A REVIEW ON IMPROVED FUZZY C-MEANS (FCM) BASED BRAIN TUMOR SEGMENTATION MECHANISM

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***Abstract*:** The image segmentation techniques are used in variety of application varying from object detection, object recognition, region localization, etc. The image segmentation techniques are primarily based upon the color pixel intensity based techniques or texture based region separation methods. In this paper, an adaptive multilayer threshold based technique has been proposed to segment the image contents in different segments, which uses the improved fuzzy c-means (FCM) thresholding method coupled with support vector machine (SVM) for the classification of the brain tumor type. The proposed model will be developed with a wider adaptability, which includes the malignant and benign types of the tumors. The proposed model is expected to resolve the accuracy issue by improving the overall accuracy of detection & classification, which will be measured in the form of various statistical parameters such as accuracy.

***Index Terms*: Image segmentation, Brain tumor detection, Region of interest, improved FCM.**

I. INTRODUCTION

Segmentation is the process of separating a digital image into different regions which have similar properties such as gray level, color, texture, brightness etc. On the basis of pixel intensity we can differentiate the boundaries of different objects. Segmentation identifies separate object within an image and also find boundary between different regions. Image segmentation is used to separate an image into several "meaningful" parts. It is an old research topic, which started around 1970, but there is still no robust solution toward it. There are two main reasons, the first is that the content variety of images is too large, and the second one is that there is no benchmark standard to judge the performance.

In computer vision, image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as super pixels). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image (see edge detection). Each of the pixels in a region are similar with respect to some characteristic or computed property, such as color, intensity, or texture. Adjacent regions are significantly different with respect to the same characteristic.

There are multiple methods for the classification and segmentation of the regions in the given image data. The following can be used to determine the different segments in one given image matrix. Segmentation can be classified into two types:

i. **Local segmentation** Local segmentation is small windows on a whole image and deal with segmenting sub image.

ii. **Global segmentation** deals with segmenting whole image. Global segmentation mostly deals with relatively large no of pixel.

But local segmentation deal with lower no of pixel as compare to global segmentation. Image segmentation is one of the classical problems in image processing and computer vision. Using of Image segmentation we can able to understand the fundamental of digital image processing. Image segmentation is used to enhancement of image and also useful to different medical application. Image segmentation can also use for analysis of the image and further pre-processing of the image. After a segmentation process each phase of image treated differently. Medical images play a vital role in assisting health care providers to access patients for diagnosis and treatment. Studying medical images depends mainly on the visual interpretation of the radiologists. However, this consumes time and usually subjective, depending on the experience of the radiologist. Consequently the use of computer-aided systems becomes very necessary to overcome these limitations.

Fuzzy c-means (FCM) is a method of clustering which allows one piece of data to belong to two or more clusters (soft clustering). This method is developed by Dunn in 1973 and improved by Bezdek in 1981. It is frequently used in pattern recognition. It is based on minimization of the following objective function

$$J_m = \sum_{i=1}^{N}\sum_{j=1}^{C} S_{ij}^{m} \left\| x_i - c_j \right\|^2 \qquad (1)$$

Where, m $(1 \leq m < \infty)$ is any real number greater than 1, N is no. of data, c is no. of clusters, Sij is the degree of membership of xi in the cluster j, xi is the ith of d-dimensional measured data, cj is the d-dimension center of the cluster, and $\|*\|$ is any norm that expresses the similarity between any measured data and the center.

Fuzzy partitioning is carried out through an iterative optimization of the objective function shown above, with the update of membership μ_{ij} and the cluster centers c_j by:

$$S_{ij} = \frac{1}{\sum_{k=1}^{C} \left(\frac{\|x_i - c_j\|}{\|x_i - c_k\|} \right)^{\frac{2}{m-1}}} \qquad (2)$$

$$C_j = \frac{\sum_{i=1}^{N} S_{ij}^m \cdot x_i}{\sum_{i=1}^{N} S_{ij}^m} \qquad (3)$$

