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Brain Tumor Segmentation Using Kmeans Clustering and Water Shed Algorithm

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ABSTRACT - A brain tumor is a collection of abnormal cells in our brain. Tumor detection is one of the most important fields in medical science because brain tumors affect the normal functioning of the human body. Medical imaging technique plays a crucial role in identifying the tumor cells. With the help of a CT scan and MRI imaging technique, images of the brain can be obtained. By applying various image processing techniques in the image obtained, we can get the image of the human brain with improved quality. Here, the images obtained through CT scan or MRI imaging technique are going to be processed, enhanced, and segmented to locate the exact location and size of the tumor in the brain. These images can be used for better treatment. Several techniques were developed to detect and segment the Brain tumor using several Segmentation algorithms such as Watershed Algorithm, K-means clustering. To identify the brain tumor, scanned MRI images are given as the input.

Keywords - Tumor cells,MRI scan image,K-means clustering,Watershed Algorithm.

1. INTRODUCTION

The brain is a sensitive, irreplaceable, and lightweight tissue. A tumor is an abnormal group of tissue that forms when cells grow and divide more than they should or do not die when they should. A brain tumor is a collection of irregular cells that become either inside the brain or on the other hand around the brain. All healthy brain cells could be destroyed by tumors. It can indirectly, adversely harm the healthy brain cells by crushing into different parts of the brain and causing aggravation, brain swelling, and inducing pressure inside the skull. Exact measurements in brain tumor diagnosis are very harder due to varied shapes, sizes, and tumor appearance.

As these tumors normally stay in the posterior cranial fossa of the human brain so, it is hard to detect them by hand. The human brain has five types of soft tissues:

1. white matter
2. gray matter
3. cerebrospinal fluid (CSF)
4. Edema
5. tumor tissue.

Various tissues look different, and these differences can effectively be observed in the MRI scanning sequences which attract and erase the hydrogen part of our human brain. Greater the hydrogen component, the brighter the image. That is why for the high-graded gliomas cases, necrosis and tumor tissues are described easily due to those hydrogen components. However, for the low-graded (LGG) cases, it is even difficult to delineate the tumor tissue. We used MRI for assessment purposes. Brain soft tissues are easily differentiated in MR images, unlike CT scan other images. For the recognition of Brain Tumor disease, MRI is most popular because of the non-invasive imaging and soft tissue contrast of MRI. Pre-processing of the MR image is the primary step that removes noise and polishes the image. To prevent misidentification of brain tissue and non-brain tissues, skull stripping is done. Then, Image Segmentation is carried out using marker-controlled

watershed segmentation. Then finally the tumor region is detected from the segmented image using morphological operation. Finally, the location of the tumor region is determined.

2.MOTIVATION

Brain tumor segmentation is an important task in medical image processing.The main goal of this project is to extract significant and accurate information from the given input image with least possible error.Early diagnosis of tumor tissues plays an important role in improving treatment possibilities and this increases the survival rate of patients. The motivation of this project is to make the process of detection of tumor cells in the human brain simpler and easier.If the image of the human brain is given with the help of MRI scan or CT scan, then using our project doctors can easily locate the position of tumor cells in the human brain.In addition to this doctors can also get the size of tumor cells in the human brain.Thus, our motive is to segment the tumor cells from the human brain with the help of images from MRI scan or CT scan.

3.RELATED WORKS

Adel Kermi , Khaled Andjouh and Ferhat Zidane, proposed a method to Pre-processing of image is done to remove noise. Using FBB method, detection of tumor is done automatically. Geodesic level set based 3d deformable model is applied to detect the boundaries of tumor, regardless of its shape and size.The accuracy of this proposed method is over 83%.The advantage of proposed method is that the average calculation time of detecting and
segmenting tumor, including the skull stripping operation from 3D head MRI, is about 5 min.

V. Anitha and S. Murugavalli, proposed a method to Pre processing by non local mean filter. Segmentation by KMeans algorithm, categorization- 2 tier, feature extraction by DWT, filtering on basis of KNN.The accuracy of this proposed method is 85%.The advantage of proposed method is that it is superior to SVM based classification. Computation time almost half. Real time application possible.

