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A Study on Brain Tumor Detection from Magnetic Resonance Images

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***Abstract*— Medical image segmentation plays a vital role in one of the most challenging fields of engineering. It is indeed very helpful in the detection of the disease and its progressive treatment. More research has been enhanced for more effectiveness as far as the subject is considered. There are different methods used for medical image segmentation for medical images such as Thresholding method, Region Growing, Deformable Model, Clustering methods, Classifier, Markov Random Model etc. The main purpose of this paper is to provide a comprehensive reference source involved in Fuzzy C Means based medical image processing. There are different types of FCM algorithms and their advantages and disadvantages are discussed.**

***Keywords*— Clustering; Segmentation; Medical Image Processing; Fuzzy C Means.**

I. Introduction

Brain tumour segmentation in MRI images has been recent area of research in the field of automated medical diagnosis as the death rate is higher among humans due to brain tumour [1]. In automated medical diagnostic systems, MRI (magnetic resonance imaging) gives better results than computed tomography as MRI provides greater contrast between different soft tissues in our human body. Therefore, MRI is much more effective in brain and cancer imaging [2]. Detection of brain tumour requires brain image segmentation Manual brain MR images segmentation is a difficult task. It requires plenty of time, non- repeatable task, non-Uniform Segmentation and also segmentation results may vary from expert to expert. So computer aided system is useful in this context. An automated brain tumour detection system should take less time and should classify the brain MR image as normal or tumorous accurately It should be consistent and should provide a system to radiologist which is self explanatory and easy to operate.

Automatic brain tumour detection and segmentation faces many challenges. It is indeed a difficult task to segment brain tumour in an automatic computerized system as it involves pathology and physics related to

MRI along with intensity and shape analysis of MRI image. Here, the major issue occurring with brain tumour segmentation is that the tumour varies in form of size, shape, location and image intensities. Generally, the manual segmentation of brain tumour requires human experts and it takes a lot of time, which makes a computer aided system for brain tumour detection and segmentation a desirable method.

Different approaches for brain tumour detection and segmentation have been proposed. Hierarchical self-organizing map based multiscale image segmentation was suggested by Suchendra[4]. Murugavalli. used high speed parallel fuzzy c-mean and neuro fuzzy algorithm for brain tumour segmentation [5-6]. 3D variational segmentation based method was proposed by Chunyan [7] and they tested it on tumor tissues from various patients. Clark and Fletcher-Heata [8,9] used artificial intelligence techniques for automated tumour segmentation.

An automated diagnosis system for brain tumour detection should consist of multiple phases including mri image noise removal, brain image segmentation and brain tumour extraction. In this paper, a computer aided system for brain tumour detection is presented. The systems extracts tumour by using three phases, pre processing. global thresholding and post processing.

This paper is arranged in four parts. Part II explains the proposed method and presents the step by step techniques required for automated brain tumour detection and segmentation. Experimental results of tests on the images and their analysis are given in Part III followed by conclusion in Part N

II. Proposed Method

Given a brain MRI image, the first step enhances the image, the second step segments the brain tumour image and in the third step post processing using morphological operations and windowing technique takes place. As a result of these steps, we get a final brain tumour detected image. Figure 1 shows a systematic overview of the proposed technique.

A. Preprocessing

Pre-processing of brain MR image is the first step in our proposed technique. Pre-processing of an image is done to reduce the noise and to enhance the brain MR image for further processing. The purpose of these steps is basically to improve the image and the image quality to get more surety and ease in detecting the tumour. Steps for pre-processing are as follows:

1) Image is converted to gray scale.

2) A 3x3 median filter is applied on brain MR image using equation 1 in order to remove the noise.

$$\bar{f}(x, y) = median_{(s,t)\epsilon Sxy}\{g(s, t)\} \quad (1)$$

3) The obtained image is then passed through a high pass filter to detect edges. The high pass filter mask is given in equation 2.

$$\begin{bmatrix} -1 & 2 & -1 \\ 0 & 0 & 0 \\ 1 & -2 & 1 \end{bmatrix} \quad (2)$$

4) The edge detected image is added to the original image in order to obtain the enhanced image.

