Review of Literature

2. REVIEW OF LITERATURE

Brain tumor cells have high density and intensity. HSOM Segmentation is a tool to classify tumors and high intensity tissues of brain. Image Segmentation is a process that groups pixel which has similar attributes. The results can be used in medical field for planning of treatment, tumor identification, to analyze tumor growth and computer assisted surgery.

This can be done in two ways: Manual Segmentation and Automatic Segmentation. Manual segmentation is a flexible technique but can be error prone when dealing with large number of images, while automated methods provide quick identification of tumor when compared to manual segmentation. There are various sections, presented in the review of the selected literature on image preprocessing, clustering, and segmentation.

2.1 Preprocessing

Preprocessing techniques are used to improve the detection of the suspicious region from Magnetic Resonance Image (MRI).

K.Selvanayaki1 et al. (2012), proposed in their work which performance the preprocessing and enhancement method consisting as discussed subsequently. Elimination of film artifacts such as labels and X-ray marks are removed from the MRI using tracking algorithm. This was followed by the removal of high frequency components using weighted median filtering technique. Hence the performance of the proposed method is also evaluated by means of Peak Single-to Noise-Ratio (PSNR), Average Signal-to-Noise Ratio (ASNR).The weighted median filter determines noise points in image through noise detection.

Rajesh C. Patil et al. (2012), discussed about the usage of high pass filter for noise removal and median filter to enhance the quality of image. A high pass filter which was employed in his study tends to retain the high frequency information within an image while reducing the low frequency information. A median filter was used to improve the results for edge detection on an image.

Mr.Deepak et al.(2014), In their proposed method employed Image pre-processing of image by converting RGB image into grey scale and subsequently passed that image to the high pass filter in order to remove noise. Finally an enhanced image for post-processing included watershed segmentation and thresholding as well as morphological operation was carried out.

SonaliPatil et al. (2012), presented a preprocessing method for MR and CT images containing tumors, which utilized a median filter for removal of film artifacts from MRI/ CT images. Median filter was efficient as compared to tracking algorithm and provides output images that are suitable for further processing. Here a morphological operator algorithm was used to remove the skull portions.

Magdi et al (2013), used an intelligent Model for brain tumor diagnosis from MRI images in which the (MR) images was classified into normal, Edema, Cancer, or not classified. The work consists of three stages: In the first stage a preprocessing of brain image was done to remove the noise and to increase and enhance the contrast using multiple steps, secondly texture features was extracted, and then reduced dimensionality based on PCA, and finally Back-Propagation Neural Network (BPNN) based-on Pearson correlation coefficient was used to classify the brain images. Experimental results showed that their model achieves accuracy of 96. 8%.

Senthilalkumaran.N et al. (2010), presented a hybrid method for white matter separation from MRI brain image that consist of three phase. The first phase was used to preprocess an image for segmentation, second phase was used to segment an image using granular rough set and third phase was to separate white matter from segmented image using fuzzy sets.

2.2 Clustering

The FCM algorithm gives best result for overlapped data set and also gives better result than k-means algorithm. Here, the data point can belong to more than one cluster centre.

M N Ahmed et al.(2002), presented customized algorithm for estimation of intensity in homogeneity using fuzzy logic that supports fuzzy segmentation of MRI data. The proposed algorithm was articulated by altering the objective function used in the standard FCM algorithm. The alteration of the objective function compensates intensity in homogeneities and allows labeling of a pixel (voxel) to be influenced in its immediate neighbourhood. Formulated by modifying the objective function of the standard fuzzy c-mean (FCM) algorithm to compensate for such in homogeneities and to allow the labeling of a pixel to be influenced by the labels in its immediate neighbourhood. The neighbourhood effect acts as a regularizer and biases the solution toward piecewise-homogeneous labeling.

Gopal et al. (2010), proposed an automatic detection of brain tumor through MRI can provide the valuable outlook and accuracy of earlier brain tumor detection. In this paper an intelligent system was designed to diagnose brain tumor through MRI using image processing clustering algorithms such as Fuzzy C Mean along with intelligent optimization tools, such as Genetic Algorithm (GA), and Particle Swarm Optimization (PSO). The detection of tumor was performed in two phases: Preprocessing and Enhancement in the first phase and segmentation and classification in the second phase.