This Iteration will stop when

$$max_{ij} \left\{ S_{ij}^{(k+1)} - S_{ij}^k \right\} < \epsilon \qquad (4)$$

II. LITERATURE REVIEW

Khang Siang Tan (2011) et. al. has worked on the segmentation of the color image using the histogram based method. This paper presents a novel histogram thresholding – fuzzy C-means hybrid (HTFCM) approach that could find different application in pattern recognition as well as in computer vision, particularly in color image segmentation. The proposed approach applies the histogram thresholding technique to obtain all possible uniform regions in the color image. Then, the Fuzzy C-means (FCM) algorithm is utilized to improve the compactness of the clusters forming these uniform regions.

Rafika Harrabi (2012) et. al. has developed multi-level segmentation model controlled by the layered thresholding mechanism. In this article, the authors presented a new color image segmentation method, based on multilevel thresholding and data fusion techniques which aim at combining different data sources associated to the same color image in order to increase the information quality and to get a more reliable and accurate segmentation result.

Dibya Jyoti Bora (2014) et. al. has worked on segmentation based image cluster technique. In computer vision, image segmentation is always selected as a major research topic by researchers. Due to its vital rule in image processing, there always arises the need of a better image segmentation method. Clustering is an unsupervised study with its application in almost every field of science and engineering. Many researchers used clustering in image segmentation process. But still there requires improvement of such approaches. In this paper, a novel approach for clustering based image segmentation is proposed. Here, we give importance on color space and choose l*a*b* for this task. The famous hard clustering algorithm K-means is used, but as its performance is dependent on choosing a proper distance measure, so, we go for "cosine" distance measure. Then the segmented image is filtered with sobel filter. The filtered image is analyzed with marker watershed algorithm to have the final segmented result of our original image.

Rajiv Kumar (2011) et. al. has developed the novel image segmentation approach based upon discontinuity to detect the non-continuous patters in the image patterns. Image segmentation is the process by which the authors have segmented a given image into several parts so that we can further analyzed each of these parts present in the image. They have extracted some information by analyzing them and this information is useful for high-level machine vision application. There are numerous techniques of image segmentation available in literature. In this paper, the authors analyzed the discontinuity-based approach for image segmentation. The discontinuity-based segmentation can be classified into three approaches: point detection, line detection, and edge detection.

FINDINGS OF LITERATURE REVIEW

Brain tumors are created by abnormal and uncontrolled cell division in brain itself. If the growth becomes more than 50%, then the patient is not able to recover. So the detection of brain tumor needs to be fast and accurate. Some of the problem occurred during this whole procedure are like image problem therefore if the image of tumor is not correctly displayed than it is not possible to detect it. Image segmentation is the process of segmenting the image into number of meaningful parts. Conventional methods used for the purpose of image segmentation were not quite successful as these methods were not able to work in case where the image contains noise or low light effects. So there is need for getting such a technique which will provide the results efficiently. A new technique for image segmentation needs to be proposed that will apply image enhancement and then images will be segmented for obtaining satisfactory results.

III. METHODOLOGY

When an image is segmented into several parts and the parts ought to be meaningful, it is called as image segmentation. The conventional techniques had several drawbacks as studied in previous section. The proposed technique is the enhanced version of traditional FCM algorithm which incorporates filtering, DSIHE for image enhancement and edge detection by using canny edge detection along with the implementation of Contour model. In present work segmentation is done by applying the FCM (Fuzzy c-Mean). This proposed technique for image segmentation yields satisfactory results and hence it is an efficient technique for image segmentation. This improved technique results in more correct segmented image as compare to traditional technique.

