ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 2, February 2017

A Survey on Different Image Segmentation Technique for Brain Tumor Detection from MRI

Anjali Gupta[1], Sachin Meshram[2]

M. Tech [Digital Electronics], Dept. of ECE, Chouksey Engineering College, Bilaspur, Chhattisgarh, India[1]

Assistant Professor, Dept. of ECE, Chouksey Engineering College, Bilaspur, Chhattisgarh, India [2]

ABSTRACT: In medical image processing brain tumor extraction and its analysis are challenging tasks because brain image and its structure is complicated that can be analyzed only by expert physicians or radiologist. Location of tumor is one of the factors that determine how a brain affects an individual's functioning. Segmentation plays a crucial role in processing of medical images. For diagnosis of brain and other medical images MRI (Magnetic resonance imaging) has become useful diagnostic tool. Existing literature suggests and analysis of medical images but a robust method for extraction of brain tumor is yet to be developed.

KEYWORDS: MRI (Magnetic resonance imaging), Medical images, segmentation, image processing, radiologist.

I.INTRODUCTION

Our body is constructed with many types of cells and each cell has special functions. The cells of our body grow and then divide in proper way and as cells are helpful for diagnosis of brain tumor is difficult because of different shapes and sizes of tumor. Treatment plans and evaluation of disease, progression of disease affect specific tissues or structure, leads to loss and abnormalities. An accurate, reliable and automatic segmentation of these tissues band structures can improves diagnosis and treatment of brain disease. But this is uncontrolled growth of cells and they divide too often without any order when cells lost ability to control their growth. Due to abnormal and uncontrolled cell division in brain itself causes brain tumor may not be possible if the growth becomes more than 50%. Hence, accurate diagnosis of tumor in early stage is very important.

II.IMAGE PROCESSING AND ENHANCEMENT

Image processing

Image processing is a collection of tool such as image acquisition, image enhancement, deals with portioning the image into certain number of sub images or regions. Medical image processing or segmentation is a digital image segmentation in which the images are produced through some sort of medical imaging schemes.raw data or images need to be enhanced so that they become suitable for an application.

Image preprocessing

Image pre-processing is an important step where all the original images are subjected to that the images is prepared for applying to the methods of implementation. It can be seen that the original images are of improper format, size, color that need to be pre-processed so that they become suitable for applications. Certain amount of noise is also removed in this process. Image smoothening, sharpening, contrast enhancement, histogram modification are few examples of noise removal method used to eliminate noise and improve image quality. The purpose of image sharpening is to make tumor edges sharp and more clear.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 2, February 2017

Image enhancement

Pre-processing of images includes image enhancement as very important step to improve the quality of images. The artifacts present in images are labeled and removal from the MRI images using suitable algorithm of images enhancement of image enhancement. Image enhancement is broadly divided in top two categories namely enhancement in spatial domain; and frequency domain. It is said that there is no robust theory in image processing it means that robust approach is always a challenging task for finding a suitable method.

