Tumor Detection in Brain MRI using Clustering and Segmentation Algorithm

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ABSTRACT

This paper represents the combination of K-means algorithm and Fuzzy c-means with the Multi-thresholding for brain MRI. This algorithm is used to detect the range and shape of the tumor in brain MRI images. CT scan or MRI that is directed into intracranial cavity produces a complete image of a brain. This image is visually examined by the physician for detection and diagnosis of brain tumor. However, this method of detection resists the accurate determination of stage and size of a tumor. To avoid that it uses computer-aided method for segmentation of brain tumor based on the combination of two algorithms. As compared to manual segmentation it provides segmentation of tumor with accuracy and reproducibility. It reduces the time for analysis. The tumor is extracted from MRI image and its exact shape and position are determined. The amount of area calculated from the cluster is used to display the size of the tumor.

Keyword: *- K-Means Clustering, Fuzzy C-Means, Thresholding, Magnetic Resonance Imaging (MRI).*

1. INTRODUCTION

Normally the Brain can be viewed by the MRI scan or CT scan. In this paper the MRI scanned image is taken for the entire process. The MRI scan is safer than CT scan for diagnosis. It will not affect the human body. Because it doesn't use any radiation. It is based on the magnetic field and radio waves. There are various types of algorithm were developed for brain tumor detection. But they may have some drawback in detection and extraction.

Two clustering algorithms are used for segmentation. As it gives the accurate result for tumor segmentation. The brain tumor can be either primary or secondary. If it is an origin, then it is known as primary. If the part of the tumor is spread to another place and grown on its own then it is known as secondary. Brain tumor affects CSF (Cerebral Spinal Fluid) area. Mass and Malignant are two types of brain tumor cells. The detection of the malignant tumor is somewhat difficult to a mass tumor. The accurate result of the malignant tumor can be detected using a 3-D representation of brain and 3-D analyzer tool. Segmentation is used on detection of mass tumor detection. The developing platform for the detection of brain tumor is Matlab because it is easy to develop and execute. At the end, we are providing a system that detects the brain tumor and its shape.

1.1 LITERATURE SURVEY

In the internal structure of the human body, magnetic resonance imaging is often used in the medical field for detection and visualization. It is basically used to detect the differences in the body tissues which have a considerably better technique as compared to CT scan. Thus, this technique becomes a special technique especially for the brain tumor detection and cancer imaging. Basically, for comparison, CT uses ionizing radiation while MRI uses the strong magnetic field to align the nuclear magnetization that follows by changes the alignment of the magnetization by radio frequencies that can be detected by the scanner. This paper provides a review of image-based tumor detection.

Brain tumor has become one of the main cause for increasing mortality among children and adults. The CT-scan technique is used for monitoring the images of damaged brain part. The images of the CT Scans are shown in the form of grayscale images as the equipment for CT scans support this form of image color and for easy detection of the tumor from the image. Any clotting that exists in the brain that shows any kind of damage can be detected as dark gray in color. The process of extraction of parameters is basically like taking out per pixel information and then plotting it. For an image obtained from CT-Scan, the images are shown in this manner; tumor appears white and brain damaged cells shown in black color, thus the binary values of the pixel showing the brain damaged cells are 0 and showing the tumor are 1, thus by extraction process, further analysis can be done such as checking and plotting in MATLAB. The patient with a damaged brain can be differentiated from the normal patient by using this technique. In addition, the tumor can also be detected clearly based on the image. In this paper, we have used k-means algorithm, fuzzy c-means clustering and Segmentation methods.

1.2 OUTLINE OF THE WORK

Preprocessing is done by using filtering technique. Segmentation is carried out by K-means clustering algorithm. Feature extraction is done using thresholding and we have used approximation method to recognize the tumor shape and position in MRI image. The proposed method consists of two algorithms were developed for segmentation. They are not good for all types of the Brain MRI images.

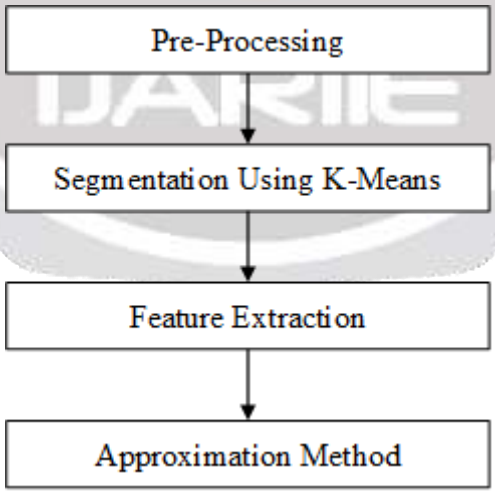

Fig.1: Block diagram of proposed method

The proposed method consists of five modules. Each modules and its function will be explained below.

2. METHODS

2.1 PRE-PROCESSING

The preprocessing step convert the input image for the need of next level. It performs noise filtering and artifacts in the image and sharpening the edge in the image. RGB to gray conversion and reshaping of the image takes place here. The median filter is used for noise removal.