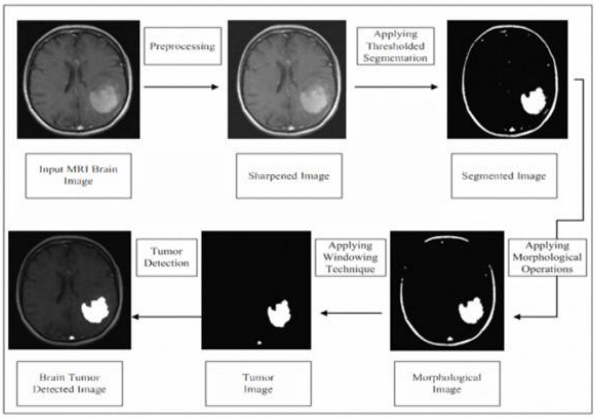

Fig 1: Flowchart of Brain tumor Detection

Numerous methodologies have been proposed and a dense literature is available for extracting information from an image and to partition it into different regions. The problem is that these images suffer from various limitations in terms of time complexity and accuracy. This is due to not well defined boundaries of clusters within the image such that the techniques other than fuzzy result in disambiguates in segmented images; which being fuzzy image segmentation methodologies yield good results

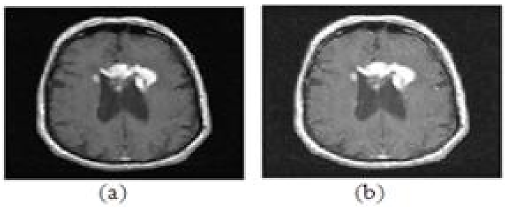

Fig 2: Preprocessing a) Original b) Enhanced

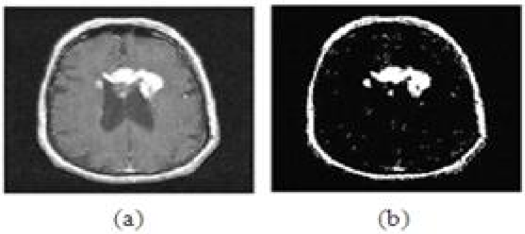

Fig 3: Segmentation a) Enhanced b) Segmentation

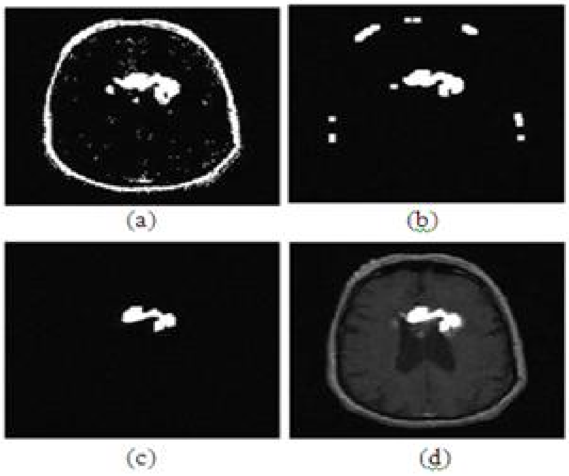

Fig 4: Preprocessing a) Segmented image b) Output of Morpological operation c) Output of Windowing d) Tumor Extracted image

B. Brain Tumour Segmentation

After enhancing the brain MRI image, the next step is to segment the brain tumour MRI image. Segmentation process is undergone to separate the image foreground from its background. Also, segmenting an image will save the processing time for further operations that has to be applied to the concerned image. Here, segmentation using a global threshold is done in order to segment the brain tumour image. The basic steps for global threshold segmentation are as follows:

1) Select a threshold value for the image.

2) Apply the threshold value to enhanced image to convert the image to binary.

3) If a particular pixel value is above the threshold value it is considered as foreground otherwise background.

4) The final brain tumour detected image is obtained by applying the tumour mask on dilated brain MR image.

