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Detection and Identification of Brain Tumor in Brain MR Images Using Fuzzy C-Means Segmentation

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Abstract: Brain tumor is an uncontrolled growth of tissues in human brain. This tumor, when turns in to cancer become life-threatening. So medical imaging, it is necessary to detect the exact location of tumor and its type. For locating tumor in magnetic resonance image (MRI) segmentation of MRI plays an important role. This paper includes survey on different segmentation techniques applied to MR Images for locating tumor. It also includes a proposed method for the same using Fuzzy C-Means algorithm and an algorithm to find area of tumor which is usefull to decide type of brain tumor.

Keywords: Magnetic Resonance Imaging (MRI), Image segmentation, Fuzzy C-Means.

I. INTRODUCTION

For images of human brain different techniques are used to capture image. These techniques involve X-Ray, Computer Tomography (CT) and MRI. For diagnosis, MRI has more advantages over other techniques such as
MRI provides rich information about anatomical structure, enabling quantitative pathological or clinical studies.

The fundamental aspect that makes segmentation of medical images difficult is the complexity and variability of the anatomy that is being imaged. It may not be possible to locate certain structures without detailed anatomical knowledge. This makes general segmentation a difficult problem, as the information must either be built into the system or provided by a human operator.

There are many conventional Methods of MRI segmentation that uses image processing techniques such as region growing, edge detection, and histogram Equalization, etc. The problem with all these methods is that, they need human interaction for accurate and reliable segmentation.

A tumor is a mass of tissue that grows out of control of the normal forces that regulates growth. The multifaceted brain tumors can be split into two common categories depending on the tumors beginning, their enlargement prototype and malignancy. Primary brain tumors are tumors that take place commencing cells in the brain or commencing the wrapper of the brain. An inferior or metastatic brain tumor takes place when cancer cells extend to the brain from a primary cancer in a different component of the body. The majority of investigations in developed countries demonstrate that the amount of people who develop brain tumors and depart this life from them has greater than before maybe as much as 300 over past three decades. The computationally efficient method runs orders of magnitude faster than current state of the art techniques giving comparable or improved results. This paper expresses a well-organized technique for automatic brain tumor segmentation for the removal of tumor tissues from MR images. A brain tumor is an intracranial mass produced by an uncontrolled growth of cells either normally found in the brain such as neurons, lymphatic tissue, cells, blood vessels, pituitary and pineal gland, skull, or spread from cancers primarily located in other organs [2]. Brain tumors are classified based on the type of tissue involved, the location of the tumor, whether it is benign or malignant.

1) Benign brain tumor:

This type of tumor generally do not consist cancer cells and can be removed. Benign brain tumors usually have an obvious border or edge. They don't spread to other parts of the body. However, benign tumors can cause serious health problems.

2) Malignant brain tumor:

This consists of cancer cells and hence also called as brain cancer. They are likely to grow rapidly and can affect nearby healthy brain tissues. This type of tumor can be a threat for life. Now, depending on what is type of cell of tumor, doctor group brain tumors by grades. There are four grades as grade I to grade IV. Cells from low-grade tumors (grades I and II) look more normal and generally grow more slowly than cells from high-grade tumors (grades III and IV). Over time, a low-grade tumor may become a high grade tumor.

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II. SEGMENTATION TECHNIQUES

There are number of segmentation techniques available in image processing. These techniques are explained in short below:

1) Histogram thresholding:

Histogram thresholding is easiest method of segmentation because thresholding is fast and economical in computation. In thresholding, histogram of an image is subdivided using a threshold which is nothing but a gray level. Band thresholding, local thresholding, multi thresholding and semi- thresholding are some of the modifications of this technique. Single thresholds that can differ in image elements are known as local threshold whereas Single thresholds that can be applied to the complete image are known as global threshold. Then depending on value of this threshold, image pixels are assigned with two gray levels. [14]

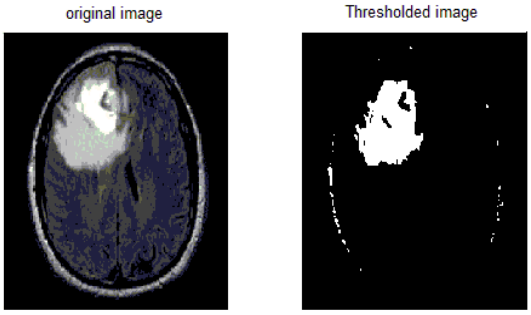

Fig. 1 Result of Thresholding for brain MRI

2) Region growing:

In region based segmentation, pixels with same properties are grouped together. The property that is taken in to consideration is intensity of pixels. There are two types of segmentation, region growing and region merging. Pixels are examined with their neighborhoods and are grouped together. Region growing technique can be applied in brain tumor diagnosis. In region growing, we start with similar pixels and go on grouping with pixels having same intensity. One of the drawbacks of this method is that dissimilar starting points may not result growing into identical regions. [10]

