A REVIEW: BRAIN TUMOR SEGMENTATION USING K-MEANS CLUSTERING FOR DETECTION AND CALCULATION OF TUMOR AREA

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Abstract

The most challenging and emerging field is medical image processing. For the detection and identification of tumor in MRI of brain is implemented here. The traditional method for brain medical resonance imaging and the detection of tumor is done by human inspection which is operator dependent. Segmentation is done by operator in the clinical environment which is very tedious task and time consuming work. Segmentation of MRI of brain is complicated in this medical imaging field except few presented methods. Brain MRI can be divided into various regions mainly soft tissues like white matter, cerebrospinal fluid, gray matter etc. Using this process of segmentation, the location and size of tumor may be found evaluated. The present methodology proposed here consisting of preprocessing like removal of noise, process of segmentation and some morphological operations which are the basic steps in the image processing tool. Extraction and detection of tumor from brain MRI scan images is done by using k-means clustering method in MATLAB software.

Keywords: *MRI (Magnetic Resonance Imaging), K-means Clustering.*

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1. INTRODUCTION

Brain tumor is the main cause for increasing the mortality among adults and in children also. By studying few researches, the numbers of people has been found, are becoming victim of brain tumors has increased tremendously.

To improve the image quality and analysis approach from different applications, the image processing tool is used. It helps to improve the accuracy but it is time consuming [1]. Image processing has different application areas like biometric, remote sensing, security and medical. The medical diagnosis purpose is one of the application areas. Current research is on detection of Brain Tumor and its area calculation using image processing. It is an implementation of automated calculation of tumor area [2].

When the growth of tissues becomes uncontrolled in human brain is called tumor and when it converts into a cancer, it becomes life threatening and hence it is very necessary to detect the location and area of tumor means actual size of tumor by using medical imaging. Segmentation of brain MRI plays an important role in locating tumor in magnetic resonance image [3]. For this purpose there are different techniques which are used to capture images such as Computer Tomography (CT), X-Ray and Magnetic Resonance Imaging. But among these methods the MRI is advantages than other because it provides more useful information of anatomical structure which is used for the pathological and clinical studies [4]. The segmentation of medical image is a difficult task due to complexity of the anatomy that is being imaged. Many times it is impossible to detect certain structures without detailed knowledge regarding anatomy. Due to this the process of segmentation becomes a difficult task. Either the information is built in that system or built by an operator. For segmentation process there are many methods which are convenient and used for segmentation purpose such as edge detection, region growing, histogram equalization etc. They need human interaction is the main problem with these methods for reliable segmentation and accurate work. To overcome this problem K-means clustering method is used for segmentation [7].

2. TRADITIONAL APPROACH

The traditional method used to detect the tumor from MRI scan images is such a way that radiologist detect and manually calculate size of tumor from CT scan images.

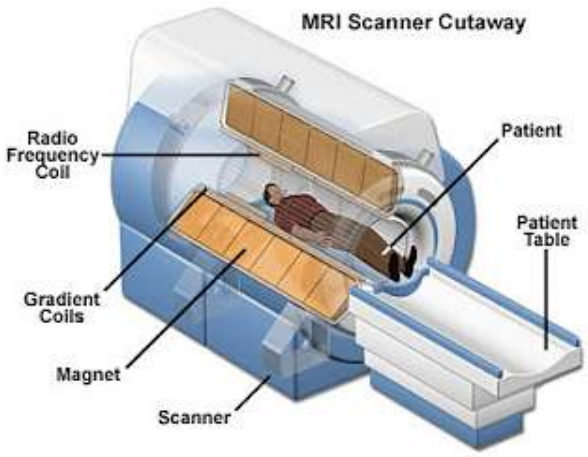

Fig. 1 MRI Scanner

Usually the Computer Tomography technique is used for monitoring purpose of these images of damaged brain parts. The Computer Tomography Scan images are in the form of color image and the detection of tumor from the image becomes easy.

The cerebrum part in the parietal section of the head is displayed in the form of the gray color and the veins, arteries are displayed like creamish white color using CT-Scan images.

