Survey of MRI Brain Image Segmentation Methods

N.Pradeepa [1], A.Renuga Devi[2], Saumiya Jose Thomas [3]
[1, 2,3] *Faculty of Electronics and Communication, Sathyabama University, Jeppiaar nagar, Rajiv Gandhi salai, Chennai,India.*

Abstract

This survey is based on various image segmentation algorithms. The motive and the need is to improve the accuracy in image segmentation for professional field namely the medical imaging. In Medical fields segmentation is necessary for earlier diagnosis. Many segmentation techniques are being used for medical advancement. This paper presents various image segmentation techniques. This analysis provides knowledge to identifying the advantages and choosing correct method for segmentation.

Keywords: *Magnetic Resonance Imaging(MRI), FCM, GVF snake, gaussian distribution.*

I. INTRODUCTION

Medical imaging technology is used in radiology to investigate the anatomy and function of the body in both health and disease. MRI scanners use strong magnetic fields and radio waves to form images of the body.MRI does not use any ionizing radiation so it is preferred when compared to CT scans. This MRI images accuracy is determined by the accuracy level in the segmentation. This paper establishes an effective method to determine the accurate segmented output.

II. LITREATURE SURVEY

A. *Research of Brain MRI Image Segmentation Algorithm Based on FCM and SVM*

SVM cannot partition categorical data of uncertainty samples and FCM is sensitive to noise. So fuzzy is introduced in SVM. Here, FCM and FSVM selects higher membership degree in the segmentation. As FCM is sensitive to noise the space constrains are applied to reduce the noise. This is achieved by GDFP-BCFCM algorithm. FSVM is used for feature extraction. This method gives an high level of accuracy in segmentation.

B. *An Efficient Brain Tumor Detection Methodology Using K-Means Clustering Algorithm*

The image segmentation methods can be classified into three categories namely edge based detection, region based detection and pixel based detection. Here, K-means clustering algorithm is used in pixel based segmentation method. This unsupervised algorithm reduces the distance between the data points and the cluster center by performing iterations at each run. By this method it is found that the unsupervised segmentation methods are better than supervised methods. This method has less processing speed due to less number of iterations and its execution time is 1.87 sec.

C. *MRI Brain Image Classification Using Neural Networks*

The neural network technique consists of three stages namely preprocessing, dimensionality reduction and classification. The MR image is first converted to an suitable MATLAB environment and stored as an single matrix. Then the dimensionality of the image is reduced by means of Principle Component Analysis(PCA) and classified using back propagation algorithm, where feed forward network architecture is used. The accuracy level is about 96.33%. As its efficient in classification it is easy to implement and the execution time is fast.

D. *A Modified Probabilistic Neural Network For Partial Volume Segmentation In Brain Mr Image*

In this method the PNN's kernel function's weighting factor is replaced by covariance matrix. In general PNN performs segmentation on MR images and produces output with Bayesian Posterior probabilities. The accuracy in PDF is estimated by semi parametric methods. Here SOM-WPNN is used to estimate the PDF. The advantage of WPNN is, partial volume can be estimated in different tissue types even in modeling process. By this method the MCR and the relative overlap ratio are improved. In future work the partial volume effects and the investigation on theoretical aspects of WPNN.

E. *Segmentation of Brain MRI Images with GVF Snake Model*

This method is an semi automatic segmentation method. Boundary of the tumor can be extracted clearly in this method. Canny operator is used for edge detection process which gives an better result than other operators namely pewitt, log and sobel. Thinning is used to resolve the "double edges" problem. GVF field is then determined to segment the image. The GVF field is normalized. This method overcomes

the problem in the traditional GVF snake method which does not has an efficient converge to the weak boundary.

