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Survey on Brain Tumor Detection using K-Means Clustering Algorithm

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ABSTRACT: This paper deals with the survey of simple algorithm that detects tumor area and its accurate size in brain MR images. Brain tumor is inherently serious and life-threatening because of its character in the limited space of the intra-cranial cavity. Most Research in developed countries show that the number of people who have brain tumorswere died due to the fact of inaccurate detection. Generally, CT scan or MRI that is directed into intra-cranial cavity produces a complete image of brain. This image is visually examined by the physician for detection and diagnosis of brain tumor. However this method defy the accurate determination of stage. To avoid that, this project uses computer aided method for detection of brain tumor based on K-means algorithm. This method allows the segmentation of tumor tissue with accuracy and reproducibility comparable to manual segmentation. In addition, it also reduces the time for analysis. At the end of the process the tumor is extracted from the Magnetic Resonance Image and its exact position and the shape is also determined. The stage of the tumor is displayed based on the amount of area calculated from the cluster. In addition with image processing we are using Hadoop for storing segmented MRI Images

KEYWORDS: K-means Clustering, Magnetic Resonance Imaging(MRI), Thresholding, Brain Tumor analysis, Hadoop

I. INTRODUCTION

This project deals with the concept for automatic brain tumor detection. Normally the anatomy of the Brain can be viewed by the MRI scan or CT scan. In this project the MRI scanned image is taken for the entire process. The MRI scan is more suitable than CT scan for diagnosis. MRI does not affect the human body, because it doesn't use any radiation. It is based on the magnetic field and radio waves. Number of techniques has been invented in current years to seal this break, but still there is no generally customary automated technique by doctors to be used in clinical floor due to accuracy and robustness issues.

Tumor is due to the uncontrolled growth of the tissues in different part of the body. The tumor may be primary or secondary. If it is an beginning, then it is known as primary. If the part of the tumor is spread to different place and grown as its own then it is known as secondary. Normally braintumor affects Cerebral Spinal Fluid which causes strokes. The physician gives the treatment for the strokes in spite of the treatment for tumor. So detection of tumor is important for that treatment. The life time of the person who is affected by the brain tumor will increase if it is detected at current stage. That will increase the lifetime about 1 to 2 years. At the end, tumor will be categorized as non-tumor, less severe, tumor

II. LITERATURE SURVEY

Martial Heber (2005), presented an evaluation of two well known segmentation algorithms, the mean shift-based segmentation algorithm and a graph-based segmentation scheme[1].

Hui Zhang (2008), distinguished subjective & supervised evaluation methodology for image segmentation. Subjective evaluation and supervised evaluation, are infeasible in many vision applications, so unsupervised methods are must.

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Unsupervised evaluation enables the objective comparison of both different segmentation methods and different parameterizations of a single method[1].
J. selvakumar (March 2012) Tumor may be as 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 some noise present in the MR image it is removed before the K-means process. The noise free image is given as a input to the k-means and tumor is extracted from the MRI image. And then segmentation using Fuzzy C-means for extracting accurate tumor shape of malignant tumor and thresholding of output in feature extraction. Finally approximate reasoning for calculating tumor shape and position calculation[2].
Rohini Paul Joseph (2014) Image processing is an active research area in which medical image processing is a highly challenging field. Medical imaging methodologies 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 part 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 part. Segmentation of brain image is essential in surgical planning and treatment planning in the field of medicine. In this work, we have proposed a computer aided system for brain MR image segmentation for detection of tumor region using K - means clustering algorithm followed by morphological filtering. We were able to segment tumor from different brain MRI images from our database[3].
Swati Khurana (April 2015) The purpose of this paper is to provide review for MRI based brain tumor segmentation methods. Firstly, space a brief introduction to brain tumors and imaging modalities. Then, proceeding with the comparison in different imaging modalities. Finally, the brief discussion of the current state is performed and the qualities of different approaches are critically reviewed[4].
Vignesh Rajesh (October 2015) This experiment was performed to locate the presence of brain tumor by implementing medical imaging approaches. Image segmentation is done mainly by a technique based on median filtering, K Means Clustering and FCM Segmentation. The propounded approach was tested with brain tumor images acquired by the help of MRI, thus precisely segmenting and detecting the brain tumor in the images. It gives more accurate and efficient outcomes when compared to other approaches. The propounded approach is easier to comprehend and apply. We can obtain a far better segmented image using this approach[5].
NiladriHalder (2016) The executed technique segments the brain tissues from the other tissues of the human head in an automatic way. The convolutions of the brain are noticed and white matter, gray matter, and CSF are separated. The process compensates for intensity in homogeneities. However, developments can be made to the algorithm to make it more robust and automated. The initialization of the algorithm must be upgraded to make the process completely automated. The bias field correction could also be developed to obtain better results. This method gives efficient results as compared to previous researches. Experiments are applied on various images and results were unexpectedly good. Our proposed research is easy to implement and thus can be managed easily. Our future work is to extend our recommended method for color based segmentation of 3D images. For this case we need a classification method to establish three dimensional objects into distinct feature classes, whose characteristics can help in diagnosis of brain diseases[6].