3) Watershed Segmentation:

Watershed method comes under the edge-based method. The term watershed is a geographical one. In geography, a watershed line is defined as the line separating two catchment's basins. The rain that falls on either side of the watershed line will flow into the same lake of water. This idea can be fruitfully cashed in the digital images. The image gradient can be viewed as terrain. The homogeneous regions in the image usually have low gradient values. Thus, they represent valleys while the edges represent the peaks having high gradient values. The watershed transform is often preferred to separate the touching objects in an image. The watershed transform finds the catchment basins and watershed ridge lines in an image by treating it as a surface. The basic watershed algorithm is well recognized as an watershed transformation is that it produces a large number of segmented regions in the image around each local minima embedded in that image. A solution to sort out this problem is to introduce markers and flood the gradient image starting from these markers instead of regional minima efficient morphological segmentation tool which has been used in a variety of gray scale image processes and video processing applications. However, a major problem with the watershed transformation is that it produces a large number of segmented regions in the image around each local minima embedded in that image. A solution to sort out this problem is to introduce markers and flood the gradient image starting from these markers instead of regional minima. [5]

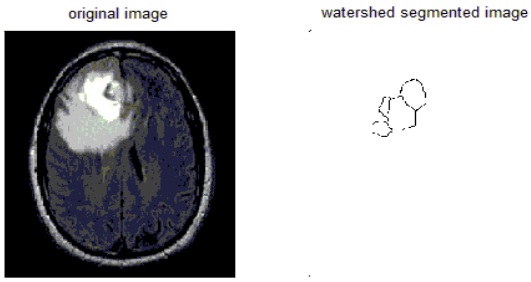

Fig. 2 Result of watershed segmentation for brain MRI

4) K-Means Clustering:

K-Means is the one of the unsupervised learning algorithm for clusters. Clustering the image is grouping the pixels according to the some characteristics. In the k-means algorithm initially we have to define the number of clusters k. Then k-cluster center are chosen randomly. The distance between the each pixel to each cluster centers are calculated. The distance may be of simple Euclidean function. Single pixel is compared to all cluster centers using the distance formula. The pixel is moved to particular cluster which has shortest distance among all. Then the centroid is re-estimated. Again each pixel is compared to all centroids. The process continuous until the center converges. [8]

5) Ant Colony Optimization:

Ant Colony Optimization (ACO) is a recent population-based approach is inspired by the observation of real ants colony and based upon their collective foraging behaviour.

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Real ants are capable of finding the shortest path from a food source to the nest without using visual cues. Ants are moving on a straight line that connects a food source to their nest is a pheromone trail. Pheromone is a volatile chemical substance lay down by ants while walking, and each ant probabilistically prefers to follow a direction rich in pheromone. This elementary behaviour of real ants can be used to obtain optimum value from a population. In ACO, solutions of the problem are constructed within a stochastic iterative process, by adding solution components to partial solutions. Each individual ant constructs a part of the solution using an artificial pheromone, which reflects its experience accumulated while solving the problem, and heuristic information dependent on the problem. [11]

III PROPOSED METHODOLOGY

This paper consists of a proposed methodology. This proposed technique can be explained with following block diagram:

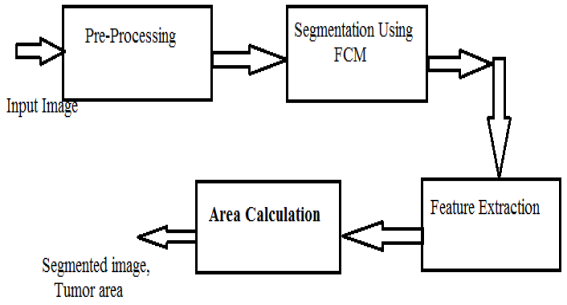

Fig.3 Block Diagram of Proposed System.

This system consist of,

1) Pre-Processing:

The pre-processing step converts the image according to the need of the next level It performs filtering of noise and other artifacts in the image and sharpening the edges in the image. RGB to grey conversion and Reshaping also takes place here. It includes median filter for noise removal. The possibilities of arrival of noise in modern MRI scan are very less. It may arrive due to the thermal effect. The main aim of this paper is to detect and segment the tumor cells. But for the complete system it needs the process of noise removal. Generally Median filter is used to remove noise.

2) Segmentation using Fuzzy C-Means:

The fuzzy logic is a way to processing the data by giving the partial membership value to each pixel in the image. The membership value of the fuzzy set is ranges from 0 to 1. Fuzzy clustering is basically a multi valued logic that allows intermediate values i.e., member of one fuzzy set can also be member of other fuzzy sets in the same image. There is no abrupt transition between full membership and non membership. The membership function defines the fuzziness of an image and also to define the information contained in the image. These are three main basic features involved in characterized by membership function. They are support, Boundary. The core is a fully member of the fuzzy set. The support is non membership value of the set and boundary is the intermediate or partial membership with value between 0 and 1.

