IJCSMS (International Journal of Computer Science & Management Studies) Vol. 15, Issue 06
Publishing Month: June 2015
An Indexed and Referred Journal with ISSN (Online): 2231–5268
www.ijcsms.com

A Survey on Brain Tumor Detection Technique

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Abstract

Brain tumor analysis is done by doctors but its grading gives different conclusions which may vary from one doctor to another. So for the ease of doctors, a research was done which made the use of software with edge detection and segmentation methods, which gave the edge pattern and segment of brain and brain tumor itself. The brain tumor is abnormal growth of cells inside skull which causes damage of the other cells necessary for functioning human brain. The brain tumor detection is challenging task due to complex structure of human brain. MRI images generated from MRI scanners using strong magnetic fields and radio waves to form images of the body which helps for medical diagnosis. This paper gives the overview of the various techniques used to detect the tumor in human brain using MRI images.

Keywords: *Pre-processing, Image Segmentation, Feature Extraction, Classification, Braintumour, MRI images.*

1. Introduction

Brain tumor is an abnormal growth of cells inside the skull. Normally the tumor will grow from the cells of the brain, blood vessels, nerves that emerge from the brain. There are two types of tumor which are- benign (non-cancerous) and malignant (cancerous) tumors. The former is described as slow growing tumors that will exert potentially damaging pressure but it will not spread into surrounding brain tissue. However, the latter is described as rapid growing tumor and it is able to spread into surrounding brain. Tumors can damage the normal brain cells by producing inflammation, exerting pressure on parts of brain and increasing pressure within the skull. Figure 1 shows the presence of tumor in the brain [1]

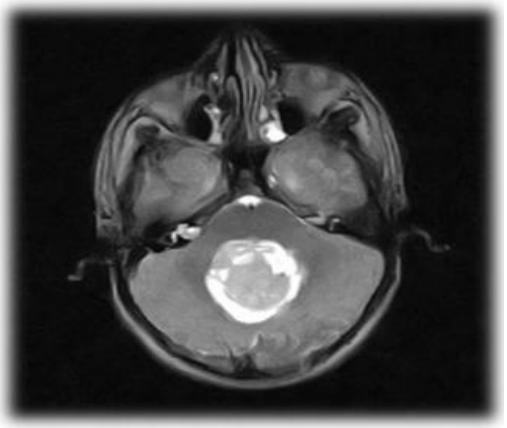

Figure 1: The presence of brain tumor[1]

A conceptually block based approach is used to analyze MRI brain images. In this approach tumor in the brain is detected. The process involved in general methodology is given below: It involves pre-processing, edge detection, segmentation by histogram thresholding, morphological processing. First the input taken is tumor affected MRI image. Then it is pre-processed by using median filter. Since the reason to choose median filter is it completely removes the noise and makes image very clear, whereas the Gaussian and linear filter does not. After this the edge of the image is detected using canny filter. Since the canny filter itself performs the functioning of Gaussian filter which is responsible for smoothening of the image, whereas other filters does not. The next step is the most important which segmentation is the tumor image is divided into four quadrants and in each quadrant the pixel values are taken. Histograms clustering in which grouping of similar values of pixels are done and threshold value is set and is compared with the healthy brain image [2]

Detection of brain tumor from MRI images involves various Phases such as Preprocessing, Feature extraction, Segmentation and classification. Figure 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[3].

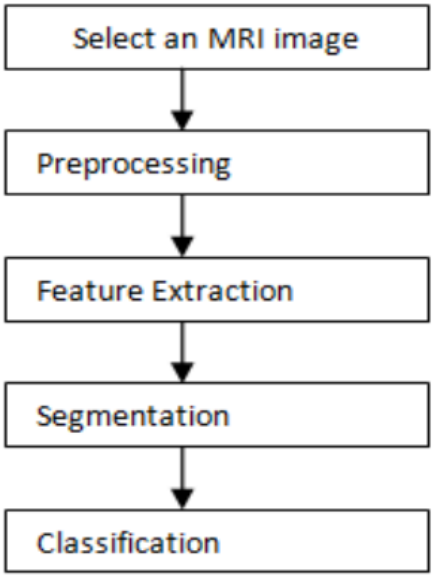

Figure 2: Stages in Brain Tumor Detection[3]

2. Image Pre- Processing

Pre-processing of MRI images is the primary step in image Analysis which perform image enhancement and noise reduction techniques which are used to enhance the image quality. Image is enhanced in the way that finer details are improved and noise is removed from the image. Enhancement and noise reduction techniques are implemented in brain tumor detection that can give best possible results. Enhancement will result in more prominent edges and a sharpened image like tumor is obtained noise will be reduced thus reducing the blurring effect from the image[4] .

3. Feature Extraction

Feature extraction is the technique of extracting specific features from the pre-processed images of different abnormal categories. This technique extracts high-level features needed in order to perform classification of targets. Features are those items which uniquely describe such as size, shape, composition, location etc .Feature Extraction is an important step in the construction of any pattern classification and aims at the extraction of the relevant information that characterizes each class [4]

4. Image Segmentation

The purpose of image segmentation is to partition an image into regions (spatially connected groups of pixels called classes. or subsets) and objects with respect to one or more characteristics or features. Image segmentation plays a significant role in image processing as it helps in the extraction of suspicious regions from the medical images. The idea behind segmentation is to segment an image into several clusters. The results will be such that, it is possible to identify regions of interest and objects in the original image.

5. Image Classification

Classification is the labeling of a pixel or a group of pixels. Multiple features are used for a set of pixels i.e. many images of a particular object are needed. Image classification refers to the labeling of images into one of a number of predefined categories. Image classification is more important as it is a critical step for high-level processing such as brain tumor classification. 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 [4].

