispheres and muscles of proper side of the frame manipulate through left cerebral hemispheres.
2. **Cerebellum:** - The cerebellum word means little brain is the region of brain that plays an important role in body controls. Cerebellum helps to provide smooth and coordinate body movement, standing, balance and complex actions.
3. **Brain stem:** - Brain stem joints the brain with spinal cord. Brain stem controls vital sign, blood heat and breathing and controls some basic functions.



Figure 3. Indicate the Brain Structure.

MR image provide details information about human structure and tissues. Additionally MR picture is secure compare to CT Scan test and X- Ray image. It is not affect the human body. MR Image is providing information to be used of further treatment and research area.

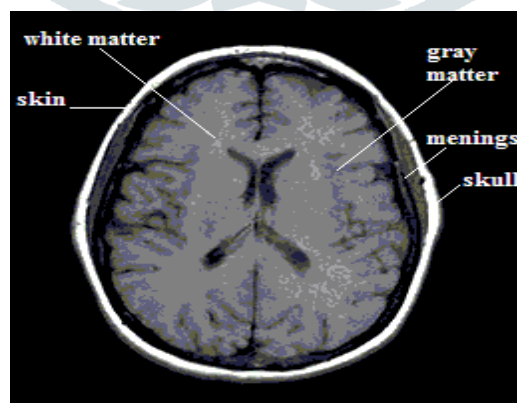


Figure 4. Brain MRI Image

a. **MRI:** A large machine with a strong magnet linked to a computer is used to make detailed pictures of areas inside your head. Sometimes a special dye (contrast material) is injected into a vessel in your arm or hand to assist show differences within the tissues of the brain. The pictures can show abnormal areas, like a tumor.

b. CT scan: Computed Tomography (CT) is used to construct brain images through a series of X-rays scan. An X-ray device linked to a laptop takes a series of distinct images of your head. You may receive contrast medium by injection into a vessel in your arm or hand. The contrast medium makes abnormal areas easier to ascertain.

II. Purpose

This approach consists for detection of range and shape of tumor in brain part with the help of MRI images. Tumor is vast growth of tissues in any a part of the body. According to the type of tumor patient need to get treatment. So, brain tumor is extremely serious disease, because it'll grow in limited space inside the skull. It needs to be recognized at early stages because it may lead to death. In our research we are using segmentation technique to detect tumor. Our innovative work is 3D visualization of tumor area. Medical image processing is that the most challenging and emerging field now each day . Processing of MRI [Magnetic Resonance Image] images is one of the parts of this field. This paper describes the proposed method to locate & extraction of brain tumor from affected person's MRI test images of the mind. This approach incorporates with some noise removal features, segmentation and morphological operations which can be the critical concepts of picture processing. Detection and extraction of tumor from MRI scan images of the brain is completed by using MATLAB software.

III. BACKGROWND

Brain Tumor is described as abnormal development of tissues in the brain. Nowadays the prevalence of tumors is growing fast. In 2016, an estimated 23,800 adults. (10,350 women and 13,450 men) in the US will be identified with the harmful tumors of brain as well as spinal code. Analysis of mind tumors is somewhat elaborate as the varied form, size, tumor place and the presence and appearance of tumor in mind. MRI is the only and substantially used approach for mind tumor detection. gift tools and techniques to investigate tumors and their behavior have grow to be greater popular. Image processing method may be used to pick out brain tumors.. In this study we will focus how to identify brain tumors usage image processing strategies.

The 2016 WHO(world health organization) on classification of brain tumor of critical worried system is an conceptual as well as positive review of predecessor. WHO classification CNS tumor that is used molecular parameters for its analysis shape. Further than 2016 CNS WHO presence the new diffuse gliomas and other tumor and defines the new feature like both histology as well as molecule.

The fourth edition of the WHO i.e. world health organization classification of tumor of central nervous system published in 2007.there are several new titles and information list including glioma, papillary, glio neuronal tumor etc. The histological editions are able to different edge distribution, place, symptoms and the behaviors or medical.

Fuzzy clustering is technique which broadly used biomedical to discover the image.

The effective fuzzy clustering algorithm is used in abnormal MR brain image segmentation.

An image can be defined as a two-dimensional function $f(x, y)$, wherein x & y are spatial coordinates, & the amplitude of f at any pair of coordinates (x, y) is referred to as the depth or gray degree of the photo at that point. virtual photograph consists of a finite range of elements, each of which has a specific region & cost. The factors are referred to as pixels.

Image segmentation is the method of partitioning a digital image into multiple segments (Unit of pixels, also known first-rate pixels). Segmentation is usually used to discover items and obstacles (lines, curves, and so forth.) in images.

For the extraction of useful features from the complex brain structure Magnetic resonance imaging (MRI) is reliable. MRI is very important in order to improve the diagnosis and treatment of brain tumor, by detecting tumor at its early stage.

Segmentation of medical images is first important step in their analysis, the segmentation gives organ detection and variation of growth of tissues as a output in medical images. Some segmentation approaches are Region Growing, Edge Based Segmentation, K-means Clustering, and Fuzzy C-means Clustering.

Clustering the process of collection of objects which are similar between them and are dissimilar objects belonging to other clusters.

Region growing is a technique of segmentation in which pixels with similar intensities are grouped in order to find the regions directly. This group of pixels belonging to the region of focus is known as seeds. Clustering is appropriate in biomedical image segmentation while the quantity of cluster is understood for specific clustering of human anatomy.

