Brain Tumor image Segmentation using Adaptive clustering and Level set Method

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Abstract- **Image Segmentation is a most important task of image analysis. Number of method used for image segmentation. Image segmentation mainly used in different field like medical image analysis, character recognition etc. A segmentation method finds the sets that are different structure from each other and completion of segmentation process that cover entire image. In Proposed method Select multiple regions that with tumor or without tumor, used hybrid segmentation technique to detect the selected region has a tumor or not. Apply Segmentation technique like Adaptive Clustering technique and Level Set Method. Final output is tumor region area and calculates tumor region area.**

Keyword- Segmentation, Edge detection method, Region based segmentation, Thresholding, Adaptive Clustering, Level set

I. INTRODUCTION

Segmentation refers to the process of partitioning a digital image into multiple regions (sets of pixels) [2].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 [2].Image segmentation is the partitioning of an image into non-overlapping, constituent regions that are homogeneous with respect to some characteristics [3].A segmentation method finds those sets that correspond to distinct anatomical structures or regions of interest in the image [3].The result of image segmentation is a set of regions that collectively cover the entire image. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, or texture [2]. Adjacent regions are significantly different with respect to the same characteristics. Several general-purpose algorithms and techniques have been developed for image segmentation [2].In an initial stage, the segmentation is used to separate the image in parts that represents an interest object that may be used in a specific study [2]. There are several methods that intend to perform such task, but are difficult to find a method that can easily adapt to different type of images, that often are very complex or specific [2]. Medical images play vital role in assisting health care providers to access patients for diagnosis and treatment[1].Medical image segmentation is an important application of image segmentation in medical research, however there isn't a common and effective segmentation method to meet the command of the entire medical image (CT,MRI and PET) [5]. Based on different technologies, image segmentation approaches are currently divided into following categories, based on two properties of image.

• Detecting Discontinuities

It means to partition an image based on abrupt changes in intensity, this includes image segmentation algorithms like edge detection [9].

• Detecting Similarities

It means to partition an image into regions that are similar according to a set of predefined criterion; this includes image segmentation algorithms like thresholding, region growing, region splitting and merging [9].

II. CLASSIFICATION OF SEGMENTATION TECHNIQUES

In this section briefly describe various methods used for image segmentation. Some of those methods are Edge Detection Method, Region Based Segmentation Method, Thresholding Method, and Clustering Method.

A. EDGE DETECTION METHOD

There are two main edge based segmentation methods-gray histogram and gradient based method [9]. Edge detection is a term in image processing and computer vision, it refers to algorithms which aim at identifying points in a digital image at which there is an abrupt change in image brightness or more formally, has discontinuities or simply where there is a jump in intensity from one pixel to the next [9]. Gradient is the first derivative for image f(x, y), when there is abrupt change in intensity near edge and there is little image noise, gradient based method works well. This method involves convolving gradient operators with the image [1, 9].

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B. REGION BASED SEGMENTATION METHOD

For image segmentation region growing method is a well developed technique [6]. The basic idea of region growing method is a collection of pixels with similar properties to form a region [9]. For region growing, **seeds** can be automatically or manually selected [10]. Their automated selection can be based on finding pixels that are of interest, e.g. the brightest pixel in an image can serve as a seed pixel [10]. An operator manually selects a seed point and extracts all pixels that are connected to the initial seed based on some predefined criteria [6]. Region growing can also be sensitive to noise, causing extracted regions to have holes or even become disconnected [6]. In **Region Splitting and Merging**, the image Subdivided into a set of arbitrary disjoints regions and then merge and/or split the region according to the given condition for segmentation [9]. The main purpose of image segmentation is to segment an image into the homogenous regions [9].

C. THRESHOLDING METHOD

Threshold is one of the widely methods used for image segmentation [4]. Image segmentation by Thresholding is a simple but powerful approach for segmenting images having light objects on dark background [1]. The segmentation is done by grouping all pixels with intensity between two such thresholds into one class [6]. A process to determinate more than one threshold value is called multi-thresholding [6]. Thresholding operation convert a multilevel image into a binary image i.e., it choose a proper threshold T, to divide image pixels into several regions and separate objects from background [1]. Any pixel (x, y) is considered as a part of object if its intensity is greater than or equal to threshold value i.e., $f(x, y) \geq T$, else pixel belong to background [1, 7]. As per the selection of Thresholding value, two types of Thresholding methods are in existence [1, 8], global and local Thresholding. When T is constant, the approach is called global Thresholding otherwise it is called local Thresholding [1].

D. CLUSTERING METHOD

Clustering can be termed here as a grouping of similar images in the database [9]. Clustering is done based on different attributes of an image such as size, color, texture etc [9]. Clustering use no training stages rather train themselves using available data [1]. Two methods mainly used for clustering based segmentation.