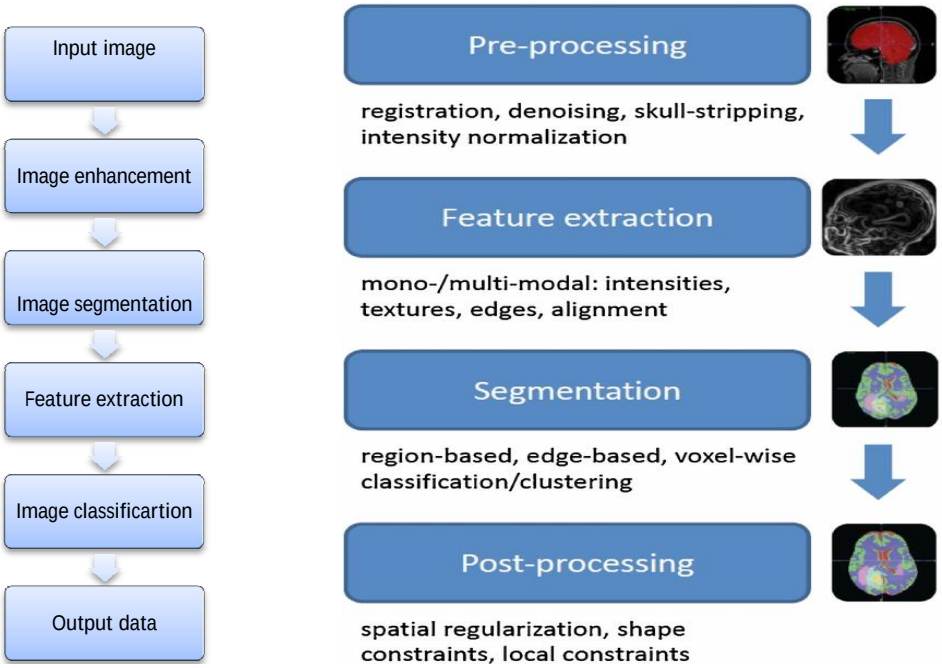

Fig1. Steps for Brain Tumor extraction and detection

III.SEGMENTATION METHODS

1. **Pixel-based segmentation**

Point-based or pixel-based segmentation is conceptually the simplest approach used for segmentation.

2. **Edge-based segmentation**

Even with perfect illumination, pixel based segmentation results in a bias of the size of segmented objects when the show variations in their gray values. Darker objects will become too small, brighter objects too large. The size variations result from the fact that the gray values at the edge of an object change only gradually from the background to the object value. No bias in the size occurs if we take the mean of the object and the background gray values as the threshold. However, this approach is only possible if all objects show the same gray value or if we apply different thresholds for each object. An edge based segmentation approach can be used to avoid a bias in the size of the segmented object without using a complex thresholding scheme. Edge-based segmentation is based on the fact that the position of an edge is given by an extreme of the first-order derivative or a zero crossing in the second order derivative.

3. **Region- Based segmentation**

Methods focus on an important aspect of the segmentation process missed with point-based techniques. There a pixel is classified as an object pixel judging solely on its gray value independently of the context. This meant that isolated

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 2, February 2017

points or small areas could be classified as object pixels, disregarding the fact that an important characteristic of an object is its connectivity.

4. **Model-based segmentation**
All segmentation techniques discussed so far utilize only local information. The human vision system has ability to recognize objects even if they are not completely represented. It is obvious that the information that can be gathered from local neighborhood operators is not sufficient to perform this task. Instead specific knowledge about the geometrical shape of the objects is required, which can then be compared with the local information. This a train of thought leads to model-based segmentation. It can be applied if we know the exact shape of the objects contained in the image.

IV. CLUSTERING TECHNIQUES

1**. Fuzzy c-means (FCM) clustering**: Fuzzy c-means (FCM) is a clustering method in which one piece of data belongs to two or more clusters. Firstly, the algorithm selects the initial cluster centers from SOM clustering algorithm. Then, after many iterations of the algorithm, the final result converges to actual cluster centre; thereby a good set of initial cluster is generated. FCM algorithm fails to deal with images that contain noise. In order to deal with noise sensitivity BCFCM has been proposed i.e. Bias Corrected FCM.

2. **K-Means Clustering**: The simplest and most commonly used algorithm, employing a squared error criterion is the K-means algorithm. K-mean is one of the simplest unsupervised learning algorithms that solve the well known clustering problem. The K-mean clustering is a popular approach to partition d- dimensional data into K clusters such that an objective function providing the desired properties of the distribution of feature vectors of clusters in terms of similarity and distance measures is optimized. A generalized K-mean clustering algorithm initially places K clusters at arbitrarily selected cluster centroids = 1, 2…k and modifies centroids for the formation of new cluster shapes optimizing the objective function. The K-means clustering method optimizes the sum-of squared error based objective function.

3. **The region growing**: The region growing starts with a seed, selected in the centre of the tumor region. During the region growing phase, pixels in the neighbor of seed are added to region based on homogeneity criteria which thereby resulting in a connected region.

4. **The active contour model**: The active contour model is a framework for delineating an object outline from a noisy image and is based on a curve, X(s) = [x(s), y(s)], defined in the image domain where s in range of [0, 1] is an arc length. It deforms in a way that minimizes an energy function. The internal energy and is used to control the tension and rigidity of the deforming curve. The external energy is used to guide the deforming curve toward the target used Gaussian Gradient Force to compute external force. Advantages of this method are insensitiveness to contour initialization, boundary concavities, saving computation time, and high accuracy.

