# SURVEY PAPER BASED ON MEDICAL IMAGE SEGMENTATION AND CLUSTERING TECHNIQUES

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*ABSTRACT-*

Image segmentation is very important in many medical imaging applications. We are presenting some survey and review of the current technologies and approaches of semi automated and automated methods for the segmentation of medical images. Some important issues in medical image segmentation have been discussed in this paper. Reviews related with medical image segmentation and problem identification about those papers have been covered.

*KEY WORDS-*

Magnetic Resonance Imaging, Vector Median Filter, Otsu Thresholding, Apriory Algorithm, Krushkal's Algorithm.

## I. INTRODUCTION

Image segmentation plays very important role in computer-aided diagnosis of medical images. The objective of image segmentation is to partition an image into non overlapping, and homogeneous parts with respect to intensity and texture of that medical image. For segmentation of any image the first step is denoising, in this step image is passed through appropriate filter such as low pass filter, high pass filter, vector median filter. After denoising, it is necessary to convert an image to a binary image, depending on threshold values, that extract the objects from the background. For this conversion thresholding approach is used such as Otsu thresholding and the histogram thresholding which is based on the shape properties of the histogram. The image histogram has different peaks and valleys, with each peak related to one distinct region, and the valleys as the threshold values for straightening out these regions. Then segmentation will be performed.

There is some segmentation approaches are used such as region based segmentation and edge based segmentation. For problem identification of any medical image or for extraction of affected area clustering approach is used. Clustering is a process of grouping data in the form of their properties and characteristics. In other words it can be said that each group members should have similar characteristics and properties. Some clustering approach which have used for medical images are, genetic algorithm, K-means clustering, fuzzy c-means algorithm and Krushkal's algorithm. Basic steps used for segmentation as shown in fig 1.
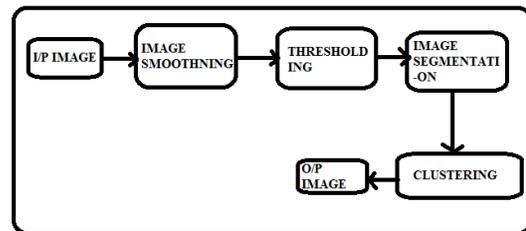


Fig 1: Basic steps of medical image segmentation.

## II. LITERATURE SURVEY

There are so many research works have been performed on segmentation of medical images. Basic segmentation techniques are follows:

- Thersholding approach
- Region growing approach
- Classifiers
- Clustering approach
- Markov random field approach
- Artificial neural networks
- Deformable modals
- Atlas guided approach

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## 2.1 Review of Segmentation Methods

Shraddha Tripathi and Krishna Kumar in [1] define segmentation as a method or procedure to divide and image into inhomogeneous regions, according to them segmentation results affects all the processes of image analysis as description and representation of object feature measurement and higher level tasks like object classification. In this paper they have deal with current segmentation methods, with the help of these methods segmentation of any image can be performed easily and in efficient manner and then we get appropriate result.

## 2.2 Fuzzy Symmetry Based Genetic Clustering Algorithm

Indah Soesanti, Adhi Susanto, Thomas Sri Widodo, introduced in[2] segmentation of brain MRI, Fuzzy symmetry based genetic clustering technique which is efficient in the manner this is the solution of a persistent problem occurred in brain MRI segmentation. Which problem is automated and reliable tissue classification is further complicated by overlap of MR intensities of different tissue classes and by the presence of a spatially smoothly varying intensities inhomogeneity [2]. In this paper they have use Hidden Markov Random Field (HMRF) model for segmentation. This model's characteristics were combined with the expectation maximization (EM) algorithm, for estimating the involved model parameters. They have conclude that unsupervised clustering method has high reproducibility because its results are mainly based on the information of image data itself, and it requires little or no assumption of the model, and the distribution of the image data [2]. In this paper a fuzzy variable string length genetic point symmetry (fuzzy-VGAPS) based clustering technique is proposed which is then used to automatically segment the brain image here membership values of points to different clusters are computed based on a newly proposed point symmetry based distance rather the Euclidean distance. Comparison between FCM algorithm and fuzzy VGAPS algorithm has also been done the result of comparison between fuzzy VGAPS and FCM algorithm in their manner has been shown.

## 2.3 Automatic and Semi Automatic segmentation

Caroline Petitjean , Jean Nicolas  Dacher reviewed in[3] the fully and semi automated methods performing segmentation in short axis images using a cardiac cine MRI sequence medical background and specific segmentation difficulties associated to these images are presented[3]. In their paper importance of prior knowledge has been shown. There has a lot of research work about automated segmentation methods. In particular commercial software packages such as ARGUS are today available for automatic ventricle delineation. They have focused on methods dedicated to cardiac MR segmentation the particularly shape of both ventricles as well as MR characteristics have required specific developments despite more than 15 years research the problem is still open as shown by the holding of a segmentation contest of the  LV in 2009[3]. During the MICCAI conference and remains completely unsolved for RV. Numerous segmentation problems require the use of priory knowledge so as to increase their robustness and accuracy. Fig2 shows the comparison between manual and computer aided identification of left ventricle. The comparison between manual and computer based segmentation is shown in fig 2.
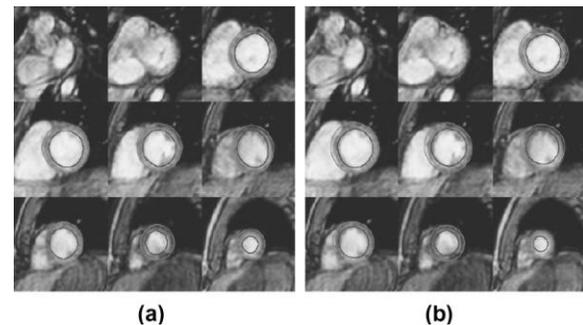


(a)        (b)

Fig 2: Segmentation results by 3D AAM. (a) Manually identified contours. (b) 3D AAM determined segmentation of the left ventricle.

