Survey on Various Techniques of Brain Tumor Detection from MRI Images

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ABSTRACT
Brain tumor is an abnormal growth of brain cells within the brain. Detection of brain tumor is challenging problem due to complex structure of brain.MRI can provide the detail information about human soft tissue anatomy, which is helpful in diagnosis of brain tumor. Detection of brain tumor involves different stages such as image preprocessing, segmentation, feature extraction and classification. This paper summarizes the study of various techniques of brain tumor from MRI images.

Keywords: *Classification, Feature extraction, MRI, Neural Network, Preprocessing, Rough set, Segmentation*

I. INTRODUCTION

Brain is the center of human central nervous system. The brain is a complex organ as it contains 50-100 billions neurons forming a gigantic network. Brain tumor is a group of abnormal cells that grows inside of the brain or around the brain. Brain tumor can be benign or malignant, benign being non cancerous and malignant are cancerous. Malignant tumors are classified into two types, primary and secondary tumors Benign tumor is less harmful than malignant as in malignant tumor it spreads rapidly invading other tissues of brain, progressively worsening the condition causing death. Brain tumor detection is very challenging problem due to complex structure of brain. The exact boundary should be detected for the proper treatment by segmenting necrotic and enhanced cells. Magnetic Resonance Imaging (MRI) is an ideal source that provides the detailed information about the brain anatomy. Fig. 1 shows some of the data sets of MRI images of brain. The MRI of the brain can be divided into three regions: white matter (WM), gray matter (GM) and cerebrospinal fluid (CSF) because most brain structures are defined by boundaries of these tissue classes and a method to segment tissue into these categories is an important step in brain tumor detection.

Detection of brain tumor from MRI images involves various Phases such as Preprocessing, Feature extraction, Segmentation and classification. Fig 2 shows different stages in brain tumor detection. Image Preprocessing techniques are applied to improve the quality of image. MR Image segmentation is based on set of measurable features which are extracted. In this process of brain tumor detection, pixel intensity based features are extracted. Image Segmentation group pixels into regions and hence defines the object regions. Segmentation uses the features extracted from an image. Classification is the last step in the process of brain tumor detection used to classify the image into normal or abnormal and classify the abnormality type whether it is benign or malignant. This study evaluates various techniques which are used in tumor detection from brain MRI.