5. **A Markov random field models**: A Markov random field, Markov network or undirected graphical model is a set of random variables having a Markov property described by an undirected graph. It is a statistical model used to model spatial relations that exist in the neighbor of pixels. Image segmentation methods use MRF to take advantage of neighborhood information in the segmentation process, like, in medical images most neighborhood pixels have the same class and thus by using neighborhood information, influence of noise in segmentation is decreased.

6. **LVQ**: Learning vector quantization is a supervised competitive learning technique that obtains decision boundaries in input space based on training data. It defines class boundaries prototypes, a nearest-neighbor rule and a winner takes-it-all paradigm. LVQ is composed of three layers: input layer, competitive layer and output layer. The input data is classified in the competitive layer and those classes or patterns are mapped to target class in the output layer. In the learning phase weights of neurons are adjusted based on training data. The winner neuron is calculated based on the

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 2, February 2017

Euclidean distance, and then the weight of the winner neuron is adjusted. There are several algorithms to learn LVQ networks.

V. LITERATURE SURVEY

N.Salman et.al, solved the problem of undesirable over segmentation results produced by the watershed algorithm, when used directly with raw data images. An initial segmentation based on K-means clustering technique and used two techniques; the first is watershed technique with new merging procedures based on mean intensity value to segment the image regions and to detect their boundaries. The second is edge strength technique to obtain accurate edge maps of our images without using watershed method. The drawback of these techniques depends mainly on k-means results, where if the clustering procedure is not implemented correctly, the results are incorrect by the other techniques we used. This paper solved the problem of undesirable over segmentation results produced by the watershed algorithm; also the edge maps we obtained have no broken lines on entire image.

H.P.Ng et.al, propose a method which incorporates the K-means clustering algorithm with the improved watershed segmentation algorithm for medical image segmentation. It addresses the drawbacks of the conventional watershed algorithm, which include over-segmentation and sensitivity to noise. The experimental results have shown that proposed process of using K-means clustering to obtain a primary segmentation of MR images before applying the improved watershed segmentation to them is effective.

P. Kudova et.al, presented and studied a clustering technique based on genetic algorithms – Clustering Genetic Algorithm. It is capable of optimizing the number of clusters for tasks with well formed and separated clusters .It outperforms the k-means clustering, especially on tasks that posses larger number of clusters. The CGA with the silhouette fitness was applied on the 25 clusters task, where it was able to determine the optimal number of clusters.
Z.Tan et.al, The proposed IGKCA considers the ability of global search, local search and the fast astringency. The improved genetic K-means clustering algorithm applied to image segmentation has satisfactory result and high calculation efficiency. Computing time is reduced due to combining the membership matrix with the coding of chromosomes skillfully. The proposed algorithm is better than traditional genetic K-means algorithm**.**

H.Khontanlou et.al, has proposed a technique for segmenting the brain tumors in 3D magnetic resonance images. This technique was suitable for different kinds of tumors. Initially, the brain has been segments using the proposed approach. Then, the suspicious areas have been selected with respect to the approximation brain symmetry plane and fuzzy classification for tumor detection. Here, in the segmentation stage, the tumor has been segmented successfully using the combination of a deformable model and spatial relations.

M. Karnan et.al, presented novel approach to MRI Brain Image segmentation based on the Hybrid Parallel Ant Colony Optimization (HPACO) with Fuzzy C-Means (FCM) Algorithm have been used to find out the optimum label that minimizes the Maximizing a Posterior (MAP) estimate to segment the image.

T.Le et.al, proposed the new support vector machine technique for the two-class medical image classification. The main idea of the method is to construct an optimal hyper sphere such that both the interior margin between the surface of this sphere, the normal data, and the exterior margin between this surface and the abnormal data are as large as possible. The proposed method is implemented easily and can reduce both the false positive and also false negative error rates to obtain very good classification results. The Support Vector Machine (SVM) classifier is a good classifier that works well on the wide range of classification problems, even problems in the high dimensions and the cases that are not linearly separable. Perhaps the biggest problem with the support vector approach is in choice of the kernel.

Koley et.al, have presented a cohesion based self merging (CSM) algorithm for the segmentation of brain MRI in order to find the exact region of brain tumor, CSM has drawn much attention because it gives a satisfactory result when compared to other merging processes. Here, the effect of noise has been reduced greatly and found that the chance of

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 2, February 2017

obtaining the exact region of tumor was more and the computation time was very less. Their algorithm was much simpler and computationally less complex.

