RESEARCH ARTICLE OPEN ACCESS

A Survey on Automated Techniques for Brain Tumor Detection

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ABSTRACT
Brain tumor detection is difficult and complicated job for radiologist. Manual segmentation of brain tumor is tedious job and may provide inaccurate results. So there is a need of automated technique for accurate brain tumor detection. Different automatic methods have been developed till date to increase the accuracy for tumor diagnosis. This paper reviews research work on computer aided diagnosis (CAD) done by researchers. In review paper different methods of brain tumor detection used uptil now is summarized with merits and demerits of earlier proposed work.
Keywords **–** MRI, Segmentation, MLP, Clustering.

I. INTRODUCTION

Brain cancer is most deadly diseases. Brain tumors are of two main types: (i) Benign tumors (ii) Malignant tumors. Benign tumors are noncancerous tumors and do not spread. Malignant tumors are typically called brain cancer contain cancerous cells and grow rapidly. Detection of Brain tumor is a serious issue in medical science. Imaging plays a central role in the diagnosis and treatment planning of brain tumor. The MR imaging method is the best due to its higher resolution. But there are many problems in detection of brain tumor in MR imaging as well. An important step in most medical imaging analysis systems is to extract the boundary of an area we are interested in. Many of the methods are there for the MRI segmentation [1-7].Though till now histogram thresholding is used for preprocessing only in many of the segmentation methods this paper shows that it can be used as a powerful tool for segmentation [2]. The image captured from a tumors brain shows the place of the infected portion of the brain. The image does not give the information about the numerical parameters such as area and volume of the infected portion of the brain. After preprocessing of the image, first image segmentation is done by using region growing segmentation. The segmented image shows the unhealthy portion clearly. From this image the infected portion (tumor) is selected by cropping the segmented image. From this cropped image, area is calculated [1].

II. RESEARCH WORK

The authors in [2] compared the performance of classical sequential methods, a floating search method, and the "globally optimal" branch and bound algorithm when applied to functional MRI and intracranial EEG to classify pathological events. This work suggested that the sequential floating forward technique outperforms the other methodologies for these particular data. In terms of classification accuracy, the SFFS algorithm proved to be the best option for the automatic selection of features.

Luts [3] proposed a technique to create Nosologic with help of color coding scheme for each voxel to distinguish distinctive tissues in a single image. For this purpose, a brain atlas and an abnormal tissue prior is acquired from MRSI data for segmentation. The detected abnormal tissue is then classified further by employing a supervised pattern recognition method followed by calculating the class probabilities for diverse tissue types. The proposed technique offers a novel way to visualize tumor heterogeneity in a specific image. The study results point out that combining MRI with MRSI feature improves classifiers' performance. A prior for the abnormal tissue along with a healthy brain atlas further improves the nosologic images. Despite its usefulness, the proposed methodology, however, only provides the one-dimensional image features.

Shi1et al. [4] employed neural networks for medical image processing, including the key features of medical image preprocessing, segmentation, and object detection and recognition. The study employed Hopfield and feed-forward neural networks. The feed-forward and Hopfield neural networks are simplest. The advantage of Hopfield neural networks is that it does not require pre-experimental knowledge. The time required to resolve image processing predicament is substantially reduced by using trained neural network.

Kovacevic et al. [4] proposed a segmentation method for brain images that performs a basic segmentation process comprising three steps. In the first step, prominent features of images are extracted and normalization is carried out. In the next step, pixels are classified using artificial neural

networks. Finally, the results obtained in the second step are labeled. Once the aforesaid three steps are carried out, the validation is performed. The key feature of the study is that RBF network has posses better capability. Moreover, the training algorithm is relatively simple as compared to the iterative back-propagation algorithm used in the multi-layer perceptron (MLP).

Roy and Bandyopadhyay [5] proposed automatic brain tumor detection approach using symmetry analysis. First detected tumor was segmented and then the area of tumor was calculated. One of the important aspects was after performing the quantitative analysis,the status of an increase in the disease was identified. Authors have suggested multi-step and modular approached to solve the complex MRI segmentation problem. Author has obtained good results in complex situations. The authors claim that MRI segmentation is one of the important aspect in medical field but boring and time consuming if it is performed manually, so visually study of MRI is more interesting and fast.

Padole and Chaudhari [6] proposed an efficient method for brain tumor detection. One of the most important steps in tumor detection is segmentation. Combination of two standard algorithm, mean shift and normalized cut is performed to detect the brain tumor surface area in MRI. Pre-processing step is first performed by using the mean shift algorithm in order to form segmented regions. In the next step region nodes clustering are processed by Ncut method. In the last step, the brain tumor is detected through component analysis.

Kumar and Mehta [7] proposed that segmentation results will not be accurate if the tumor edges are not sharp, and this case occurs during the initial stage of tumor. Texture-based method is proposed Along with brain tumor detection, segmentation is also done automatically using texture based method The proposed texture analysis and seeded region method was implemented in MATLAB environment using 25 MRI images.