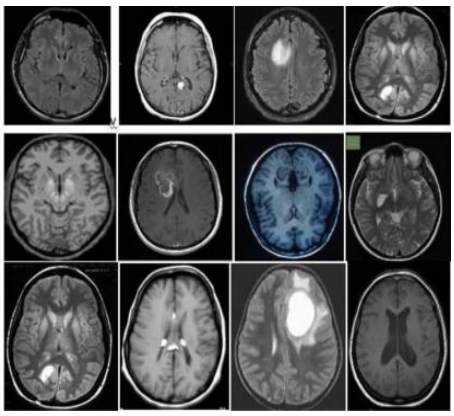

Fig 1: MRI brain Image dataset

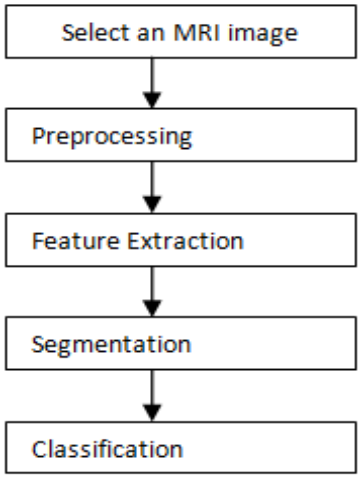

Fig 2 : Stages in Brain Tumor Detection

Literature Survey

Bhagwat et al [1] presented a paper that shows comparison of K-means, Fuzzy C-means and Hierarchical clustering algorithms for detection of brain tumor, These Three clustering algorithms K-means, fuzzy c-means and hierarchical clustering were tested with MRI brain image in non medical format (.jpg, .png, .bmp etc) as well as DICOM image. It is prove that DICOM images produce more efficient result compare to non medical images. Time required for hierarchical clustering is least and fuzzy c-means is maximum to detect the brain tumor where as K-means algorithm produce more accurate result compared to Fuzzy c-means and hierarchical clustering. Detection of brain tumor involves various stages such as image preprocessing, feature extraction, segmentation and classification. Pulse couple neural network (PCNN) uses for image smoothing, feature extraction and image segmentation and Back Propagation Neural Network (BPNN) is used for classification that classify the image whether it is normal or abnormal. [2]Roy et al [3] introduce the symmetric analysis to detect the brain tumor by making the calculations on the area of tumor. Its application with several data sets with different tumor size, intensity and location shows that it can automatically detect and segment the brain tumor. MR images gives better result compare to other technique used in the field of medical science like CT images and X-rays Segmentation is one of the essential tasks in medical area but is boring and time consuming.

Image pre-processing including converting RGB image into grey scale then passing that image to the high pass filter in order to remove noise is done and finally the last we get enhanced image for post-processing that will include watershed segmentation and thresholding as well as morphological operation. For the extraction of text region. Morphological operator is used since text regions are composed of vertical edges, horizontal edges and diagonal edge. At different orientation these text are connected together differently. In recent years the concepts of ontology has taken a wide leap from formal specification to the area of artificial intelligence in the domain of experts system. Ontology has been common on World Wide Web. This concept basically deals with classes, sub-classes and their association from the basic categorization of product along with their features.[4] Aboul Ella Hassanien et al [5] presented review paper that shows how the rough set approach and near set approach are useful to solve various problems in medical imaging such as medical image segmentation ,object extraction and image classification .This paper also shows how the rough set framework hybridized with various computing technologies such neural network (NN), support vector machine (SVM) and fuzzy sets .A combination of various computational intelligence technologies in medical image problem has become one of the most promising avenues in image processing research.

Magdi et al [6] used an intelligent Model for brain tumor diagnosis from MRI images .which consist of three different stages such as preprocessing, Feature extraction and classification. Preprocessing used to reduce the noise by filtration and to enhance the MRI image through adjustment and edge detection .texture features are extracted and principal component analysis (PCA) is applied to reduce the features of the image and finally back propagation neural network (BPNN) based Person correlation coefficient was used to classify the brain image.N.senthilal kumaran. et al [7] presented a hybrid method for white matter separation from MRI brain image that consist of three phase. First phase is to preprocess an image for segmentation, second phase is to segment an image using granular rough set and third phase is to separate white matter from segmented image using fuzzy sets This method was compared with mean shift algorithm and it was found that hybrid segmentation performs better result Rajesh patil et al [8] presented a method to detect and extract the tumor from patients MRI image of brain by using MATLAB software. This method performs noise removal function, Segmentation and morphological operations which are the basic concept of image processing . Tumour is extracted from MRI image for this it has an intensity more than that of its background so it becomes very easy locates.

Mehdi Jafri and Reza Shafaghi [9] proposed a hybrid approach for detection of brain tumor tissue in MRI based on Genetic algorithm (GA) and support vector machine (SVM).In the preprocessing stage noise is removed and contrast is enhanced. For removing high frequency noises low pass filter is used for enhancing histogram stretching method is used. in segmentation undesired tissue such as nose, eyes and skull are deleted and features are extracted by different ways like FFT,GLCM and DWT. In feature selection GA is used with PCA by using this calculations complexity is reduced. Finally the selected features are applied to SVM classifier used to classify the image into normal or abnormal.A Sivaramkrishnan [10] presented a novel based approach in which Fuzzy C-mean (FCM) clustering algorithm was used to find the centroids of cluster groups to obtained brain tumor patterns. It is also preferred as faster clustering by using this centroid point can be located easily. The histogram equalization calculates the intensity of gray level image and PCA was used to reduce dimensionality of wavelet coefficient.

II. CONCLUSION

From Literature survey ,it is conclude that MR images provides much better information about human soft tissues of brain compared to computerized tomography(CT) images. DICOM images (.dcm) produce more efficient result compare to non medical images (.jpg,.png,.bmp). MRI segmentation is one of the essential tasks in medical area. The accurate segmentation is crucial otherwise the wrong identification of disease can lead to several consequences. As diagnosis tumor is a complicated task; therefore accuracy and reliability are always assigned much importance.

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