K-Means is one of the simplest unsupervised learning algorithms. In K means objects are classified as belonging to one of k groups exclusively, k is chosen priori [11]. The main idea is to define k centroids, one for each cluster [13]. These centroids should be placed in a cunning way because of different location causes different result [13].

Fuzzy C-Mean (FCM) is an unsupervised clustering algorithm that has been applied to wide range of problems involving feature analysis, clustering and classifier design [12, 13]. FCM has a wide domain of applications such as agricultural engineering, astronomy, chemistry, geology, image analysis, medical diagnosis, shape analysis, and target recognition [12, 13]. Fuzzy C-means (FCM) algorithm is one of the most popular fuzzy clustering methods widely used in various tasks of pattern recognition, data mining, image processing, expression data Recognition *etc*.

III. LITERATURE REVIEW

Mandeep Kaur and dr. v. k. banga [16] proposed a hybrid approach for the detection of brain tumor which is based on fast bounding box algorithm and locating bounding box around tumor, which is used as a seed for segmentation of exact tumor [16].
FBB does not need image registration. This method is completely unsupervised.FBB can be implemented in real time. In thresholding, tumor region is converted into color image for good visualization. Level set method is used for smoothing.

Archana Lala, Jitendra Kumar Gupta, Mrinalini Shringirishi[13] proposed combination of two clustering method for brain tumor segmentation.The K-means algorithm is broadly used for clustering algorithm. in K-means it takes the input parameter k, and make partition of n objects into k clusters. With fuzzy c-means, the centroid of a cluster is computed as being the mean of all points, weighted by their degree of belonging to the cluster.

R. B. Dubey, M. Hanmandlu, S. K. Gupta and S. K. Gupta[11] proposed seeded region growing technique for brain tumor segmentation.For region growing, seeds can be automatically or manually selected. Their automated selection can be based on finding pixels that are of interest, e.g. the brightest pixel in an image can serve as a seed pixel. Region growing' is a procedure that groups pixels or sub regions into larger regions based on predefined criteria. This method takes a set of seeds as input along with the image.

Alyaa H. Ali, Kawther A.Khalaph, Ihssan S.Nema [17] proposed modification of thresholding method for brain tumor segmentation. Each pixel is compared to the threshold: if its value is higher than the threshold, the pixel is considered to be "foreground" and is set to white, and if it is less than or equal to the threshold it is considered "background" and set to black . Enhanced thresholding algorithm is modified form of standard thresholding algorithm.

IV. PROPOSED METHOD

Using this proposed method, find the multiple tumors in brain and also volume calculation analysis of those tumors.

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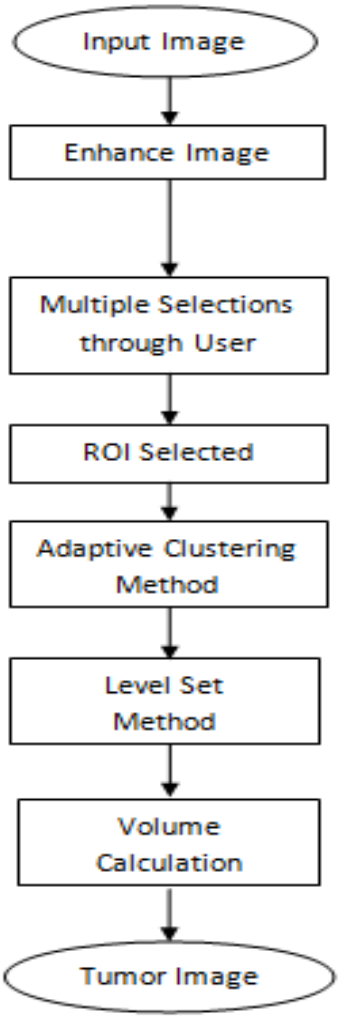


Fig: Methodology for Brain tumor Segmentation

Step 1: Input image.

Step 2: Perform image enhancement so we can clearly see the tumor of portion and skull of brain image.

Step 3: In that first user selected the region of tumors and then apply the segmentation technique on it.

Step 4: Crop the region selected by user and apply masking process on it.

Step5: Then after apply region based technique on it. Clustering technique is used for accurate segmentation.

Step 6: Apply Level set method for image smoothing. So clearly see the tumor area.

Step 7: Calculate Volume of tumors area.

Adaptive Clustering technique is different from k-means and fuzzy c-means clustering technique. In Adaptive clustering technique we have to not specify the cluster value k. Its directly apply to image and calculate the centroid of different clusters. Level set methods apply for the smoothing to a tumor area. Finally calculate the tumor area.