S. datta et.al, introduced color-based segmentation using k-means clustering for brain tumor detection. The developed algorithm shows better result than canny based edge detection. The color based segmentation carefully selects the tumor from the pre-processed image as clustering feature. The present work demonstrates that the method can successfully detect brain tumor.

J.selvakumar .et. al, deals with the implementation of Simple Algorithm for detection of range and shape of tumor in brain MR images. This project uses computer aided method for segmentation (detection) of brain tumor based on the combination of two algorithms. This method allows the segmentation of tumor tissue with accuracy and reproducibility comparable to manual segmentation. In addition, it also reduces the time for analysis. At the end of the process the tumor is extracted from the MR image and its exact position and the shape also determined. The stage of the tumor is displayed based on the amount of area calculated from the cluster.

F. Ju. et.al, proposed a method for optimization of the result obtained from k-means clustering with genetic algorithm. The problem of traditional k-means is sensitive to the initial cluster centres; the cluster results fluctuate with different initial and easy to fall into local optimum. The author uses encoding, initialization, fitness function selection, crossover and mutation of genetic algorithms into clustering problem and this algorithm has superior performance than the traditional k-means algorithm.

Swarnalatha et.al, proposed a concept based on the novel fuzzy approach with bit plane FCMBP approach. The bit plane filtering method is used to slice the presented image for classification to find out destroyed region of the presented image. The sliced image must be normalized with old techniques and then compared with fuzzy technique for the better classification and the cluster of the spoiled portion. Thereby control points are extracted that are further needed for reconstruction of the images. The performance of the fuzzy approach with bit plane technique is evaluated with the help of simulation and it is found that our approach yields better results when compared to other accessible methods. Its disadvantage is only efficient for most significant bit-planes (MSB).

M.S. H. Al- Tamimi et.al, presented a comprehensive review of the methods and technique used to detect brain tumor through MRI image segmentation. The paper concluded with a direction towards upcoming trend, more advance research studies on brain image segmentation and tumor detection.

R. G. Selkar et.al, presented an approach which detects and segments the brain image using thresholding and watershed approaches. This system consists of three stages. As first step they enhanced the input scanned image then morphological operators are applied. Finally edge operators are applied to find the tumor edges in MRI images.

Z.Karhan et al, proposed a method that is used for determining whether the medical image belongs to that class or not, using textural features of the medical images. The study was conducted on the images in the IRMA (Image Retrieval in Medical Applications), in the international database. After performing the preprocessing on medical images, discrete wavelet transform (DWT) was applied and then the discrete cosine transform (DCT) was applied to the each band components. After extracting the features, using of 1%, 3%, 5% and 7% of the obtained data were classified. K-Nearest neighbor algorithm was used in classification phase. The classification performance was around the 87 percentage. One of the main highlight of the wavelets is that they offer a simultaneous localization in time and the frequency domain.

Ketan Machhale et.al, proposed an intellectual classification system to recognize the normal and abnormal MRI brain images. At present, decision and the treatment of brain tumors is based on the symptoms and radiological appearance. Magnetic resonance imaging (MRI) is the very important controlled tool for anatomical judgment of the tumors in brain. Nowadays, various techniques were used for the classification of the brain cancer. Under these techniques used the modules like image preprocessing, image segmentation, image feature extraction and subsequent classification of

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 2, February 2017

brain cancer are performed. Support Vector Machine (SVM), K- Nearest Neighbor (KNN) and Hybrid Classifier (SVM-KNN) are the various machine learning techniques are used.

Parveen et.al, proposed a new hybrid technique based on support vector machine (SVM) and the fuzzy c-means for brain tumor classification. This algorithm is a combination of support vector machine (SVM) and fuzzy c-means, a hybrid technique for prediction of the brain tumor. In this algorithm image is enhanced with the help of techniques such as contrast improvement, and mid-range stretch. Double thresholding and the morphological operations are used for the skull striping. The Fuzzy c-means (FCM) clustering is used for the segmentation of image to detect suspicious region in the brain MRI image. Grey level run length matrix (GLRLM) is used for the extraction of the feature from the brain MRI image, after which the SVM method is used to classify a brain MRI image, which provides accurate and more effective results for the classification of brain MRI images.