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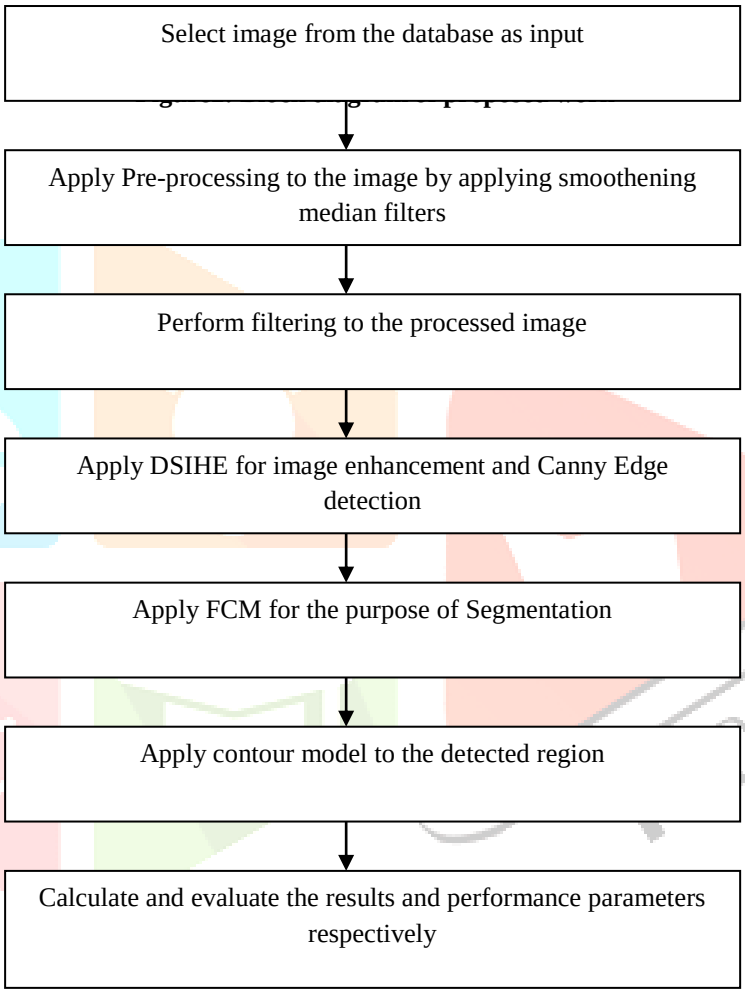
Table 1: Flow chart of proposed model



IV. CONCLUSION

The proposed model will be designed in multiple layers, where the estimation of the tumor region will be based upon the layered estimation after the application of gray level thresholding of the 2-D and 3-D images. The odd-one-out mechanism will be used to detect the bright regions in the given images, as it's a very popular known fact that the tumors are shown with the white colored pixels in contrast with other regions. The proposed model will utilize the contour model after the application of edge detection and improved fuzzy c-means to mark the boundary around the detected region, which will work on the basis of snake model to envelope the tumor region. The proposed model's performance will be compared using the detection time, classification time and several other region specific statistical parameters.

REFERENCES

[1] Hakeem Aejaz Aslam (March, 2013) "A New Approach to Image Segmentation for Brain Tumor detection using Pillar K-means Algorithm", IJARCCE, Vol. 2, Issue 3, pp 1429-1436

[2] Varshali Jaiswal (December, 2013) "A Survey of Image Segmentation based on Artificial Intelligence and Evolutionary Approach", IOSR-JCE, Volume 15, Issue 3, PP 71-78

[3] C.Sriramakrishnan (May, 2012) "Performance Analysis of Advanced Image Segmentation Techniques", International Journal of Computer Applications, Volume 45– No.7, pp 13-18

[4] Khang Siang Tan (January, 2011) "Color image segmentation using histogram thresholding – Fuzzy C-means hybrid approach", ELSEVIER, VOl:44, Issue:1, pp 1-15

[5] Rafika Harrabi (May, 2012) "Color image segmentation using multi-level thresholding approach and data fusion techniques: application in the breast cancer cells images", Springer, pp 1-12

[6] Mei Yeen Choong "An Image Segmentation using Normalized Cuts in Multistage Approach" IJSSST, pp 10-16

[7] Rajiv Kumar (December, 2011) "Image Segmentation using Discontinuity-Based Approach", IJMIP, Volume 1, Issues ¾, pp 72-78

[8] V. Sivakumar," A brief study of image segmentation using Thresholding Technique on a Noisy Image", IEEE, 2014