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A Review on 3D-Brain Tumour Segmentation Methods

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ABSTRACT

There are different segmentation technique for brain tumor but, The computational time taken by K-means is more than Fuzzy C-Means, making FCM better in the clustering technique. The performance of the Otsu thresholding is better than other thresholding techniques and also the clustering techniques. Morphological opening and closing is better in the showing of the content of the image than the other techniques. In Existing methods Color, Cluster and Morphological Based Approach is used to Segment the Brain Tumor Part. In Color and morphological based method affected by noise Where Cluster based method needs A priori specification of no. of clusters. From above problems a proposed method can be made by Adaptive KWFCM method to segment accurate and fast brain tumor.

1. Introduction

Now days, one of the main cause for increasing mortality among children and adults is brain tumour. It has been concluded from the research of most of the developed countries that number of people suffering and dying from brain tumors has been increased to 300 per year during past few decades. Pie chart is given below, which shows rate of tumour diagnosis in some countries. Generally human brain has three major parts that control different activities.

1) Cerebrum: It controls learning's, thinking, emotion, speech, problem-solving, reading, writing
2) Cerebellum: It controls balance, movement, standing, and complex actions
3) Brain Stream: It controls blood pressure, body temperature, and breathing. The main reason behind the development of this application is to provide proper treatment as soon as possible and protect the human life which is in danger.

There are different segmentation technique for brain tumor but, the computational time taken by K-means is more than Fuzzy C-Means, making FCM better in the clustering technique. The performance of the Otsu Thresholding is better than other Thresholding techniques and also the clustering techniques. Morphological opening and closing is better in the showing of the content of the image than the other techniques. In Color and morphological based method affected by noise Where Cluster based method needs A priori specification of no. of clusters. From above problems a proposed method can be made by Adaptive KWFCM method to segment in 3D accurate and fast brain tumor.

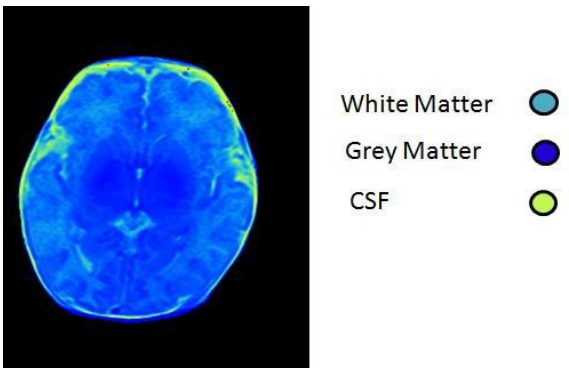

Figure1. 3D Brain Tumor

2. Related Work

Xiaoli Zhang, M. N. V. S. S. Kumar suggested in" A multi-scale 3D Otsu thresholding algorithm for medical image segmentation" In order to reduce the effects of noises and weak edges, multi-scale image representation is brought into the segmentation algorithm. The whole segmentation algorithm is designed as an iteration procedure. In each iteration, the image is segmented by the efficient 3D Otsu, and then it is filtered by a fast local Laplacian filtering to get a smoothed image which will be input into the next iteration. Finally, the segmentation results are pooled to get a final segmentation using majority voting rules. 3D Otsu can provide more precise segmentations comparing to 1D Otsu and there accuracy comes approx. 0.9852 of single different thresholding algorithm

Satrajit Mukherjee is suggested that KWSFCM serves as a robust image segmentation algorithm that accurately removes noise in case of noisy images and still maintains the structural characteristics of the image. In their paper they represents Fuzzy damping coefficients are obtained for each nucleus or center pixel on the basis of the corresponding weighted SUSAN area values, the weights being equal to the inverse of the number of horizontal and vertical moves required to reach a neighborhood pixel from the center pixel. These weights are used to vary the contributions of the different nuclei in the Kernel based framework. They represents KWSFCM accurately

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segments a noise-ridden image while removing noise and still maintaining proper edge and contour information. The computational time was evaluated after averaging through 25 runs for 20 test images, all of sizes 481x321, taken from the BSDS-500.

