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Review on different Brain Tumor Analysis Techniques

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Abstract: A literature review is described on cerebrum (brain) tumor diagnosis. The aim of this survey is to provide an outline for those who are new to the field of image processing, and also to provide a reference for those searching for literature in these applications. Tumor is because of an abnormal development of cells (tissues) inside the brain. Magnetic Resonance Imaging (MRI), Computer Tomography (CT) imaging techniques are used for early detection of abnormal changes in tumor tissues or cells. Its correct detection and identification at an early stage is the only way to get cure. Brain tumor tissues may become malignant (cancerous) if not diagnosed at right time. A recent couple of years various image processing algorithms have been proposed for correct and efficient computer aided diagnosis of cerebrum tumors. An algorithm effectively works on CT, MRI images. It is been observed that an automatic segmentation method using Convolution Neural Network (CNN) with 3*3 kernels provide deeper architecture and positive results against over fitting. Watershed segmentation algorithm removes the salt & pepper noise without disturbing edges. It is very easy for automatic and accurate calculation of tumor area. Sobel edge detection based improved edge detection algorithm provide superior performance over conventional segmentation algorithm K-Mean algorithm used

Keywords: Brain tumor, Magnetic Resonance Imaging (MRI), CNN, tissue, CT, ROI separation, Otsu segmentation, Support Vector Machine (SVM), Artificial Neural Network (ANN).

I. INTRODUCTION

A tumor is an abnormal development of brain tissue tumor can be dangerous (malignant) or non-carcinogenic (benign). A cerebrum tumor happens when anomalous cells frame inside the cerebrum i.e. Brain Primary malignant brain tumor are tumors that begins in the brain they are actually quite rare. Cerebrum meta state usually called as brain Mets are much more normal. Brain tumor is the one of the leading causes of death in the world [1]. Medical anatomical imaging for example X- ray beams and later followed by computer tomography (CT) and MRI each one of these have been extensively utilized by scientist in the medical image processing extraction of useful organic information from X- ray brain image is not very effective due to their limitations of poor image quality and not strong interaction with the light element CT imaging is very useful for viewing changes in bony structure i.e. hard tissue. Brain tumor contains soft tissue so soft tissue are not very cleared in CT scan images of brain tumor MRI is said to be most sensitive MRI scan are very good for looking at the brain and spinal cord and are considered the best way to look for tumors in these areas. The images MRI provides are usually more detailed than those from CT scan. But they do not image the bones of the skull as well as CT scan and therefore may not shows the effect of tumors on the skull.

II. LITERATURE REVIEW

Nilakshi Devi and Kaustubh Bhattacharyya et al.[1] A review of literature reveals the fact that considering the various disadvantages of manual detection of brain tumor, the researchers have now turned their attention toward using soft computing tools in the detection process to make the detection more robust and less time consuming. Too much of human interaction in the manual detection leads to chaotic results in the detection process which becomes a risk to the patient's life. Intelligent tools like ANN, fuzzy, genetic algorithm (GA), etc., in detection of brain tumor have helped in providing efficient results.

Shrutika Santosh Akshata Raut Swati Kulkarni et al.[2] The proposed work is based mainly on thresholding, application of morphological operations and extraction of the tumor region for further analysis. Thresholding technique is the application of `T' which is a constant over an image. When we apply the threshold constant `T' over an entire image, the process is called as global thresholding whereas when we change the value of `T' over an image, that process is called as variable thresholding. The image of the brain is obtained from the MRI scanning.

Ramya. K et al. [3] had done a work on tumor detetcion using watershed transformation. Firstly MRI image undergoes into preprocessing process and then watershed technique has been applied. The algorithm divides an image into two adjacent brain cells.

Morphological operation had performed on MRI image to acquire clear idea about how the abnormal cells are closer to normal cells. Background marker (labeling) used to identify the invisible tumor using threshold value. The size, shape, area and intensity of segmented tumor had been analyzed.

Padmakant dhage et al [4] had worked on brain tumor segmentation using watershed algorithm. The algorithm effectively recognizes the cancerous tissue from typical cerebrum tissue. Proposed method has four modules preprocessing, segmentation, connected component labeling and multi parameter estimation. Segmentation is done by watershed segmentation. The parameter of segmentation such as size, perimeter, eccentricity, entropy, centroid obtained by proposed method.