Fig. 2 Patient's MRI Scanning

The normal patient and the patient having the damaged brain are then differentiated by using this methodology. Again based on these image results the tumor can also be detected. Additionally, to determine tumor patient's response this technique has been practiced since long time and it is time consuming.

Fig. 3 MRI Monitoring by Doctors

The radiologist has made numbers of measurements of cross-sectional diameter by using Computer Tomography image data. Then, these measurements will be studied by comparing it with previous measurements. Due to some factors, the lesion's measurement of the diameter fails to represent the exact assessment regarding the size of tumor.

Lesion's Irregularity

These lesions may not adequately represented by diameters, that grow other than sphere shape..

Scanning Levels

At the same point or spot, the lesions may not be exactly captured.

Hence, it affects the measurement lesions diameter, which causes difficulty in calculation of tumor area.

3. MODERN APPROACH

The Modern Approach for Detection and Identification of Tumor from brain MRI consisting of Input Image Selection, Pre-processing of input image, Segmentation, Feature Extraction and Tumor area calculation.

Algorithm's steps:
1) Selection of Image.
2) Pre-processing of data.
3) K-means clustering segmentation.
4) Extraction of features.
5) Tumor Area Calculation.

3.1 Selection of Input Image

Patients MRI scan image of brain is taken as an input for the designed system.

3.2 Pre-Processing of Data

An input MRI image is converted according to the need of next level is called as preprocessing. The filtering of the noise and other artifacts from that image is carried out and also the sharpening of edges in the image. Also the conversion from RGB to gray and Reshaping of image takes place, if required here. The median filter is used for removal of noise. But the possibilities of noise arrival are less in this modern image scanning technique. Due to thermal effect it may arrive. The aim of this proposed methodology is to detect, identify and segment the tumor part in healthy cells. And this median filter is used for the process of noise removal for the complete system.

3.3 K-means Clustering Segmentation

The purpose of k-means clustering is to cluster the given set if data. K-means is one of the simplest partitions methods of clustering. It is one of the learning algorithms which is unsupervised. Clustering the image means grouping out the pixels depends on some characteristics. In K-means clustering the number of clusters k has to be defining first. The cluster centers k has to be chosen randomly. Then distance between these cluster centers and pixels are calculated. Every pixel is individually compared with all cluster centers with the help of distance formula. The pixel is moved to particular cluster which has shortest distance among all. This process is continuous until the centre converges.

Algorithm:
1. Give no. of cluster value k.
2. Choose k cluster centers randomly.
3. Calculate mean.
4. Calculate distance between each pixel to cluster center.
5. If distance is near to center then moved to that cluster.
6. Otherwise move to next cluster.
7. Re-estimate the center

3.4 Feature Extraction

While extracting the features the cluster extraction from the output of K-means clustering process. The clusters which are extracted from output of k-means are given to the thresholding process. In this process the binary mask is applied over whole image. Due to this binary masking, the dark pixels become darker and the white pixels become brighter. In threshold coding each coefficient of transform is compared with a threshold. If it is below the threshold value then it is considered as zero and if it is more than the threshold, then it is considered as one. In this Methodology, the coefficients whose magnitudes are above threshold are retained.

3.5 Tumor Area Calculation

For calculation of tumor area the extracted tumor image is taken as an input then by calculating number of white pixels and transforming it the tumor area is calculated.

Algorithm used for tumor area calculation.
1. Read the input image.
2. Input image is filtered by using median filter to improve the quality of image and for sharpening purpose.
3. Segmentation of filtered image is carried out for grouping out white pixels.
4. Calculate the no. of white pixels.
5. Converting the pixels into mm2 by using standard value.
   (1 pixel = 0.26432 mm2)
6. Display the area a.

4. CONCLUSION

In today's world, Medical Imaging has become a very useful task and important work. Application part of this image processing or medical imaging can be found in number of areas which are medical field, remote sensing and the electronics. For diagnosis purpose, as we focus on medical applications, image segmentation process is now widely used. In this proposed methodology, we have discussed a system that can be used to detect and identify tumor part of brain using segmentation of brain MRI. Further we may decide its type by finding area of tumor.

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