In the approximate reasoning step the tumor area is calculated using the binarization method. That is the image having only two values either black or white (0 or 1). The binary image can be represented as a summation of total number of white and black pixels [18]. Area of an image is the total number of the pixels present in the area which can be calculated in the length units by multiplying the number of pixels with the dimension of one pixel [17].

Image, $I = \Sigma\ 255w{=}0\Sigma\ 255H{=}0[f(0) + f(1)]$ ……(2)

Pixels = Width (W) X Height (H) = 256 X 256

f (0) = white pixel (digit 0)

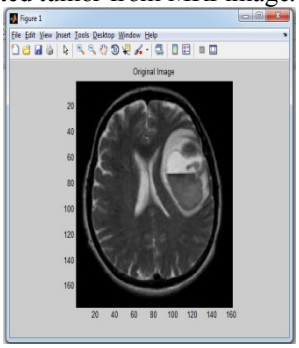
f (l) = black pixel (digit 1)

No_ of_ white pixel $P = \Sigma\ 255w{=}0\Sigma\ 255H{=}0[f(0)]$ ……(3) Where,

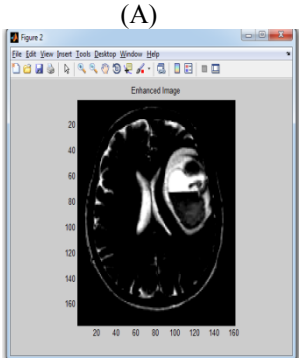
P = number of white pixels (width*height)

V. RESULT

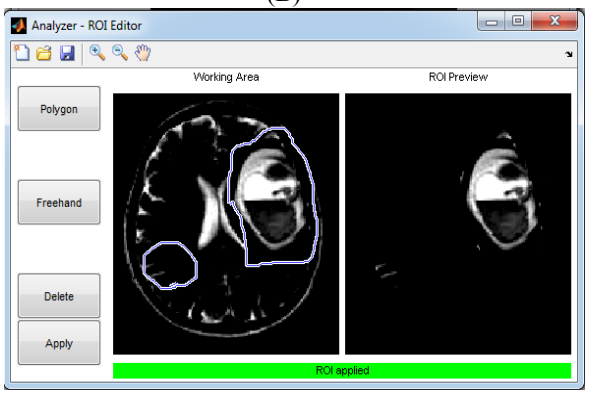
Figures show the images as an output of adaptive clustering and levels et method image, Finally input image and extracted tumor from MRI image.



(A)



(B)



(C)

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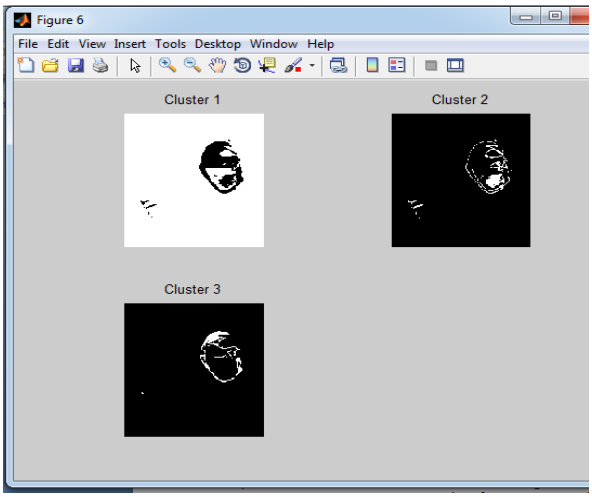
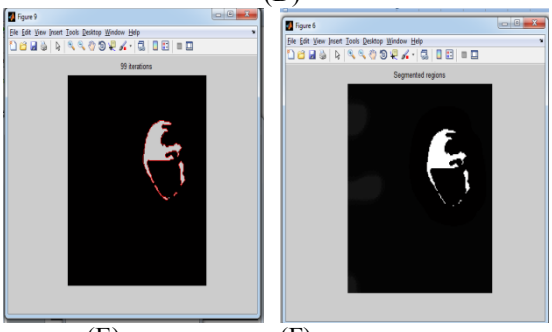


(D)



(E) (F)

Fig:(A)Original Image (B)Enhance Image (C)Selection of Region (D) Adaptive Clustering Method (E) Level set Method (F)Final Segmentation Image

VI. CONCLUSIONS

Image segmentation has a promising future as the universal segmentation algorithm and has become the focus of contemporary research. In medical image analysis used method of image segmentation like Region based segmentation; Level set method, Thresholding method and Edge detection method etc. In Thresholding method Choose the threshold value according to whole image and compare with only selected image pixel. For Adaptive clustering, automatically select the clusters value. In this research proposed process is continued until all pixels belong to some region. Level set method is used for smoothing for image.

