An Ameliorate Technique for Brain Lumps Detection Using Fuzzy C-Means Clustering

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ABSTRACT-*Clustering is commonly used in biomedical applications particularly for brain lumps detection in Abnormal magnetic resonance images (MRI). In terms of segmentation efficiency Fuzzy clustering using fuzzy local information C-means algorithm proved to be greater over the other clustering methodologies. Most Research in developed countries show that the number of people who have brain cancer were died due to the fact of inaccurate detection and not in time. Generally, CT scan or MRI that is directed into intracranial cavity produces a complete image of brain. This image is visually examined by the physician for detection & diagnosis of brain cancer. However this method of detection resists the accurate determination of size of lump. In addition, it also reduces the time for analysis. At the end of the process the lump is extracted from the MR image and its exact position and the shape also determined. The graph based on pixel value is drawn taking the various points from the swelled cells lies in the original position from the affected region. Here the affected region is considered as ellipsoid shape and the volumes have been calculated from it. A fuzzy level set algorithm is proposed in this paper to facilitate medical image segmentation & on this performance of evaluation of the proposed algorithm was carried.*

Index Terms— introduction, clustering, Fuzzy clustering, image segmentation, Fuzzy C-Mean, result

1 INTRODUCTION

Now a day's brain abnormality mainly brain lumps are one of the most common brain diseases, so detection and quantification of lumps in MRI are important in medical diagnosis. Through past many researchers have prepared important research in the field of brain abnormality segmentation but still now it is very important research fields due to the large number of variation of MRI of brain. The accurate segmentation of internal structures of the brain is of great interest for the study and very helpful for the treatment of lumps. It aims at reducing the mortality and improving the surgical or radio therapeutic management of lumps. The most important aim of medical image analysis in general and brain MRI analysis in particular, is to extract clinical information that would improve diagnosis and treatment of disease. The aim is to provide information associated to anatomical structures as well as potential abnormal tissues necessary to treatment planning and patient follow-up. There are different brain lumps detection and segmentation methods to detect and segment a brain lumps from MRI images. The measurement of brain lumps volume can assist lumps staging for brain lumps volume measurements is developed which overcome the problem of inter-operator variance, besides partial volume effects and shows satisfactory performance for segmentation, thus segmentation is very important for volume calculation. Different segmentation techniques such as thresholding based segmentation methodology, Region Growing based segmentation, K-nearest neighbours (KNN), Bayesian approach, Markov Random Field Models , Expectation maximization (EM), Support vector machine (SVM), Fuzzy c-means algorithms, K-means algorithms, Morphology-based segmentation, Atlas-guided based segmentation, Knowledge based segmentation, Texture-based segmentation, Artificial neural networks (ANNs), Fusion-based, Fuzzy connectedness, Watershed Methods, Level set based segmentation, Hybrid Self Organizing Map (SOM), SOM, Graph Cut based segmentation, Fractal-based segmentation, Parametric deformable models (snakes), Boundary based methods, Geometric deformable model, The Combination of Watershed and Level Set segmentation, Spatio-Temporal Model, Hidden Markov Model, Genetic algorithms based segmentation, Kohon-en Self Organizing Map (SOM) with a common phase pre-processing and segmentation and its steps are shown below. Thus accurate segmentation over full field of view is another very much problem but during the segmentation procedure verification of results is another source of difficulty. Statistical classification may not allow differentiation between non-enhancing lumps and normal tissue due to overlapping intensity distributions of healthy tissue with lumps and surrounding edema. Manually segmenting brain lumps from MR imaging is generally time consuming and difficult.
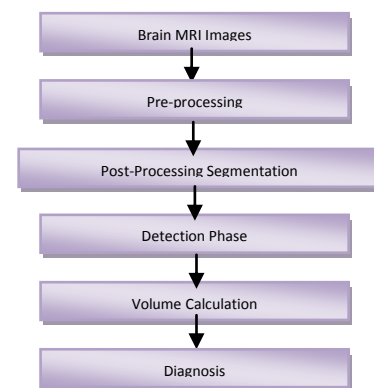

Fig: 1 Segmentation process

An automate segmentation method is desirable because it reduces the load on the operator and generates satisfactory results.

The region growing segmentation is used to segment the brain lumps due to its wide range of applications and automatic features. After taking the image of the lumps brain there is a need to process it. The image clearly shows the place of the lumps portion of the brain. The image does not give the information about the numerical parameters such as area and volume of the lumps portion of the brain. After segmentation the desired lumps area is selected from the segmented image. This selected region is used to calculate the area and volume of the lumps present in the MR image.