III. CONVENTIONAL METHODS

A wide variety of segmentation methods has been proposed. However, there is no standard approach which yields successful results for MRI brain segmentation or clinically acceptable. In general segmentation techniques are divided into four categories

A. *THRESHOLD BASED TECHNIQUES:*

Thresholding is one of the simplest and oldest method for image segmentation. In the process of thresholding the objects of an image are classified by comparing the intensities with one or more intensity thresholds. Thresholding methods are classified into global and local thresholding. In global thresholding, images compared pixel by pixel with the selected threshold intensity. Local thresholding can be determined by estimating a threshold value for the different

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regions from the intensity histogram.However, threshold based segmentation methods are not capable of exploiting the detailed information provided by MRI, since in pre-processing stage of medical image segmentation.

B. ***REGION BASED TECHNIQUES:***

Region-based segmentation techniques examine pixels in an image and form disjoint regions by merging neighborhood pixels with homogeneity based on predefined similarity criterion thereby resulting in a connected region. Region growing is simplest technique to extract a region of the image based on predefined criteria starts with seed point which can be selected manually or provided by automatic seed finding procedure. The regions are grown by comparing unallocated pixels to the region. The procedure iterates until no more pixels can be added to the region

C. ***PIXEL CLASSIFICATION OR CLUSTERING TECHNIQUES:***

Another type of segmentation algorithms proposed so far are based on pixel clustering or classification. Clustering involves the task of dividing data points into homogeneous clusters so that the items in the same cluster are as similar as possible and items in different clusters are as dissimilar as possible depending upon the similarity criteria.

- K-Means Clustering:
  The most commonly used nonhierarchical unsupervised technique is the K-means method, which clusters n data points into k cluster (k<n). this algorithm selects the number of clusters k, then randomly generate clusters and determines the cluster centers. The next step is to assign each data point to the nearest cluster center and then recomputing the new cluster center. This two steps are iterated until the minimum variance criterion is achieved. The main objective behind the algorithm is to achieve a minimum intra cluster variance v.

- Fuzzy C-Means Clustering:
  Fuzzy C-means is a method of clustering which allows one piece of data to belong to two or more clusters. This algorithm works by allotting membership to every data point corresponding to every cluster center on the basis of distance between the cluster center and the data point. More the data is closer to the cluster center more is its membership towards the particular cluster center. Clearly, addition of membership of every data point should be equal to one. After every iteration membership and cluster centers are updated. The disadvantage of this algorithm is it require more time for analysis.

D. ***MODEL BASED TECHNIQUE:***

Deformable model based segmentation methods including Parametric Deformable Model and Geometric Deformable Model were proposed to address the problem of segmenting volumetric image data. In model based segmentation, prior knowledge of object like shape, location and orientation are required for constructing a connected and continuous model for a specific anatomic structure. These models are physically motivated for detecting region boundaries by using closed parametric curve that deform under the influence of internal and external forces.

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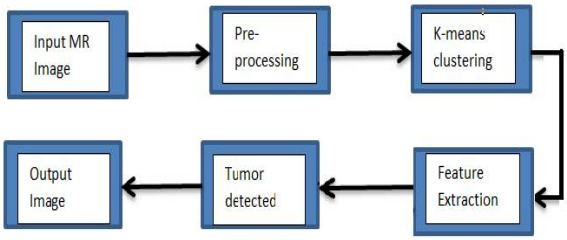
IV. PROPOSED WORK

Following figure shows the block diagram of our system.



Magnetic Resonance Image(MRI) is taken as an input. Then pre-processing is performed on input image. Pre-processing includes applying various steps on input image such as

1. GrayscaleAlgorithm : It performs RGB to Gray scale conversion.
2. Edge Detection Algorithm : Sharpening of image is performed here.
3. Thresholding : It is used for creating the histogram of the gray scale image .

Output of the edge detection image is subtracted from segmented image through the Feature Extraction step. Finally tumor is successfully detected with Accurate size, position and area.

V. CONCLUSION

In this study, the outline of various segmentation methodologies is explained. In spite of huge research, there is no universally accepted method for image segmentation, as of the result of image segmentation is affected by many factors. Thus there is no single method which can be considered good. All methods are equally good for a particular type of image. Due to this, image segmentation is a challenging problem in image processing. The medical image segmentation has difficulties in segmenting complex structure with uneven shape, size, and properties. In such condition it is better to use unsupervised methods such as K-Means algorithm. For accurate diagnosis of tumor patients, appropriate segmentation method is required to be used for MR images to carry out an enhanced diagnosis and treatment. Through examination of the literature, we found that the K-Means algorithm should be used because of its simplicity and it is also preferred for faster clustering.

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BIOGRAPHY

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