Meenakshi and Anandhakumar [7] emphasize that MRI are useful for analyzing brain images because of its high-accuracy rate. Detection of the brain tumor has become a challenging task. Most of the existing techniques used machine learning techniques to detect brain tumor, but still patients suffers from wrong diagnosis. The proposed technique combines the clustering and classification algorithm to minimize the error rate. Segmentation task is performed using orthonormal operators and classification using BPN. Images having the tumor are processed using K-means clustering and significant accuracy rate of 75% is obtained.

In [1], brain segmentation is automated using Dual Localization method. In the first step of their process scull mask is generated for the MRI images. White matter and tumor region is used to improvise K-means algorithm. In the last step of their method, author assessed the breath and length.

Corso et al. [2] stated that bottom up affinity-based segmentation and top down generative model techniques were not enough to get good results, and propose a novel methodology of automatic segmentation of heterogeneous images. Main difference in this paper is the use of Bayesian formulation to make complex calculations on soft models. It uses multichannel MR volumes to detect and segment brain tumor. Calculation in this model is more efficient than the conventional presented models, and results are presenting improved output in the form of quantitative analysis. A 2D portion of MR image can be used to detect multiform brain tumor, and an outline can be drawn to label the edema or active part of tumor. An automatic segmentation technique is helping the medical clinic researchers with automatic labeling freeing them from manual labeling. Fuzzy clustering is also a very famous technique for detecting brain tumor. It has demonstrated that fuzzy clustering approach provides better results by using raw multi sequence data. The Segmentation by Weighted Aggregation algorithm is also used to give a graph hierarchy of segments at different scales.

Kekre 2010) have proposed a vector quantization segmentation technique to identify cancerous mass from MRI images. In order to improve the radiologist's diagnostic performance, Computer-Aided Diagnosis (CAD) scheme has been introduced to enhance the recognition of primary

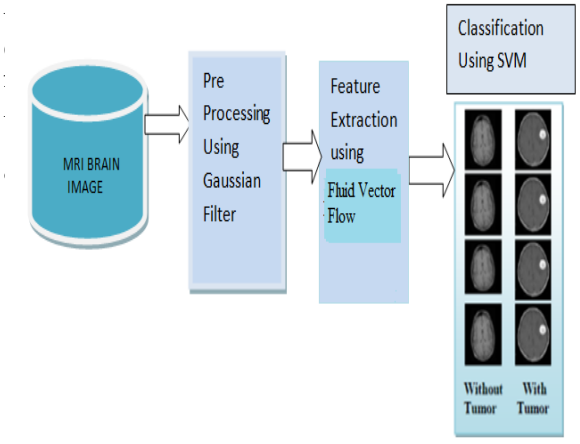

Fig.2.1 Approach used for SVM

Signatures of this disease: masses and micro calcifications. As well, a template-based framework for multi-object segmentation of deep brain structures Roy and Bandyopadhyay explored symmetric analysis for detection of brain tumor by making calculations on the area of tumor. Magnetic resonance imaging is used to perform quantitative

analysis. MR images gave better results as compare to other techniques used in the field of medical sciences like CT images and X-rays and ultrasound. Automatic segmentation of images facilitates medical specialists to make manual labeling since a healthy brain has a strong symmetry which does not remain stronger in case of a tumor.

Author Evangelia J.Zaharaki and Ahastasios Bezerianos employed semi supervised scheme for abnormality detection & segmentation in medical image.The method was applied for automatically segmentating brain pathologies such as simulated brain infarction and dysplasia as well as real lesion in diabetic patients.

Chaijie Duan,Kehong yuan Fanghua Liu,Ping Xiao introduced an adaptive window setting scheme. The presented scheme was validated by ten T1 weighted MR image. The validation results demonstrated potential for presented scheme,providing high sensitivity and low false positive rate.

Author Daniel J.Mirota,Ali uneri,Sebastian Schefer,Sajendra Nithiananthan emphasized a system for high accuracy 3D image registration of endoscopic video to C-arm cone beam CT for image guided skull base surgery.Overall system performance was evaluated in cadaver study simulating trasphenoidal skull base tumor excision.
Shaheen Ahmed, Khan M.Iftekharuddin Arestoo Vossough introduced Kullback-leibler divergence measure used for feature ranking and selection which offered best results for brain tumor segmentation. In this author had shown that for T1 weighed MRI best posterior –fossa tumor segmentation is obtained using multifractural Brownian motion. whereas for T2 weighed MRI fusing level set shape with intensity feature is suitable.

III. CONCLUSION

Image segmentation is used in many biomedical-applications. Diagnosis of tumor is a difficult job and sensitive therefore, accuracy and reliability play a very important role. Hence, there is need for developing a robust technique which should be high in precision and help in contribution to engineering theory to the medical field..

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