2. LITERATURE SURVEY

The previous methods for brain lumps segmentation are thresholding, region growing & clustering. Thresholding is the simplest method of image segmentation. From a grayscale image, thresholding can be used to create binary images. During the thresholding process, individual pixels in an image are marked as "object" pixels if their value is greater than some threshold value (assuming an object to be brighter than the background) and as "background" pixels otherwise. This convention is known as threshold above. Variants include threshold below, which is opposite of threshold above; threshold inside, where a pixel is labelled "object" if its value is between two thresholds; and threshold outside, which is the opposite of threshold inside. Typically, an object pixel is given a value of "1" while a background pixel is given a value of "0." Finally, a binary image is created by colouring each pixel white or black, depending on a pixel's labels.

The major drawback to threshold-based approaches is that they often lack the sensitivity and specificity needed for accurate classification. Brain cancer cells have high proteinaceous fluid which has very high density and hence very high intensity, therefore watershed segmentation is the best tool to classify cancers and high intensity tissues of brain [6]. Watershed segmentation can classify the intensities with very small difference also, which is not possible with snake and level set method. A similar method for tumor detection is proposed by Malhotra [2], but multi-parameter extraction was not used. Hossam and P Vasuda [10] have proposed a method for brain tumor detection and segmentation using histogram Thresholding detects the tumor but the result shown crops excessive area of brain. An efficient and improved brain tumor detection algorithm was developed by Rajeev Ratan, Sanjay Sharma and S. K. Sharma [8] which makes use of multi-parameter MRI analysis and the lumps cannot be segmented in 3-D unless and until we have 3-D MRI image data set. So, a relatively simple method for detection of brain lumps is presented which makes use of marker based watershed segmentation with improvement to avoid over & under segmentation. The Segmentation of an image entails the division or separation of the image into regions of similar attribute. The ultimate aim in a large

number of image processing applications is to extract important features from the image data, from which a description, interpretation, or understanding of the scene can be provided by the machine. The segmentation of brain lumps from magnetic resonance images is an important but time consuming task performed by medical experts.[5] The digital image processing community has developed several segmentation methods, many of them ad hoc. Suchendra et al. (1997) suggested a multi scale image segmentation using a hierarchical self-organizing map; a high speed parall fuzzy c-mean algorithm for brain lumps segmentation; an improved implementation of brain lumps detection using segmentation based on neuron fuzzy technique designed a method on 3D variational segmentation for processes due to the high diversity in appearance of lumps tissue from various patients. When experts work on lumps images then they use three different types of algorithms. Some of the techniques based on pixel based, some based on texture of images and some of them based on structure of images.

3. AN AMELIORATE TECHNIQUE FOR BRAIN LUMPS DETECTION

Content based image retrieval methods are one of them with widely used in retrieving medical images from MRI data sets. In this research paper we are presenting An Ameliorate Technique, based on modified classifiers & feedback method for lumps image retrieval from MRI images. This technique uses new concepts of texture and shape properties of the images by using fuzzy c-means clustering and modified SVM classifier. It also uses subjective feedback method for efficient and accurate results. This method uses following phases –
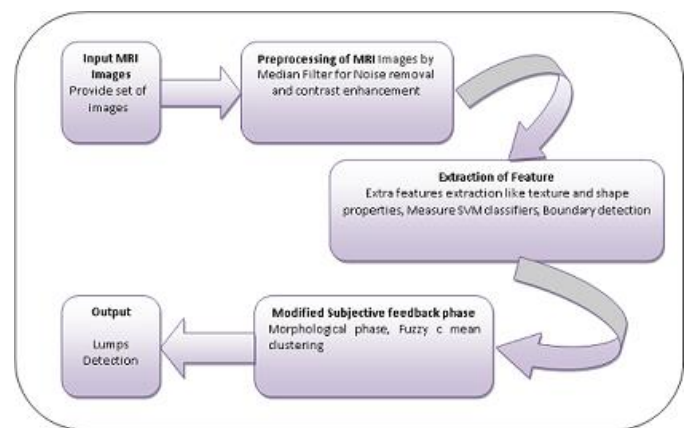

Fig2: Phases of Brain Lumps Detection

Algorithm for an Ameliorate Technique for Brain Lumps Detection

Input- Set of MRI images

Output- Detect Brain Lumps accurately

1- Select input image from image data set

2- Apply pre-processing on image

   o   Noise removal- by using Median filter

- Select a noisy MRI image and separate each plane and each scalar component is treated in dependently.
- Generate zero arrays around an image based on image mask size using pad array command.
- Select 3 * 3 masks from an image and the mask should be odd sized
- For each component of each point under the mask a single median component is determined.
- Contrast enhancement

3- Feature Extraction
- Boundary detection
- The Intensity Gradient and Texture map are calculated
- Extra features extraction such as texture and shape properties
- Measure SVM classifiers

4- Modified Subjective feedback phase
- Apply Fussy C-Means clustering

4. CLUSTERING TECHNIQUES

Clustering is the processes of collection of objects which are similar between them and are dissimilar objects belong to the other clusters. The clustering is suitable in biomedical image segmentation when the number of cluster is known for particular clustering of human anatomy. Clustering algorithm are classified two types: ⬜Exclusive clustering ⬜Overlapping clustering In the exclusive clustering, one data (pixel) is belong to the one cluster then it could not belong to another cluster. K-mean is the example of exclusive clustering algorithm. In overlapping clustering, one data (pixel) is belonging to the two or more clusters. Fuzzy C-mean is example of the overlapping clustering algorithm. [10]