Asra Aslam et al. [5] had proposed an enhanced edge detection algorithm for cerebrum tumor segmentation. The proposed strategy is a mix of Sobel technique with image independent Thresholding method. Close contour technique is utilized which decrease the rate of false edges. In the last, tumor extracted from the image based on intensity of pixels within closed contours. Brain tumor extracted from proposed method is better than the tumor extracted from sobel edge detection.

Sergio Pereira et al. [6] had proposed a novel Convolutional Neural Network (CNN) based method for brain tumor segmentation in MR images. The 3*3 bit CNN is used as deep CNN architecture. High Grade Gliomas (HGG) & Low Grade Gliomas (LGG) tumor samples are used for test. During training, the number of training patches is augmented artificially by rotating training patches and rare samples of LGG augmented by samples of HGG. Multi-site, multi-scanner acquisition of MRI images using intensity normalization had proposed by Nyul et.al. This achieved the good segmentation. Brain tumor cells are highly variable in their structural composition and spatial localization, so data augmentation used to overcome this variability. The author had also investigated the performance of deep architecture with small kernels by comparing with shallow architectures with larger filters. They found that shallow architectures had given lower performance even with a large number of samples.

Swapnil R. Telrandhe et al [7] had worked on support Vector Machine (SVM) for tumor identification. Median filter used, filter change the intensity of corrupted pixels of damaged image. The author had used the filter for preserving the local details of the image. Skull masking had applied on an image which helped in extracting abnormal tissues from normal tissues in brain MRI. Segmentation done by using K-Means clustering which group objects based on attributes or features into k-number of groups. K as positive integer colors was used in segmentation. The reason for using colors was, human eyes are more sensitive to color images then grey scale images [5]. The object labeling had been performed after segmentation of an image. For more ne result of feature extraction the author had made the Fusion of texture and color features. The unsupervised SVM used for classification. The system framework successfully had done the classification of tumor into normal & abnormal classes.

Sonali B. Gaikwad et al. [8] had worked on brain tumor classification using PNN. The feature selection had been performed using PCA (dimension reduction approach).

The method worked with MRI images of cerebrum tumor. The three output classes were detected at the output: (i) Normal, (ii) Benign and (iii) Malignant. The author had again classified malignant tumor into Glioma and Meningioma cancer type.PCA 2 method provides a powerful tool for data analysis and pattern recognition. Probabilistic Neural Network (PNN) algorithm for classifications of brain tumor. In proposed method, the first stage is to extract features from brain MR images using PCA and then train the PNN for classification.

Roshan G. Selkar et al[9] had represented tumor segmentation and detection based on thresoulding and watershed segmentation algorithm .Author had worked initially on MRI scan converted it into the grayscale image so that it becomes easy to process after that converted to the binary format using thresoulding segmentation. Then applied watershed algorithm to group the same intensity pixels .then morphological operations are applied to recognize the tumor.

Amitava Halder, Chandan Giri et al.[10]The proposed method is applied on different types of tumor affected T2 weighted MRI images (20 images). The shape and size of the tumor is different and varying from image to image. The results (tumor detection) of the different MRI images using K-means followed by threshold method, FCM-Kmeans [2] and proposed method with ground truth (manually created) are shown in Figure 2.

Overall error is calculated from false alarm and miss alarm. Finally, accuracy of the proposed system is measured with the help of overall error. It is observed from the result that percentage of accuracy of the proposed method is better than the other two methods.

Carlos Arizmendi et al.[11] Author had proposed a binary classification of brain tumors using Energy criteria and Discrete Wavelet Transform (DWT).Based on pattern recognition techniques holds the assures of substantially improving the quality of medical practice in diagnostic and predictive tasks. In this study, the core of a decision support system for brain tumor classification from magnetic resonance spectroscopy (MRS) data is presented. It combines data pre-processing using Gaussian decomposition, dimensionality reduction using moving window with variance analysis, and classification using artificial neural networks (ANN).

III. DISCUSSION

MRI is more effective and safe scan than X-Ray and CT scan. There is no harm to human body because of zero radiation. MRI consist of powerful magnetic field, radio frequency and a computer to produce more detail and clear picture of human organs and soft tissues. One of the limitation of using MRI images of brain is, large amount of information is produced by MRI scan do not let the manual segmentation to process in reasonable time. So the automatic and reliable segmentation must have to use for tumor segmentation in cerebrum MRI images. Brain tumor detection method based on clustering, consider any type of tumor. Clustering mainly applied on MRI images. It is extremely least complex and quick segmentation strategy. Clustering provide better segmentation quality. The algorithm is more robust to noise. The beauty of this technique, it consider image intensity values only. Cerebrum (brain) tumor segmentation method using CNN have also been considered in various proposed work. As the cerebrum contains expansive fluctuation in soft and hard tissues so the powerful brain tumor segmentation strategy is required to explain segmentation challenges.