IV. Methodology

Image Processing techniques are used to detect tumor that has mainly following steps are– Pre-Processing, segmentation, Feature Extraction and Classification. The flowchart of the steps followed in tumor detection and classification is shown in figure:-

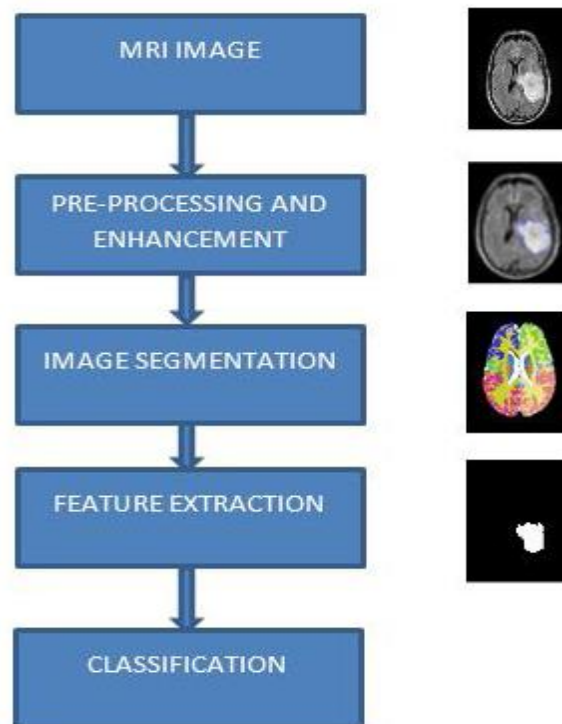


Figure 5. Steps of Tumor Detection

Preprocessing and Enhancement of an Image: This is the first step of image processing it is used to enhance the chances of detecting the suspicious region. Finer details of the image are enhanced and noise is removed from the image. Clinical MRI when corrupted by noise reduces the accuracy of the image. Various filters are used to remove this noise. Anisotropic filter is used to remove background noise, weighted median filter is used to remove salt and pepper noise. The original image and image after enhancement.

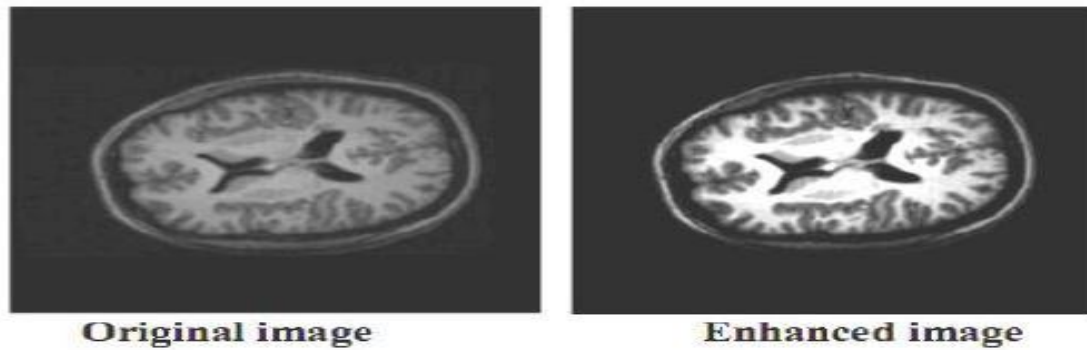


Figure 6. Image Enhancements

Pre-processing stage consists of Noise removal this will be done by using various spatial filters linear or nonlinear filters (Median filter).

This processing involves RGB to grey conversion and reshaping . It includes median filter for noise removal. Basically preprocessing means to converts the RGB image into Grayscale image.

Segmentation methods: Image segmentation is that the method of breaking down a picture into small parts. Segmentation is performed to make the analysis easier. It is mostly used to detect boundaries and objects in an image It is a technique of drafting a label to each pixel in the image so that pixels having the same label can share common visual attributes. There are following types of image segmentation methods are:-

Various Methods	Advantages	Disadvantages
Active contour Method	In this method keep line shapes accurately and globally.	Find strong image gradients for the contour. It is inaccurate with image having noise.
Watersheds Method	It uses mathematical morphology. It is used to improve the capture range.	Over segmentation.
Threshold Method	It uses gradient magnitude method to find out the edge pixels.	It fails in images having poor contrast.
Region Based	Correctly separate regions according to the similarity of properties.	Noise may lead to quality of final result.
Fuzzy C Means, & K Means	This Technique is helpful in large images which are having poor contrast.	In this Sample which are to be selected and provide fuzzy sets may be hard to apply.
Region Growing	It accurately differentiates the regions having matching properties which are used to detect the seed points.	It Requires manual not automatic interaction to get seed point.

Feature Extraction: Extracting the precise tumor may be a crucial task just in case of brain tumor due to the complex structure of brain. Certain parameters are taken under consideration for feature extraction as size, shape, composition, location of the image. As per the results obtained from the feature extraction the classification of the tumor is completed . When segmentation phase is completed next step is to extract features from image which means to extract the relevant information from image to study the effective results. The features which are extracted will give the characteristics of the input

category to the classifier by allowing for the description of the applicable properties of the image into feature vectors like area, shape, texture contrast and entropy.

V. CONCLUSION

Today's, image segmentation plays a vital role in medical image segmentations. The segmentation of brain tumor from resonance images is a crucial task. Manual segmentation is one of the techniques for finding tumor from the MRI. This method is time-consuming but also generates errors. So, several automated techniques have been developed. In this paper several existing brain tumor segmentation and detection methodologies have been discussed for MRI of brain images. After segmentation the next step is feature extraction. The feature extraction is extracting the cluster which shows the anticipated tumor at the FCM output. In this work only area is calculated but many features like height, width, perimeter and volume are needed to properly analyze the MR images.

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