Kshitij Bhagwat et al. (2013), presented a paper that shows comparison of K-means, Fuzzy C-means and Hierarchical clustering algorithms for detection of brain tumor. These three were tested with MRI brain image in non-medical format (.jpg, .png, .bmp etc) as well as with DICOM image. It was proved that DICOM images produce more efficient result compared to non medical images.

Sivaramkrishnan. A et al.(2013), proposed an efficient detection of brain tumor region from cerebral image was done using Fuzzy C-mean clustering and histogram. The histogram equalization calculates the intensity values of the grey level images and decomposition of image are extracted using principle component analysis was used to reduce dimensionality of the wavelet co-efficient. The Fuzzy C-mean clustering algorithm finds the centroids of the cluster groups together the brain tumor patterns obtained from MRI images. Segmentation result shows the extract suspicious tumor region.

Kavitha. A et al.(2013), proposed method was incorporated to segment the tumor in an MRI medical image. The quantitative and qualitative comparisons performed on simulated and real brain MR images with different noise levels demonstrate unprecedented improvements in segmentation results compared to other FCM-based methods.

Rajendran.A et al. (2011), analyzed the segmentation of MRI brain image into different tissue using Possibilistic fuzzy c-mean (PFCM) clustering. Application of this method gives better segmentation when compared to Fuzzy c-mean (FCM) and Possibilistic fuzzy c-mean (PFCM). The results are verified quantitatively using similarity metrics, False Positive Volumes Function (FPVF) and False Negative Volume Functions (FNVF).These values are shows that PFCM segments the tumor class effectively. This was achieved by effectively utilizing the membership and possibility (typicality) function in the PFCM.

Liew, AWC et al. (2005), analyzed the image segmentation algorithm based on Adaptive Fuzzy C-Mean (AFCM) clustering. In the conventional FCM clustering algorithm, cluster assignment was based solely on the distribution of pixel attributes in the feature space, and does not take into consideration the spatial distribution of pixels in an image. Introduced a novel dissimilarity index in the modified FCM objective function, the new adaptive fuzzy clustering algorithm was capable of utilizing local contextual information to impose local spatial continuity, thus exploiting the high inter-pixel correlation inherent in most real-world images. The incorporation of local spatial continuity allows the suppression of noise and helps to resolve classification ambiguity.

Chen S et al. (2004), suggested the convention Gaussian mixture model with spatial constraints for noisy image segmentation. Gaussian mixture model was an effective algorithm suitable for image segmentation based on the Bayes theorem. Unlike the fuzzy c-mean clustering with spatial constraints, it was able to consider the density distribution of input data. The experimental results on a synthetic image and a real image show that our proposed algorithm was more effective than fuzzy c-mean with spatial constraints.

KS Chuang et al. (2006), proposed averaging the fuzzy membership function values and reassigning them according to a trade off between the original and averaged membership values. This approach can produce accurate clustering if the trade off was well adjusted empirically, but it was enormously time-consuming.

F Hoppner et al.(2003), proposed a fuzzy clustering algorithm like the popular fuzzy c-mean algorithm (FCM) was frequently used to automatically divide up the data space into fuzzy granules. When the fuzzy clusters are used to derive membership functions for a fuzzy rule-based system, then the corresponding fuzzy sets should fulfill some requirements like boundedness of support or unimodality. The fuzziness of the partition into account, continuous transitions between the single local models can be obtained easily. However, unless the overlapping of the clusters was very small, the local models tend to mix and no local model was actually valid. The membership functions can be generalized to a fuzzified minimum function.

Shasidhar et al. (2011) proposed a clustering approach was widely used in biomedical applications particularly for brain tumor detection in abnormal magnetic resonance (MRI) images. Fuzzy clustering using Fuzzy C-Mean (FCM) algorithm proved to be superior over the other clustering approaches in terms of segmentation efficiency. The effectiveness of the FCM algorithm in terms of computational rate was improved by modifying the cluster center and membership value updating criterion. The application of modified FCM algorithm for MRI brain tumor detection was explored.