Guoqing Wu et al, proposed a method to CNN is utilized to segment. KSVD is used dictionary training methods. OMP algorithm is used to solve the sparse representation. Sparse representation-based feature selection method is adopted to select a few crucial features. New co-efficient of regularization term is used in the SRC model to combine the multi-model feature information, based on the internal relationships among the sparse representation coefficients.The accuracy of this proposed method is over 98%.The advantage of proposed method is that the Optimum results. High precision and specificity.

Lamia Sallemi,Ines Njeh, and Stephane Lehericy, proposed a method to Convivial algorithm for Glioblastoma modelization. Tumor region is extracted using fast distribution matching based global pixel wise data.The accuracy of this proposed method is over 89%.The advantage of proposed method is that it has Very fast computation speed and Less than 0.5 sec/ image.

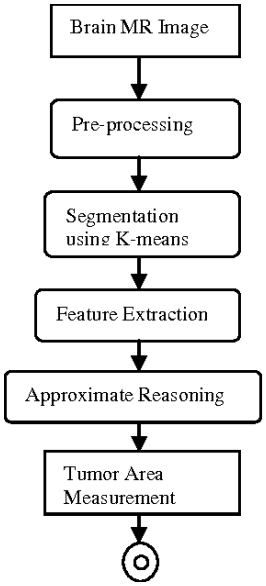
Chao Ma, Gongning Luo, Kuanquan Wang , proposed a method to Based on feature scheme learning, segmentation is made and it is then formulated as hybrid problem of voxel classification and boundary contour evaluation of tissue. Afterward both models are fused employing ccRFs to create highly precise soft segmentation mapping.The accuracy of this proposed method is over 89%.The advantage of proposed method is that the Good overall result on all major parameters such as accuracy and sensitivity.

4.SYSTEM DESIGN

K-means, Thresholding sand Watershed techniques put up to the partitioning of brain tumors. The segmentation of the image depends on the image being segmented into regions. Image segmentation is based on comparison quality. Those with Similarities are placed out into groups so that we could get the features and important information regarding the image.

A.K-Means Clustering

K-Means Clustering groups the unlabeled dataset into different clusters. In K-means, K defines the number of pre-established clusters that need to be produced in the process, and if K=2, there will be two clusters, and for K=3, there will be three clusters, and so on. It allows us to cluster the data into different groups and to discover the categories of groups in the unlabeled dataset on its own without the need for any training. Each cluster is associated with a centroid. The main objective of this algorithm is to reduce the sum of distances between the data point and their corresponding clusters. The algorithm takes the dataset as input, and divides it into k-number of clusters, and repeats the process until it does not find the best clusters. The value of k should be prearranged in this algorithm.

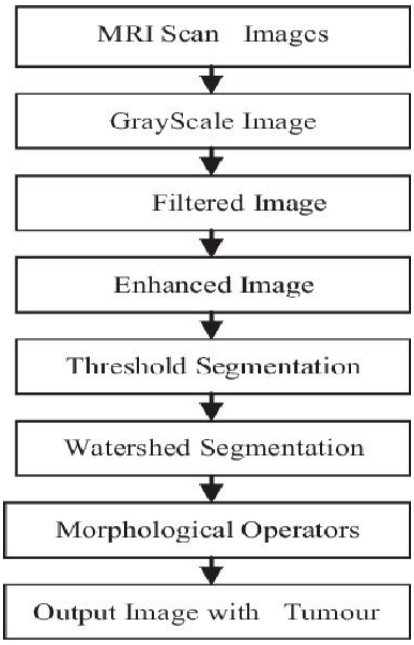


B.Thresholding

Threshold segmentation is based on a simple segmentation technique where we input an image called the grayscale image is first converted into a binary format using the binarization technique. This segmentation method is carried out on a threshold value that varies as per the features of the grayscale image while being converted into a binary image format. The selection of a threshold value for segmentation is the primary concern. Image utilizing histogram helps us in finding a single threshold value for the same. Image Utilizing Histogram is a sort of histogram that is based on a graphical representation for the tonal distribution in a advanced picture. The quantity of pixels for each tonal value is plotted on the histogram.

C.Watershed Algorithm

Watershed segmentation is remarkable, compared to other plans of action for collecting image pixels based on their intensity. Pixels at the same intensity are combined, which eases the segmentation procedure so that we can separate a tumor from the image.Watershed is a scientific morphological working technique.



5. IMPLEMENTATION DETAILS

A.Obtain Image

It involves obtaining the scan image from MRI scan or CT scan.