6. Related Work

T.Logeswari and M.Karnan et al.[5] (2010) implemented a fuzzy based segmentation process to detect brain tumor . In that performance of the MRI image in terms of weight vector, execution time and tumor pixels detected. They have described several methods in medical image processing and discussed

requirements and properties of techniques in brain tumor detection .This search are used to give more information about brain tumor detection and segmentation of HSOM with FCM is given. In this search various step in detection of automatic system like (a) Image capturing (b) Image segmentation (c) Performance Evaluation are discussed.

A.Padma et al. [6] (2011) presented an automated segmentation of brain tumors in computed tomography images (CT) using combination of Wavelet Statistical Texture features (WST) obtained from 2-level Discrete Wavelet Transformed (DWT) low and high frequency sub bands and Wavelet Co occurrence Texture features (WCT) obtained from two level Discrete Wavelet Transformed (DWT) high frequency sub bands. In the proposed method, the wavelet based optimal texture features that distinguish between the brain tissue, benign tumor and malignant tumor tissue is found. Comparative studies of texture analysis is performed for the proposed combined wavelet based texture analysis method and Spatial Gray Level Dependence Method (SGLDM). Their proposed system consists of four phases i) Discrete Wavelet Decomposition (ii) Feature extraction (iii) Feature selection (iv) Classification and evaluation. The combined Wavelet Statistical Texture feature set (WST) and Wavelet Co-occurrence Texture feature (WCT) sets are derived from normal and tumor regions. Feature selection is performed by Genetic Algorithm (GA). These optimal features are given as input to the PNN classifier to segment the tumor. An Probabilistic Neural Network (PNN) classifier is employed to evaluate the performance of these features and by comparing the classification results of the PNN classifier with the Feed Forward Neural Network classifier (FFNN).The results of the Probabilistic Neural Network, FFNN classifiers for the texture analysis methods are evaluated using Receiver Operating Characteristic (ROC) analysis. The performance of the algorithm is evaluated on a series of brain tumor images

Dina Aboul Dahab et al. [7] (2012) modified image segmentation techniques were applied on MRI scan images in order to detect brain tumors. Also in this search ,a modified Probabilistic Neural Network (PNN) model that is based on learning vector quantization (LVQ) with image and data analysis and manipulation techniques is proposed to carry out an automated brain tumor classification using MRI-scans. The assessment of the modified PNN classifier performance is measured in terms of the training performance, classification accuracies and computational time. The simulation results showed that the modified PNN gives rapid and accurate classification compared with the image processing and published conventional PNN techniques. Simulation results also showed that the proposed system out performs the corresponding PNN system and successfully handle the process of brain tumor classification in MRI image with 100% accuracy when the spread value is equal to 1. These results also claim that the proposed LVQ-based PNN system decreases the processing time to approximately 79% compared with the conventional PNN which makes it very promising in the field of in-vivo brain tumor detection and identification.

V.M. Ramaa Priyaa et al. [8] (2013) implemented probabilistic Neural Network with image and data processing technique was employed to implement an automated brain tumor classification. The conventional method for medical resonance brain images classification and tumors detection is by human inspection. Operator-assisted classification methods are impractical for large amounts of data and are also non-reproducible. Medical Resonance images contain a noise caused by operator performance which can lead to serious inaccuracies classification. The use of artificial intelligent techniques for instant, neural networks, and fuzzy logic shown great potential in this field. Hence, in this search the Probabilistic Neural Network was applied for the purposes. Decision making was performed in two stages: feature extraction using the principal component analysis and the Probabilistic Neural Network (PNN). The performance of the PNN classifier was evaluated in terms of training performance and classification accuracies. Probabilistic Neural Network gives fast and accurate classification and is a promising tool for classification of the tumors.

Table 1: Author, Year and Description

Author	Year	Description
T.Logeswari	2010	In this weight vector, execution time and tumor pixels detected and provide about brain tumor detection and segmentation of HSOM with FCM.

		In this search various step in detection of automatic system like (a) Image capturing (b) Image segmentation (c) Performance Evaluation are discussed
A.Padma	2011	In the proposed method, the wavelet based optimal texture features that distinguish between the brain tissue, benign tumor and malignant tumor tissue is found. An Probabilistic Neural Network (PNN) classifier is employed to evaluate the performance of these features and by comparing the classification results of the PNN classifier with the Feed Forward Neural Network classifier (FFNN). The performance of the algorithm is evaluated on a series of brain tumor images
Dina Aboul Dahab	2012	The modified PNN gives rapid and accurate classification compared with the image processing and published conventional PNN techniques. These results also claim that the proposed
		LVQ-based PNN system decreases the processing time to approximately 79% compared with the conventional PNN which makes it very promising in the field of in-vivo brain tumor detection and identification
V.M. Ramaa Priyaa	2013	In this search probabilistic Neural Network with image and data processing technique was employed to implement an automated brain tumor classification. Decision making was performed in two stages: feature extraction using the principal component analysis and the Probabilistic Neural Network (PNN). The performance of the PNN classifier was evaluated in terms of training performance and classification accuracies. Probabilistic Neural Network gives fast and accurate classification and is a promising tool for classification of the tumors.

7. Conclusion

This paper describes different image processing techniques for detecting Brain tumor in MRI image. Four components were discussed in MRI images to improve the performance, classification and accuracy of detecting the brain tumor. They are Pre-processing, segmentation, feature extraction and classification. MRI images help to brain tumor detection by accurate segmentation which is very crucial otherwise the wrong identification of disease can lead to several consequences.

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