VI.CONCLUSION

Detection extraction of Brain tumor via MRI is a challenging task for doctor in a medical field. The incorrect analysis leads recreation of tumor. To overcome the challenges Medical image processing advent too many fast growing techniques. The research towards this field is still going on and will continue in the future. Medical image analysis through computer vision is not in a frequent use of physician. The technology has to proceed in a way that it can deal with real world issue which is outside the department of computer vision. The solution comes through medical image processing is to be accepted by a physician and to be added to the workflow of medical procedure. Accuracy and reliability are always assigned much importance as diagnosis of brain is complicated task.

REFERENCES

[1] N.Salman “Image Segmentation based on Watershed and Edge Detection Techniques”, The International Arab Journal of Information Technology (IAJIT), Vol.3, no.2, pp10-110, 2006.
[2] H.P.Ng, Ong, S.H, Foong, K.WC, Goh, P.S, Nowinski, W.L “Medical Image Segmentation using K-means Clustering and Improved Watershed algorithm” IEEE Southwest Symposium in image analysis and interpretation, Vol.1,no.2 , pp. 132-142,2007.
[3] P.Kudova, “Clustering Genetic Algorithm”, 18th workshop on databases expert system applications, Vol.1, no.3, pp.138-142, 2007.
[4] Zhicun Tan, RuhinaLu, “Application of Improved Genetic K-Means Clustering Algorithm in Image Segmentatio” 1st International Workshop on Education Technology and Computer science, ETCS, Vol.2, no.4, pp.625-628,2009.
[5] M.karnan, Gopal, N.N, “Hybrid Markov Random Field with Parallel Ant Colony Optimization and Fuzzy C Means For MRI Brain Image Segmentation”, 5th IEEE International conference Intelligence and Computing Research (ICCIC), pp.1-4, 2010.
[6] Trung Le, Dat Tran, Wanli Ma and Dharmendra Sharma, “a new support vector machine method for medical image classification”, IEEE 2015.
[7] Koley, Subhrani and Anupam Majumdar, “Brain MRI Segmentation for Tumor Detection using Cohesion based Self Merging Algorithm”, 3rd IEEE International Conference on Communication software and Networks (ICCNSN), pp 781-785, 2011.
[8] S.Dutta, M.Chakarborty, “Brain Tumor Detection from Pre-processed MR Images using Segmentation Techniques”. 2nd National Conference-Computing, Communication and Sensor Network (CCSN) Published by foundation of Computer science, New York, USA, Vol.2, pp.1-5, 2011.
[9]J.selvakumar,A.Lakshmi,T.Arivoli, “Brain Tumor Segmentation and Its Area Calculation in Brain MR Images using K-Mean Clustering and Fuzzy C-Mean Algorithm” , IEEE-International Conference On Advances In Engineering, Science And Management (ICAESM) 2012 .
[10] Bin Lu, Fangyuan Ju,” An optimized Genetic K-means Clustering Algorithm”, International Conference on Computer Science and Information Processing (CSIP), Vol.1, no. 2, pp.1296-1299, 2012.
[11]Mohammed Sabbih Hamoud Al-Tamimi, Ghazali Sulong, “Tumor Brain Detection through MR Images: A Review of Literature”, Journal of Theoretical and Applied Information Technology, Vol. 62, no.2, 2014.
[12] Roshan G. Selkar and M. N. Thakare, “Brain Tumor Detection And Segmentation By Using Thresholding And Watershed Algorithm”, IJAICT, Vol.1, no. 3, 2014.
[13] Zehra Karhan, Burhan Ergen, “Content Based Medical Image Classification Using Discrete Wavelet and Cosine Transforms”, IEEE 2015.
[14] Ketan Machhale, Hari Babu Nandpuru “MRI Brain Cancer Classification Using Hybrid Classifier (SVM-KNN)”, International Conference on Industrial Instrumentation and Control (ICIC) 2015.
[15] Parveen, Amritpal Singh, “ Detection of Brain Tumor in MRI Images, using Combination of Fuzzy C-Means and SVM”, 2nd International Conference on Signal Processing and Integrated Networks (SPIN) 2015.
[16] Swaranlatha, “ A novel Fuzzy C-Means approach with bit Plane algorithm for Classification of Medical Images”, IEEE International Conference on Emerging Trends in Computing Communication and Nanotechnology (ICECCN).