K-MEANS CLUSTERING

K-mean clustering is unsupervised algorithms that solve clustering problem. The procedure for k mean clustering algorithm is the simple and easy way to segment the image using basic knowledge of the clustering value. In k-mean clustering initially randomly define k centroids. Selection of this k centroid is placed in the cunning way because different location makes the different clustering. So that, the better is to place centroid value will be as much as far away from the each other. Secondly calculate the distance between each pixel to selected cluster centroid. Each pixel compares with the k clusters centroids and finding the distance using the distance formula. If pixel has the shortest distance among all, than it is move to particular cluster. Repeat this process until all pixel compare to the cluster centroids. The process continues until some convergence criteria are the met [10]

FUZZY C-MEANS CLUSTERING

Fuzzy C-means clustering is the overlapping clustering technique. One pixel value depending upon the two or more clusters centers. It is also known as soft clustering method. Most widely used the fuzzy clustering algorithm is the Fuzzy C-means (FCM) algorithm (Bezdek 1981). The FCM

algorithm is the partition of the n element X={x1,...,xn} into a collection of the c fuzzy clustering with respect to the below given criteria [9][10][4] It is based on the minimization of the following objective function:

Where, m = level of the fuzziness and real number greater than 1. uij= degree of the membership of xi in the cluster cj x = data value Fuzzy C-means is the popular method for medical image segmentation but only consider the image intensity thereby producing unsatisfactory results in noisy images. A bunch of the algorithms are proposed to make the FCM robust against noise and in homogeneity but it's still not perfect. In 2012, J. Selvakumar, A, Lakshmi and T. Arivoli [7] proposed a technique for brain lumps segmentation using the k-means and the fuzzy c-means algorithm. Its use the pre-processing steps for filtering the noise and other artefacts in image and apply the K-means and fuzzy c-mean algorithm. This purposed algorithm, fuzzy c-mean is slower than the K-means in efficiency but gives the accurate prediction of lumps cells which are not predicted by the K-means algorithm.

5. EXPERIMENTAL RESULT

The proposed algorithm and Fuzzy C-Means algorithm is implemented using MATLAB software and tested on the brain MRI images to explore the segmentation accuracy of the proposed approach. The comparison is made between the Fuzzy C-Means and proposed algorithm. The quality of the segmentation of the proposed algorithm can be calculated by segmentation accuracy which is given as.
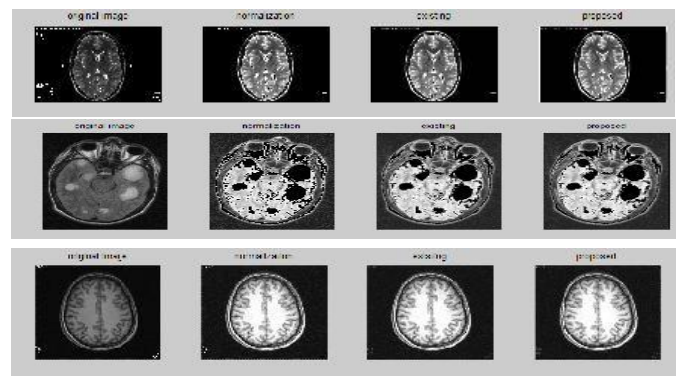The input image and the corresponding segmented image is shown below.

Fig: 3 Experimental Results on different brain images

Following table & graph shows result comparison of k-means and FCM algorithm

Table 1. Results

Parameters	In %	
	Existing K-Means	Implemented FCM
Precision	91	94.73
Recall	90.54	92.52
Specificity	88.70	96.77

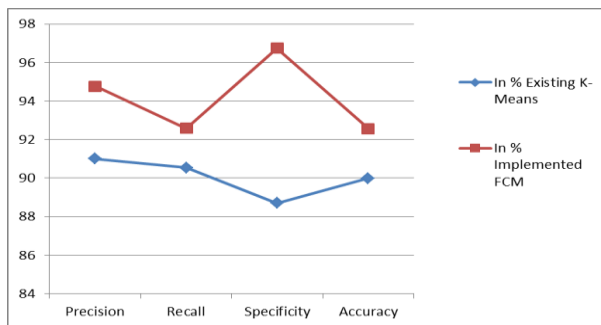| Accuracy	89.90	92.51

Fig 4. Graphical comparison of Results

6. CONCLUSION

Recently**,** the applications of the image processing can be found in the areas like electronics, remote sensing, natural scene detection, biometrics, bio-medical etc. If we concentration the bio-medical applications, image processing is commonly used for the diagnosis of different tissues purpose. By use of suitable image segmentation method and the use of accurate input image we get accurate results.

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