C. Post-processing

After segmenting the brain MR image, several post-processing operations are applied on the image to clearly locate the tumour part in the brain. The basic purpose of the operations is to show only that part of the image which has the tumour that is the part of the image having more intensity and more area. These post-processing operations include morphological operations and windowing technique. The basic steps of post-processing are as follows:

1) The morphological erosion is applied on the segmented brain MR image with 3x3 structuring element.

2) The morphological dilation is applied on the eroded brain MR image with 3x3 structuring element.

3) Binary tumor masked window is created to segment out the tumor region from the image. Tumor tissue has basically more intensity than the other surrounding tissues of the brain MR image.

III. Experimental Results

The tests of proposed technique are performed with respect to the brain tumour segmentation accuracy using 100 MR images of different patients. The images used for testing are of size 676x624 pixels, eight bits per colour channel. Images that we have used for testing contain brain tumour of different size, shape and intensity. In order to check the accuracy of automated segmented tumour area, tumour from all images is segmented manually by the ophthalmologist. The manually segmented images are used as ground truth. The true positive rate is the ratio of number of true positives (pixels that actually belong to tumour) and total number of tumour pixels in the MR image. False positive rate is the ratio of false positives (pixels that don't belong to tumour) by total number of non tumour pixels in the MR image.

Figure 5 shows the experimental results for different MR images containing tumour of different shape and size. It shows that proposed method have extracted the brain tumour accurately.

The results of tumour segmentation for MR images are summarized in table-I. It shows the results in terms of average accuracy and their standard deviation as compared with ground truth.

IV. Conclusion

In this paper, brain tumour segmentation and detection is done using MR images. The proposed method enhanced the MR image and segments the tumour using global thresholding. False segmented pixels are the removed using morphological operations and applying windowing technique. The proposed method is invariant in terms of size, shape and intensity of brain tumour. Experimental results show that our method performs well in enhancing, segmenting and extracting the brain tumour from MR images.

References

[I] Pal NR, Pal SK, "A review on image segmentation techniques", Pattern Recognition, vol. 26, no. 9, 1993, pp. 1277-1294.

[2] Bhandarkar, S.M. and P. Nammalwar, "Segmentation of Multispectral MR images Using a Hierarchical Self-Organizing Map Computer-Based medical system CBMS 2001", Proceedings, 14th IEEE Symposium on vol 26, no. 27, 2001, pp. 294-299.

[3] Bhandarkar, S.M., J. Koh and M. Suk, "Multiscale image segmentation using a Hierarchical self organizing map", Neurocomputing, vol. 14, 1997, pp. 241-272.

[4] Murugavallil S, Rajamani V, "A high speed parallel fuzzy cmean algorithm for brain tumor segmentation", BIME Journal, vol. 6, no. 1, 2006.

[5] Murugavallil S, V. Rajamani, "An Improved Implementation of Brain Tumor Detection Using Segmentation Based on Neuro Fuzzy Technique" J. Compo Sc., vol. 3, no. II, 2007, pp.841-846.

[6] Chunyan J, Xinhua Z, Wanjun II, Christoph M, "Segmentation and Quantification of Brain Tumor,"IEEE International conference on Virtual Environment, Human-Computer interfaces and Measurement Systems, USA, 2000, pp. 12-14.

[7] Clark, M.e., Hall, L.O., Goldgof, D.B., Velthuizen, R., Murtagh, F.R, Silbiger, M.S., "Automatic tumor-segmentation using knowledge-based techniques", IEEE Transactions on Medical Imaging, vol. 117, 1998, pp. 187-201.

[8] Fletcher-Heath, L.M., Hall, L.O., Goldgof, D.8., Murtagh, F.R, "Automatic segmentation of non-enhancing brain tumors in magnetic resonance images", Artifical Intelligence in Medicine vol. 21, 2001, pp.43-63.

[9] Kaus, M.R, Warfield, S.K., Nabavi, A., Chatzidakis, E., Black,

[10] P.M., Jolesz, FA, Kikinis, R, "Segmentation of meningiomas and low grade gliomas in MRr', In: Taylor, e., Colchester, A. (Eds.), Lecture Notes in Computer Science, MICCAI, vol. 1679. Springer, 1999, pp. 1-10.