F. Improving Ant Colony Optimization for Brain MRI Image Segmentation and Brain Tumor Diagnosis

In this method brain images are segmented with the help of ANT colony algorithm. This methods determines the movement of an ant and its tendency to go to other place. Here the shortest path is identified by means of pheromone (ie) pheromone matrix is first determined. Then the matrix value is converted into an binary image by k-means clustering algorithm. By this method the execution time is less than two minutes which is a better result when compared to other algorithms.

G. Unsupervised Medical Image Segmentation on Brain MRI Images Using Skew Gaussian distribution

In this method gaussian distribution is used where the performance namely the average difference, maximum distance, image fidelity, mean square error, SNR etc.. can be compared. The main disadvantage of this method is, it is not an common algorithm which can be used for all the segmentation methods. To categorize both symmetric and asymmetric images skew gaussian distribution is used and then segmentation is performed. Here accuracy is high. This method gives an better result for the above said parameters.

H. Segmentation of Brain Tumors in MRI Images Using Multi Scale Gradient Vector Flow

This method uses multi scale GVF algorithm. This method is used for edge detection. GVF snake is superior to the original snake algorithm. As GCF snake depends on edge map the edges of the images with low intensities. To overcome this problem we go for MSGVF algorithm. Two methods are included in this method to improve noise performance. Canny operator which eliminates the false edges and B-spline snake which performs edge detection by multiple knots. By means of gaussian smoothing filter when noise is added to an image and its noise scale is constantly increased the accuracy in the edge detection and the sensitivity is also increased. 30% accuracy is achieved when compared with traditional GVF method and 10% to B-spline GVF.

I. Extraction of Brain Tumors from MRI Images with Artificial Bee Colony Based Segmentation Methodology

Here segmentation is performed by Artificial bee colony algorithm (ABC). This can be achieved by three stages namely MRI image enhancement, segmentation by ABC method and then extraction. Initially thresholding method was used which avoids the spatial information in an image and not able to deal with noise. To overcome this we go for ABC technique. By comparing this result with K-means, FCM and Genetic Algorithm ABC gives a better result. In future the accuracy can still be increased.

III. CONCLUSION

In this paper, various medical image segmentation techniques based on various transforms were studied. In these techniques a unique characteristic is used to segment medical image with some drawbacks. All segmentation techniques are useful for real-time medical images. Selecting a method which gives an better accuracy to maintain the quality of the image and success in segmentation process.

REFERENCES

[1] Hsu C W, Lin C J, "A comparison of methods for multiclass support vector machines ",*IEEE Transactions on Neural Networks*, 2002,13(2):415-425.

[2] Platt J C, Cristianini N, Shawe-Taylor J, "Large margin DAGs for multiclass classification", *Advances in neural information processing systems*,2000,12(3):547-553.

[3] Chiang J H, Hao P Y. "A new kernel-based fuzzy clustering approach: support vector clustering with cell growing ". *IEEE Transactions on Fuzzy Systems*,2003, 11(4): 518-527.

[4] J. C. Bezdek, L. O. Hall, and L. P. Clark, "Review of MR image segmentation techniques using pattern recognition," *Med. Phys.*, vol. 20, no. 4, pp. 1033–1048, 1993.

[5] L. P. Clarke and L. O. Hall, "MRI segmentation: Methods and applications," *Magn. Reson. Imag.*, vol. 13, no. 3, pp. 343–368, 1995.

[6] D. L. Pham, C. Y. Xu, and J. L. Prince, "A survey of current methods in medical image segmentation, annual review of biomedical engineering," *Annu. Rev.*, vol. 2, pp. 315–337, 2000.

[7] P. K. Sahoo, S. Soltani, and A. K. C.Wong, "A survey of thresholding techniques," *Comput. Vis. Graph. Image Process.*, vol. 41, pp. 233–260, 1988.

[8] M. Masroor Ahmed and Dzulkifli Bin Mohamad "*Segmentation of Brain MRImages for Tumor Extraction by Combining Kmeans Clustering and Perona-Malik Anisotropic Diffusion Model"* International Journal of Image Processing,Volume (2) Issue (l),2010.