Ch. Rajasekhara Rao suggested in "MRI Brain Tumor Segmentation and Its 3D Construction" that the MRI slices are segmented and then they are reconstructed to into 3D for better understanding the stage of tumor. First the MRI images are preprocessed and a new heuristic algorithm based on Expectation-Maximization, Histogram and object based thresholding methods is developed to identify the cancer wherein the resultant of the algorithm is 2D. For better understanding of the cancer stage these 2D images are combined to form a 3D view of the tumor. The performance of these hybrid fused techniques will be compared in terms of quality of the resultant tumor. They represents 3D volume of tumor in term of pixel in three different segmentation method, proposed algorithm result have 42347 pixel tumor

Farzana And Dr. M. Mohamed Sathik are suggested in "Analysis of 2D to 3D Reconstruction Techniques over Brain MRI" that between adaptive segmentation with marching cube and K-means clustering with marching cube, k-means is better. They use bias field correction and Gaussian low pass filter for pre-processing, for segmentation done using adaptive threshold and k-means clustering, 3D reconstruction perform by volume 3D and marching cubes. The matrices evaluated the 2D and 3D conversion technique, results is demonstrate that,3D model constructed using K-means clustering and marching cube algorithm in which k-means provides better result with accuracy 98.6794 because its accuracy, sensitivity, specificity, precision, and F-score is high. Volumetric overlap error and relative error volume difference is low.

Ivana Despotovic, Bart Goosse and Wilfried Philips represents "challenges,method,applications related to brain tumor segmentation" In this paper they review the most popular method commonly used brain MRI segmentation, they highlight difference between them and discuss their capabilities ,advantages and limitation. Then they explain different MRI pre-processing steps including image registration, bias field corrections and removal of non-brain tissues. Than reviewing brain MRI segmentation methods and discuss validation problem in brain MRI segmentation

Samee.Azad.Shaikh Anowarul Fattah, Cellia Shahnaz, proposed" An Automatic Scheme for Brain Tumor Region Detection From 3D MRI Data Based on Enhanced Intensity Variation" First efficient scheme is utilizing CDF of intensity distribution which is drastically reduced large volume of non-tumor data, next in order to enhance reparability between tumor and non-tumor region of 3D mean filtering operation carried out utilizing a spherical window, after that roughness on surface of mean filtering volume is reduced by implementing smoothing operation on its surface next voxel wise analysis based on intensity distribution in side voxel. Than ROI is extracted, ROI is semi-automatic detection technique.

3. Methodology

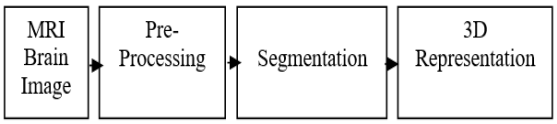

Figure 1. Basic Steps

A. MRI Brain Images:

MRI imaging uses a magnetic field, radio waves and a computer to create detailed images of organs, soft tissues, bone and virtually all other internal body structures. MRI of the brain allows physicians to examine the anatomy of the brain; determine precisely which part of the brain is handling critical functions such as thought, speech, movement and sensation, which is called brain mapping; help assess the effects of stroke, trauma or degenerative disease (such as Alzheimer's) on brain function; and monitor the growth and function of brain tumors. In some cases, the flow of cerebral spinal fluid will also be analyzed.In above reference paper used different dataset like DICOM MRI Images,2D MRI Sclices ,3D MRI data of high grade glioma patients (T1,T1c,T2,FLAIR)

B. Pre-Processing :

The image under test acquired by the acquisition device is susceptible by the environment. The restoration of images tries to minimize the effects of these degradations by means of a filter Therefore, a fundamental problem in the image processing is the improvement of their quality through the reduction of the noise. A great variety of techniques dedicated to carry out this task exist. Each of them depends on the types of the noise in images.

C. Segmentation :

Brain tumor segmentation is an essential task in many clinical application because it influences the outcomes of entire analysis. Segmentation of tumors in human brain aims to classify different abnormal tissues (necrotic core, edema, active cells) from normal tissues (cerebrospinal fluid, gray matter, white matter) of the brain. In existence, detection of abnormal tissues is easy for studying brain tumor, but reproducibility, characterization of abnormalities and accuracy are complicated in the process of segmentation.

D. 3D Representation:

The images are 2-dimensional, where the MRI images are usually presented in slices from top to bottom. These 2-dimensional slices can be joined together to produce a 3-dimensional model of the area of interest being scanned. This is called 3D MRI. Using 3D reconstruction of image tumor can identified in more efficient way, it helps to easily identify depth, volume etc. the table given below identify different 3D representation method and its performance.