B. Pre-processing

It involves the transformation of raw data into understandable format.The RGB to grey conversion and Reshaping also takes place here.Once the image is obtained from first module, the image is processed for further use in applying K-means clustering algorithm.Here the image that is obtained in BGR format is converted into RGB format so that it can be further processed.Then, the pixel values are arranged in an array of 3 columns.The pixel values are changed to floating point values.Once this processes is completed, the third module starts where segmentation takes place.

C.Segmentation

Once the Pre-processing is done, we move on to this module which is Segmentation.Here we apply the K- means clustering algorithm.In this process, we can get the location of tumor cells in our brain.For this process, initially the criteria is defined where some important information such as number of iterations that need to be done and the level of accuracy in the form of epsilon are given.Then, the K-means clustering is applied in the given image using the criteria defined above.Once this process is done, the shape of the image is changed back to the original as we changed the pixel values in the form of array with 3 columns in the Pre-processing stage to do the segmentation.Then the segmented image is plotted to see the location of tumor in the brain image.

D.Feature Extraction

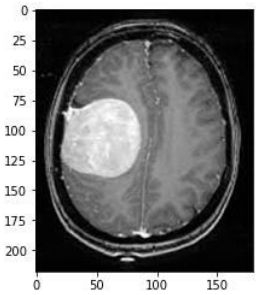
The feature extraction is extracting the cluster.The extracted cluster is given to the threshold process. It applies a binary mask over the entire image. Each transform coefficient is compared with a threshold in threshold coding. If it is smaller than the threshold value, then it is taken as zero. If it is larger than the threshold, it will be taken as one.

E.Approximate Reasoning

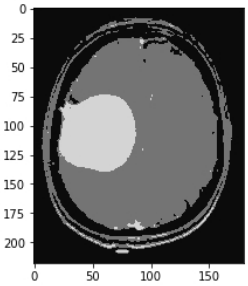
It is the process by which certain features within the images are detected and involves processing information through fuzzy rules.

6.EXPERIMENTAL RESULTS

A.KMEANS CLUSTERING

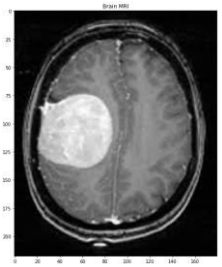


INPUT IMAGE

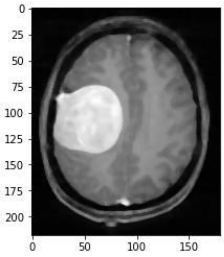


SEGMENTED IMAGE

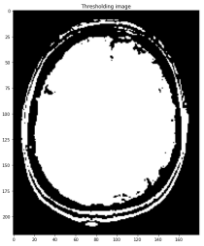
B.THRESHOLDING AND WATERSHED ALGORITHM



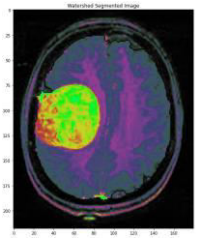
GRAY-SCALE



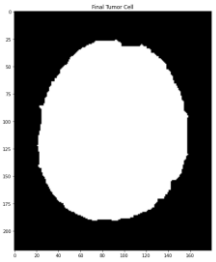
MEDIAN FILTERED



THRESHOLDING



WATERSHEDED



FINAL TUMOR CELL

7.CONCLUSION

There are different types of tumors available. They may be a group in the brain or malignant over the brain. Suppose if it is a beginning stage, then K-means algorithm is used to extract it from the brain cells. If there is any noise is present in the MRI then it is removed before the K-means process. The tumors are extracted from the image by inputting the noise-free brain image. The performance of brain tumor segmentation is asses based on K-means clustering. Dataset consists of Magnetic Resonance Imaging. The MRI image dataset that we have utilized in the image segmentation technique is taken from publicly available sources.
The image dataset has two sets one is the Training dataset and the other is the testing dataset. Thus, the Pre-processing is done by filtering. Segmentation is done by the K-means algorithm and watershed algorithm. Feature extractions are done by connecting and finally, the approximate reasoning method is used to recognize the tumor shape and position in the image. This method uses the color image or grayscale, and converts the image into a binary image by binarization technique, and detects the edge of tumor pixels in the binary image. Also, it calculates the size of the tumor by calculating the number of white pixels in the binary images. The stage of the tumor is based on the area of the tumor.

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