The algorithm contain following steps:

1. Initialize matrix M.
2. Calculate the centers vectors.
3. Perform K steps till termination value is reached.

3) Feature Extraction:

The feature extraction is extracting the cluster which shows the predicted tumor at the FCM output. The extracted cluster is given to the thresholding process. It applies binary mask over the entire image. It makes the dark pixel become darker and white become brighter. In threshold coding, each transform coefficient is compared
with a threshold. If it is less than the threshold value then it is considered as zero. If it is larger than the threshold, it will be considered as one. The thresholding method is an adaptive method where only those coefficients whose magnitudes are above a threshold are retained within each block.

4) Tumor area calculation:

In area calculation tumor extracted image is taken as input and from the image area of tumor is calculated. Algorithm to calculate area is,

1. Read the input color or grayscale image.
2. Converts input colour image in to grayscale image which is done by forming a weighted sum of each three (RGB) component, eliminating the saturation and hue information while retaining the luminance and the image returns a grayscale colour map and store it into one variable.
3. Compute numbers of rows and column in pixels.
4. Initialize a variable a=0
5. For i=1:1:r2 do
5. For j=1:1:c2 do
5. If I (i,j)==255 do
5. a =a+0
5. Else do Step4:- a=a+1
6. EndIF
7. Display the area a.

CONCLUSION

Image processing has become a very important task in today's world. Today applications of image processing can be found in number of areas like medical, remote sensing, electronics and so on .If we focus on medical applications,

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and image segmentation is widely used for diagnosis purpose. In this paper, we have proposed a system that can be used for segmentation of brain MR Images for detection and identification of brain tumor. By finding area of tumor we can decide type of tumor; whether it is benign or malignant.

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REFERENCES

[1] 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 (ICAESM -2012) March 30, 31, 2012.

[2] Sudipta Roy, Samir K.Bandyopadhyay, "Detection and Quantification of Brain Tumor from MRI of Brain and it's Symmetric Analysis", IJICTR, Volume 2 No. 6, June 2012.

[3] Krishna Kant Singh , Akansha Singh,"A Study Of Image Segmentation Algorithms For Different Types Of Images", IJCSI International Journal of Computer Science Issues, Vol. 7, Issue 5,September 2010

[4] Dr. H. B. Kekre, Dr.Tanuja Sarode,"Image Segmentation of MRI Images using KMCG and KFCG Algorithms", 2nd International Conference and workshop on Emerging Trends in Technology (ICWET) 2011.

[5] R. B. Dubey, Shantaram Vasikarla,"Evaluation of Three Methods for MRI Brain Tumor Segmentation", 2011 Eighth International Conference on IT.

[6] Mohd Fauzi Othman,Mohd Ariffanan Mohd Basri , "Probabilistic Neural Network For Brain Tumor Classification", 2011 Second International Conference on Intelligent Systems, Modelling and Simulation

[7] D. SRIDHAR, MURALI KRISHNA, "Brain Tumor Classification U sing Discrete Cosine Transform and Probabilistic Neural Networl", 2013 International Conference on Signal Processing, Image Processing and Pattern Recognition [ICSIPR]

[8] Xiao-li Jin, Tu-sheng Lin, Liang Liao, "Multi-Spectral MRI Brain Image Segmentation Based On Kernel Clustering Analysis.", 2012 International Conference on System Engineering and Modeling (ICSEM 2012) IPCSIT vol. 34 (2012)

[9] K.Selvanayaki, Dr.P.Kalugasalam, "Intelligent Brain tumor Tissue Segmentation From MRI using Meta Heuristic Algorithms", Journal of Global Research in Computer Science, Volume 4, No. 2, February 2013.

[10] Tomasz Weglinski, Anna Fabijanska,"Brain Tumor Segmentation From MRI Data Sets Using Region Growing Approach.", MEMSTECH 2011, 11-14 May 2011, Polyana-Svalyava (Zakarpattya), UKRAINE

[11] Anjum Sheikh, R.K. Krishna, Subroto Dutt, "Energy Efficient Approach for Segmentation of Brain tumor Using Ant Colony Optimization", International Journal of Computer Technology and Electronics Engineering (IJCTEE) Volume 1, Issue 3

[12] M. Ganesh, V. Palanisamy, "A Modified Adaptive Fuzzy C-Means Clustering Algorithm For Brain MR Image Segmentation", International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 1 Issue 8, October – 2012.

[13] H.B. Kekre and, Saylee Gharge, "Segmentation of MRI Images Using Probability and Entropy as Statistical Parameters for Texture Analysis", Advances in Computational Sciences and Technology ISSN 0973-6107 Volume 2 Number 2 (2009) pp. 219–230.

[14] R.C.Gonzalez and R.E. Woods. "Digital Image Processing", 2nd Ed.

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