## 2.4 Fuzzy Symmetry Based Genetic Algorithm [4]

Sriparna Saha & Sanghmitra Bandhopadhyay introduced in [4] a modified Fuzzy C-Means clustering for medical image segmentation. They have used Fuzzy C-Means algorithm with spatial

information of the images. FCM algorithm is used for clustering which is based on unsupervised learning[4]. The approaches which are used in this paper allow additional flexibility in many applications & have recently been used in processing of MRI. The method is applied in normal MRI brain images & a Glioma MRI brain images, then analyze an area of tumor from segmented image. This method is overcome the problem occurred in the (1)Classical methods: such as thresholding region growing & edge based techniques .(2) The statistical methods such as maximum likelihood classifier (MLC).The FCM algorithm assigns pixels to each category by using FUZZY memberships[4]. Result of this research shows misclassification of segmentation of MRI brain images with tumor using K-Means, FCM & FCMS methods. The result shows that FCMS method is better than K-means & FCM methods in classification of segmentation.

## 2.5 Segmentation Based On AI

Prof. Dinesh D Patil & Sonal G George discussed about the old and new segmentation methods. This is a review paper about various segmentation methods. Segmentation is very helpful in medical field, Manual segmentation are also performed by radiologists but it becomes very tedious and time consuming & the result of manual segmentation are not very accurate that is why in nowadays automatic segmentation methods are used[5]. Some current methodologies and approaches which have been discussed in this paper are follows: (1)Based on AI and machine learning .This is comprises of three layers:- (i)Image processing (ii)Image analysis (iii)Image understanding.(2)Segmentation based on edge detection : This method attempts to resolve image segmentation by detecting the edges or pixels between different regions that have rapid transition in intensity are extracted and linked to closed object boundaries[5] .The result was a binary image .Based on this paper, There are two main edge based segmentation methods (i) Gray Histogram (ii) Gradient Based Method.(3) Thresholding method :it can be selected manually according to priory knowledge or automatically by image information.

This algorithm further divided to edge based, region based & hybrid.

## 2.6 Survey of Various Clustering Algorithms

S.Revathy & Dr. T. Nalini introduced clustering as the process of grouping data which have similar properties and characteristics .These groups are termed as clusters .This paper included a comparative study of clustering algorithms according to their performance .The performance is based on time consumption and number of clusters. Clustering algorithms can be viewed as hierarchical and partitioned such as K means nearest neighbor and PAM [6]. This paper also included some clusters introduction which is applicable for large database, Such as BIRCH, DBSCAN, CURE [6]. This paper also includes some introduction about clustering algorithm such as (1) Simple K means clustering (2) Efficient K means clustering (3) Farthest first clustering make density based clustering[6] . The farthest first clustering algorithm takes very few seconds for cluster the data items whereas the simple K means takes longest time to perform clustering.

## III.    PROBLEM IDENTIFICATION

There are so many limitations present in Magnetic Resonance Imaging (MRI) such as:

- Partial volume
- RF noise
- Intensity homogeneities
- Gradients
- Motion
- Wrap Around
- Gibbs Ringing
- Susceptibility

There are some disadvantages are also occurs in MRI:

- MR acquisition takes considerably longer time as compared to CT.
- In case of MR it is more difficult to obtain uniform image quality.

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If water shed algorithm is used for segmentation than it is also able to produce a complete division of the image but the limitation of this method is over segmentation and sensitivity to false edges.FCM algorithm is highly sensitive for noisy images [7].

According to Sriparna Saha and Sanghmitra Bandhopadhyay, They have used fuzzy V GAPS algorithm for clustering. This algorithm is combination of fuzzy C means and genetic algorithm because of this combination the process becomes lengthy and very time consuming [4].

In the paper of Indah Soesanti, Adhi Susanto, Thomas Sri Widodo the comparison has shown between K means Fuzzy C Means and FCMS algorithm. This research work was performed on normal brain MRI and glioma brain MRI image [2] .And the result of this research was that FCMS algorithm was more efficient than K means and FCM algorithm but the limitation of this research was that it was needed spatial information or we can say that authentic information about database.

In the paper of Caroline Petitjean , Jean Nicolas Dacher segmentation of cardiac MRI images was included the segmentation of left ventricle only [3].According to this research there are less possibilities will occur for segmentation of right ventricle .In this paper research work was based on prior knowledge and this type of segmentation is very complex.

## IV.    CONCLUSION

This paper represents various methods of segmentation and clustering which can be helpful for medical image segmentation. This survey can be helpful for upcoming researchers.

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