Reference

[1] Prof. Dinesh D. Patil, Ms. Sonal G. Deore, "Medical Image Segmentation: A Review," IJCSMC, Vol. 2, Issue. 1, pg.22 – 27, January 2013.

[2] Pritee Gupta, Vandana Malik, Mallika Gandhi, " Implementation of Multilevel Threshold Method for Digital Images Used In Medical Image Processing," IJARCSSE, Volume 2, Issue 2, February 2012.

[3] Ayelet Dominitz, Introduction to Medical Imaging

[4] Jay Acharya, Sohil Gadhiya, Kapil Raviya, "segmentation techniques for image analysis: a review," International Journal of Computer Science and Management Research Vol 2 Issue 1 January 2013.

[5] Wankai Deng , Wei Xiao, He Deng, Jianguo Liu, "MRI Brain Tumor Segmentation With Region Growing Method Based On The Gradients And Variances Along And Inside Of The Boundary Curve," International Conference on Biomedical Engineering and Informatics (BMEI 2010)(IEEE), 3rd 2010

[6] Anamika Ahirwar, "Study of Techniques used for Medical Image Segmentation and Computation of Statistical Test for Region Classification of Brain MRI," I.J. Information Technology and Computer Science,Volume 5 April 2013.

[7] Wahba Marian, "An Automated Modified Region Growing Technique for Prostate Segmentation in Trans-Rectal Ultrasound Images", Master's Thesis, Department of Electrical and Computer Engineering,University of Waterloo, Waterloo, Ontario, Canada, 2008.

[8] Y. Zhang, H. Qu, Y. Wang,"Adaptive Image Segmentation Based on Fast Thresholding and Image Merging", Artificial reality and Telexistence-Workshops, pp. 308-311, 1994.

[9] Salem Saleh Al-amri, N.V. Kalyankar and Khamitkar S.D, " Image Segmentation by Using Thershod Techniques," JOURNAL OF COMPUTING, VOLUME 2, ISSUE 5, MAY 2010, ISSN 2151-9617.

[10] R. B. Dubey, M. Hanmandlu, S. K. Gupta and S. K. Gupta," Region growing for MRI brain tumor volume analysis," Indian Journal of Science and Technology, Vol.2 No. 9, Sep 2009, ISSN: 0974- 6846.

[11] mansur rozmin, prof. chhaya suratwala, prof. vandana shah," implementation of hard c-meansclustering algorithm for medical image segmentation," journal of information, knowledge and research in electronics and communication engineering, volume – 02, issue – 02, nov 12 to oct 13, ISSN: 0975 – 6779

[12] Archana Lala, Jitendra Kumar Gupta , Mrinalini Shringirishi, " implementation of k-means clustering and fuzzy c-means algorithm for brain tumor segmentation," International Journal of Computer Engineering & Science, Volume 3, Issue 1, pp. 27-33, Sept 2013. ISSN: 2231–6590.

[13] Ms. Pritee Gupta, Ms Mrinalini Shringirishi ,Dr.yashpal singh, "Implementation of Brain Tumor Segmentation in brain MR Images using KMeans Clustering and Fuzzy C-Means Algorithm," International Journal of Computers & Technology, Volume 5, No. 1, May -June, 2013, ISSN 2277-3061.

[14] Mahesh Yambal, Hitesh Gupta, " Image Segmentation using Fuzzy C Means Clustering: A survey", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 2, Issue 7, July 2013.

[15] Mandeep Kaur, Dr V.K. Banga (2013)"Thresholding And Level set Based

ISSN: 2278 – 1323

Brain tumor Detection Using Bounding Box As Seed" IJERT-Vol2. Issue 4 April-2013,ISSN 2278-0181

[16] Alyaa H. Ali, Kawther A.Khalaph, Ihssan S.Nema "Segmentation of brain tumour using Enhanced Thresholding Algorithm and Calculate the area of the tumour" IOSR Journal of Research & Method in Education (IOSR-JRME) e-ISSN: 2320–7388,p-ISSN: 2320–737X Volume 4,Issue 1 Ver. II (Jan. 2014).

[17] Mr.Rohit S. Kabade et al." Segmentation of Brain Tumour and Its Area Calculation in Brain MR Images using K-Mean Clustering and Fuzzy C-Mean Algorithm" International Journal of Computer Science & Engineering Technology (IJCSET), Vol. 4 No. 05 May 2013, ISSN : 2229-334

[18] Book: Image Processing, Author: Gonzales

[19] Kinjal D. Patel,Avani Dave"A review of different methods of segmentation technique" IJSRD - International Journal for Scientific Research & Development| Vol. 1, Issue 9, 2013 | ISSN (online): 2321-0613

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