2.3 Feature Extraction

Magdi et al (2013), used an intelligent model for brain tumor diagnosis from MRI images. This method was consists of three different stages such as preprocessing, feature extraction and classification. Preprocessing was used to reduce the noise by filtration and to enhance the MRI image through adjustment and edge detection. Texture features were extracted and Principal Component Analysis (PCA) was 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.

Aboul Ella Hassanien (2009), 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 was hybridized with various computing technologies such neural network (NN), support vector machine (SVM) and fuzzy sets. The near sets offer a generalization of traditional rough set theory. Finally means of feature was used to classifying perceptual objects for solving medical image problems.

R. Mishra et al. (2010), presented an efficient system, where the brain tumor has been diagnosed with higher accuracy of using artificial neural network. After the extraction of features from MRI data by means of the wavelet packets, an artificial neural network has been employed to catch out the normal and abnormal region of brain image. Normally, the benefit of wavelet packets was to give richest analysis when compared with the wavelet transforms and thus adding more advantages to the performance of their proposed system.

E. F. Badran, et al.(2010), have proposed a computer-based technique for identifying the tumor region accurately in the brain via MRI images. Here, the classification has been performed on a brain tumor image for identifying whether the tumor was a benign or malignant one. The steps involved in the proposed algorithm were preprocessing, image segmentation, feature extraction and image classification via neural network techniques. Wavelet based texture feature are extracted from normal and tumor region. These features are given as input to the SVM classifier which classified them into benign or malignant. Finally, using the region of interest technique, the tumor area has been located.

2.4 Segmentation

D. Bhattacharyya, Kim Tai-hoon, et al. (2010), has proposed an image segmentation technique to identify the tumor from the brain magnetic resonance imaging (MRI). Several existing thresholding techniques have produced different result in each image. In order to produce a suitable result on brain tumor images. A technique was proposed, where the detection of tumor was done individually.

S.Murugavalli et al. (2007), proposed an implementation of hierarchical self organizing map used to classify the image layer by layer. The lowest level weight vector was achieved by the abstraction level. The computation speed of the proposed method was also studied. The multilayer segmentation results were done with the consequences from the view point of clinical diagnosis. HSOM technique showed an accurate result.

Wen-FengKuo et al. (2004), have proposed a robust medical image segmentation technique, which combines watershed segmentation and Competitive Hopfield Clustering Network (CHCN) algorithm to minimize unwanted over-segmentation.

Rajesh patil et al(2012) , presented a method to detect and extract the tumor from MRI image of brain by using MATLAB software. This method performs noise removal function, segmentation and morphological operations. The tumour was extracted from MRI image for the ones which has intensity more than that of its background so it becomes apparent easily.

A new unsupervised MRI segmentation method based on self-organizing feature map was presented by Yan Li and Zheru Chi,(2003). Their algorithm included extra spatial information about a pixel region by using a Markov Random Field (MRF) model. The MRF model provided better segmentation results. The collaboration of MRF into SOFM has demonstrated higher potentials, as the MRF term models the smoothness of the segmented regions.

Gopal et al. (2010), suggested an algorithm which incorporated multi-scale image segmentation, this algorithm was based on fuzzy c-mean algorithm for the detection of brain tumor.

T.Logeswari et al. (2010), proposed method contained two phases for tumor segmentation. In the first phase, the MRI brain image was learned from patient database, In that film artifact and noise were removed. After that Hierarchical Self Organizing Map (HSOM) was applied for image segmentation. The HSOM was the extension of the conventional self-organizing map used to classify the image row by row. The execution time is achieved by the HSOM with vector quantization.

From Literature survey, it is conclude that MRI images provides much better information about human soft tissues of brain compared to computerized tomography(CT) images. DICOM images (.dcm) create more efficient result compare to non-medical images (.jpg,.png,.bmp). MRI segmentation is one of the critical tasks in medical area. It is highly essential that segmentation perform accurately otherwise the wrong identification of disease can lead to dire consequences. The tumor is a complicated task; therefore accuracy and reliability are always plays a critical and influential role.