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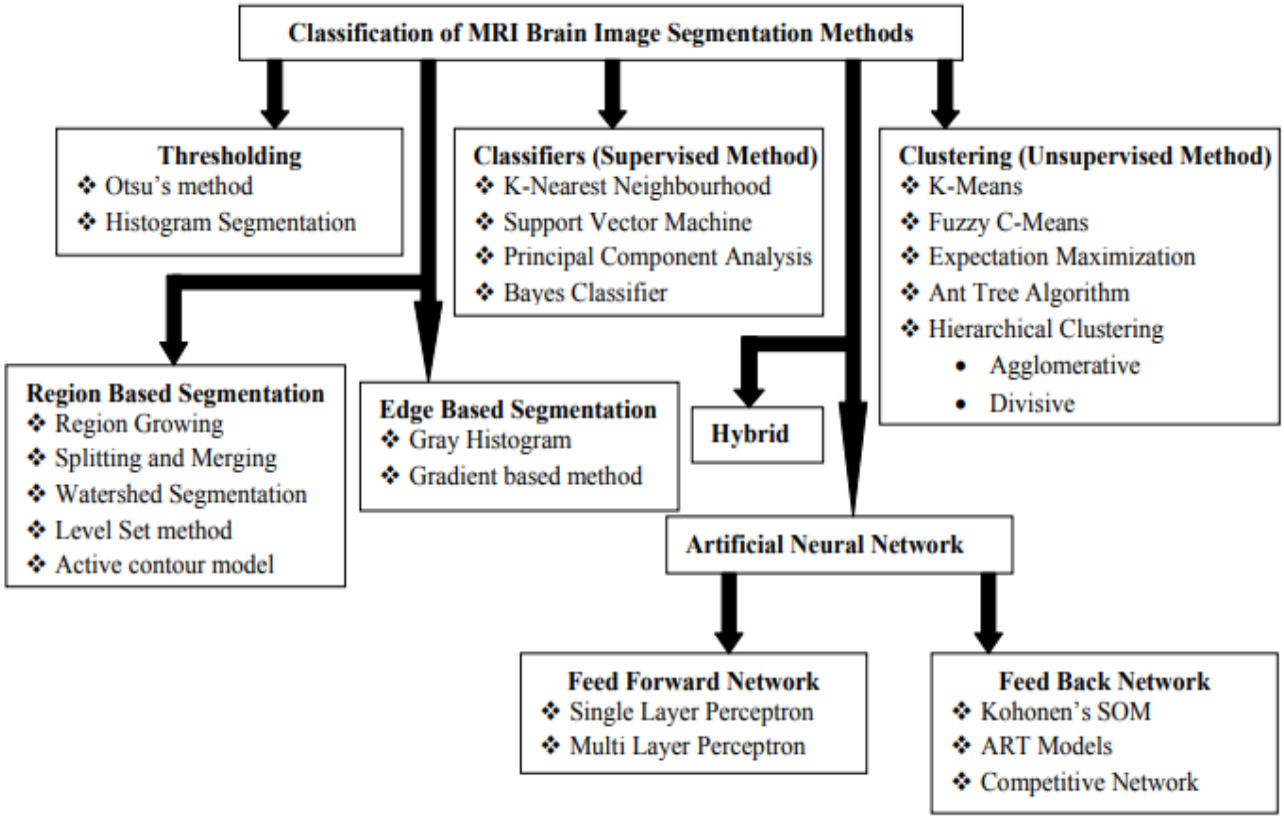

Figure2. Classification of Segementation Methods

4. Comparative Study

Table I. Comparison Between Segmentation Method

Method	Advantages	Disadvantages
[1] Thresholding		
Otsu's thresholding	The attractive features of 3D Otsu algorithm is its segmentation results is stable and it is robust to noise ,3D Otsu provide precise result comparing to because its capability of incorporating spatial information	There is no problem when variance is small, but there is problem when large variance are there and large noise is added. Reducing time complexity of the algorithm.
Histogram thresholding	Fast, especially if repeating on similar image	Histogram Thresholding is used for continues data
[2] Edge based segmentation		
Gray Histogram Technique	Selection of threshold T is proper than time complexity of algorithm is small	The result of edge detection technique mainly depends upon selection of threshold T
Gradient Based Method	Edge detection algorithms are suitable for images that are simple and noise-free as well often produce missing edges or extra edges on complex and noisy images There is little image noise then gradient based method works well	Edge detection algorithms are not suitable for noisy image.
[3] Region based segmentation		
Region growing	Compared to edge detection method, segmentation algorithms more immune to noise Region growing segmentation is particularly used for delineation of small, simple structures such as tumors and lesions.	Sometimes, manual interaction is required to select the seed point. Sensitive to noise so it produces holes or over segmentation in the extracted regions.
Region splitting and merging	The survey says split and merge algorithm is a fast computation method.	lack of sensitivity to image semantics
Watershed segmentation	Watershed segmentation algorithm can be used if the foreground and the background of the image can be identified 2. Watershed algorithm is also used to capture weak edges	Selection of seed point is the main drawback of this approach. Random selection of seed point may lead to inappropriate results and increases convergence rate.