Watershed algorithm is well-known edge based segmentation method. Simplicity and efficiency are the two main advantages of this algorithm. This method is able to remove salt and pepper noise, high frequency components without disturbing edges from MRI images. It can be easier to accurately locate the brain tissues automatically. No algorithm have been discussed yet for automatically and accurately computing tumor area . The number of textural and intensity based features are extracted from an image. The GLCM algorithm has been used for textural features extraction. GLCM algorithm provides good discrimination between tumor's abnormal tissues and its surrounding edema. One of the limitation of this method is, the extracted features are sensitive to noise and in-homogeneity DWT and DCT have been used for extraction of intensity based features. Physical characteristics of tissues in brain MRI are directly indicated by using these features. Tumor identification is fast by using physical characteristics. The limitation of this method is, different tissues in tumor may have overlapping values of intensity.

Table: Comparison between different Brain Tumor Analysis Techniques

Sr No.	Authors Name	year	Type of methodology	Advantage	Disadvantage
1	Nilakshi Devi and Kaustubh Bhattacharyya et al	2018	ANN	ANN have the ability to learn and model non linear and complex relationship which is really important in brain tumor detection.	ANN has some intrinsic disadvantages like slow convergence speed, less generalizing performance and over fitting.
2	Shrutika Santosh Akshata Raut Swati Kulkarni et al.	2017	Edge Detection (Using sobel operator) and Thresholding	edge detection and thresholding are the simplest methods to operate	The mostly edge detection techniques are gradient based and has the most important drawback of being sensitive to the noise.
3	Ramya. K et al.	2016	Watershed Trans-formation	Using Morphological Operation a clear thought about irregular cells and normal cells is been identified.	Watershed transform gives closed contours, but are over sensitive for complex images.
4	Padmakant Dhage et al.	2015	Watershed algorithm	effectively recognizes the most complex tissues from typical cerebrum tissues	Watershed transform gives closed contours, but are over sensitive for complex images.
5	Asra Aslam et al.	2015	An Enhanced Edge Detection algorithm	The regions generated by pro-posed method are better than Sobel and therefore it successfully identified the tumor which is more close to the original one.	If the amount of smoothing required is important in the spatial domain it may be slow to compute.
6	Shobana G et al	2015	DCT and DWT	Using DCT and DWT more detailed information is extracted	The high frequency coefficients are coarsely quantized, and hence the

				from the tumor.	reconstructed quality of the image at the edges will have poor quality.
7	P.Sangeetha et al.	2014	PNN	Gives the maximum tumor recognition rate	PNN are slower than multilayer perceptron networks at classifying new cases.
8	Roshan G. Shelkar et al.	2014	Thresholding and Watershed Algorithm	Tumor is detected effectively using thresholding algorithm	The major drawback to threshold based approach is that they many times lack the sensitivity required for accurate classification.
9	Amitava Halder, Chandan Giri.	2014	K-mean algorithm	This methodology extracts the tumor by victimization K-means algorithmic rule followed by Object labeling algorithmic rule.	Difficult to find K value and with global cluster it did not work well.
10	Carlos Ariz-mendi et al.	2011	Feed-Forward Bayesian ANN	The system achieved very good result using this methodology.	Here is no specific rule for determining the structure of artificial neural networks. Appropriate network structure is achieved through experience and trial and error.

IV. CONCLUSION

A brain i.e cerebrum is one the most important part of the human body and has high impact on the performance of other body parts. The computer aided algorithms for detetcion and diagnosis of cerebrum tumor have been developed to support radiologists to convey an correct designation and to cut back the rate of number of wrong decisions of brain diseases. Various techniques have been used now a days to find out brain tumor its exact location and size. In this paper four types of segmentation methods are used appropriate feature extraction and selection that will give the best performance results for classifiers. Furthermore, the best choice of a classifier has a great impact on the final classification results and classification of brain abnormalities is not an easy task even for expert like radiologists. The development in each algorithm of detection and classification required an improvement to achieve very accurate results in order to bring out the optimal performance of computer aided detection and diagnosis algorithms.

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