2.2 SEGMENTATION

Segmentation is carried out by advanced clustering algorithms i.e. K-means and Fuzzy C-means algorithms.

2.3 FEATURE EXTRACTION AND APPROXIMATION METHOD

The feature extraction is used to extract the cluster that shows the predicted tumor at the FCM (Fuzzy C-means) output. Then this extracted cluster is given to the threshold process. It applies binary mask over the entire image. In the approximation method step the tumor area is calculated using the binarization method.

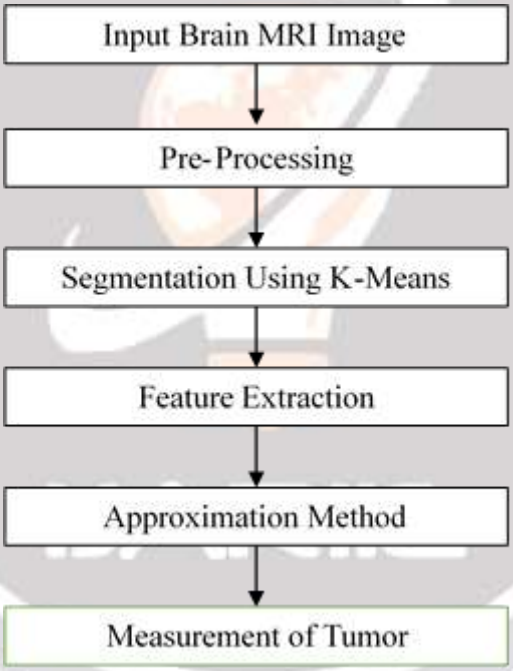

Fig. 2: Flowchart of Feature Extraction

3. MODELING TECHNIQUES

3.1 K-MEANS CLUSTERING

A cluster is a collection of objects which are similar are grouped together and are dissimilar to the objects belonging to other clusters. Clustering is an unsupervised learning method which deals with finding a structure in a collection of unlabeled data. Another definition of clustering could be the process of organizing objects into groups whose members are similar in some way. K-means clustering is an algorithm to group objects based on attributes/features into k number of groups where k is a positive integer. The grouping (clustering) is done based on the Euclidean distance between data and the corresponding cluster centroid. Thus the purpose of k-means clustering is to cluster the data.

3.2 K-MEANS ALGORITHM

The purpose of the k-means algorithm is to cluster the data. K-means algorithm is one of the simplest partitions clustering methods. K-Means is the unsupervised learning algorithm for clusters. Grouping of pixels is done according to the same characteristics. In the k-means algorithm initially, we have to define the number of clusters k. Then k-cluster center is chosen randomly. The distance between the each pixel to each cluster centers is calculated. The distance may be of simple Euclidean function. A single pixel is compared to all cluster centers using the distance formula. The pixel is moved to the particular cluster which has the shortest distance among all. Then the centroid is re-estimated. Again each pixel is compared to all centroids. The process continuous until the center converges.

Algorithm:

1. Give the no of cluster value as k.
2. Randomly choose the k cluster centers
3. Calculate mean or center of the cluster
4. Calculate the distance between each pixel to each cluster center
5. If the distance is close enough to the center then move to that cluster.
6. Otherwise, move to next cluster.
7. Re-estimate the center.

3.3 K-MEANS SEGMENTATION

Image Segmentation partitions an image into set of regions. The region represents meaningful areas in an image or be the set of border pixels grouped into structures such as line segments, edges etc. The segmentation has two objectives. First to decompose an image into regions for further analysis and to perform a change of representation of an image for faster analysis. Different types of segmentation techniques are used for segmentation. Segmentation algorithm is based on the properties of gray level values of pixels. The different types of segmentation techniques are: Edge based segmentation, Threshold Based Segmentation Region Based Segmentation, Clustering, Matching. In this paper, we discuss about the different types of threshold based segmentation Techniques.

3.3.1 THRESHOLD SELECTION

The key parameter in image segmentation using thresholding technique is the choice of selecting threshold value T. In case of manual thresholding method, the threshold value T can be selected by the user with the help of image histogram. This method is generally accomplished by a tool that allows the user to select the threshold value T based on choice. In case of automatic threshold selection method, the value of T can be chosen based on histogram, clustering, variance, means etc.

It is one of the simplest and fastest segmentation methods based on the assumption that images are formed from regions with different gray levels.

4. CONCLUSION AND FUTURE WORK

There are different types of tumors available. They can be mass in brain or malignant over the brain. Suppose if it is a mass then K- means algorithm is enough to extract it from the brain cells. If there is any noise present in the MRI image it is removed before the K-means process. The noise free image is given as input to the k-means and tumor is extracted from the MRI image. The proposed method gives more accurate result. The future work focus on segmentation using Fuzzy C means for accurate extraction of malignant tumor and thresholding of output in feature extraction. Finally approximate reasoning for calculating tumor shape can be carried out.

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