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[4] Clustering		
K-means	K-means algorithm is fast, robust and easier to understand. It also gives better result when data set are well separated from each other.	If there are 2 highly overlapping data then k-means will not be able to resolve that there are 2 clusters
Fuzzy C-means (FCM)	The FCM algorithm gives best result for overlapped data set and also gives better result than k-means algorithm.	FCM a factor is introduced which utilizes spatial distance and Euclidian distance of neighboring pixels from the center pixels but it fails to analyze the neighboring pixels when the center pixel itself is noisy

5. Conclusion

In brain tumor segmentation there are different segmentation method and each method have its own advantages and disadvantages and own working criteria. But in FCM there is new approach is KWFCM. KWFCM serves as a robust image segmentation algorithm that accurately removes noise in case of noisy images and still maintains the structural characteristics of the image. The proposed algorithm shows appreciable performance for all sorts of noises. However, the parameter σ of the kernel has not been made adaptive since a variation of σ from 5 to 5000 did not reflect any appreciable change in the performance of the algorithm. In FCM a factor is introduced which utilizes spatial distance and Euclidian distance of neighboring pixels from the center pixels but it fails to analyze the neighboring pixels when the center pixel itself is noisy. To overcome this disadvantage of FCM, KWFCM utilizes more local information by utilizing spatial variance instead of Euclidian distance.

References

1. XiaoliZhang ,XiongfeiLi ,HongpengLi,HaiyingZhao ,YuncongFeng" A multi-scale 3D Otsu Thresholding Algorithm For Medical Image Segmentation", 2016 Science Direct EISEVIER
2. Satrajit Mukherjee, Bodhisattwa Prasad Majumder, Aritran Piplai, Swagatam Das "Kernelized Weighted SUSAN based Fuzzy C-Means Clustering for Noisy Image Segmentation", 28 Mar 2016-cornell university library
3. Ch Rajsekhara Rao, M.N.V.S.S Kumar, G Sasi Bhushana Rao, "MRI Brain Tumor Segmenta-tion And Its 3D Construction"17,September 2017 ARPN Journal Of Engineering and Applied Science.
4. A.Farzana, Dr.M.Mohamed Sathik," Analysis of 2D to 3D Reconstruction Techniques over Brain MRI" ,May 2017 International Journal Of Innovative Research In Computer and Communication Engineering
5. Ivana Despotovic, Bart Goosse ,Wilfried Philips ,"challenges, method, applications releted to brain tumor segmentation",2015,Article ID 450341
6. Samee.Azad.Shaikh Anowarul Fattah, Cellia Shahnaz," An Autometic Scheme for Brain Tomor Region Detection From 3D MRI Data Based on Enhanced Intensity Vriation",2017 November, IEEE
7. Maryjo M George, Kalaivani S, "Automatic Tissue Segmentation of Neonatal Brain MRI",
8. Madhumantee Naskar, "An Autometed System For Brain Tumor Detection & Segmentation", Madhumantee Naskar , Journal of Engineering Research and Studies E-ISSN0976 – 7916.
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, pp. 186-190, 2012.
10. A Ravi, A Suvarna, A D'Souza, GRM Reddy and Megha, "A Parallel Fuzzy C Means Algorithm for Brain Tumor Segmentation on Multiple MRI Images", Proceedings of International Conference on Advances in Computing Advances in Intelligent Systems and Computing Volume 174, pp. 787-794, 2012.
11. M Sharma, S Mukharjee, "Brain Tumor Segmentation Using Genetic Algorithm and Artificial Neural Network Fuzzy Inference System (ANFIS)", Advances in Computing and Information, Springer-Verlag Berlin Heidelberg, AISC 177, pp. 329–339, 2013.
12. P. Shantha Kumar and P. Ganesh Kumar, "Performance Analysis Of Brain Tumor Diagnosis Based On Soft Computing Techniques", American Journal of Applied Sciences 11 (2): 329-336, 2014.

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