Comparative Analysis Of Liver Segmentation Using K-Means, Fuzzy C-Means And Spatial Fcm Using Mumford Shah Approach

Frizilin R, Muthukumaravel A

Abstract: ***In medical environment,liver segmentation plays ansignificantrole by helping physicians to find the location of affected region of the liver from the normal part.Automatic extraction which is recognized as segmentation by computer processing may diminish the burden as well as time consuming. To overcome the burden of identification of definite organ segmentation technique is used. In general liver analysis have done through CT scan or MRI scan whereas the image of MRI scan is utilized for the complete process which is more convenient than other scanning while diagnosing. This does not create harmful to human body due to no practice of radiation. As the initial stage, image segmentation has been done through spatial fuzzy clustering which can control level of its parameter to set advancement as a result in the fuzzy clustering. In this advanced technique, mumford shah technique is used to improve the robustness with less time consumption. This study has motivated on both less time extraction and also the accuracy. So, in order to attain spatial fuzzy clustering is proposed and also compared with the existing clustering algorithm such as K-means, Fuzzy C-Mean (FCM) to evaluate the performance efficiency in time extraction using clustering outcomes.***

Keywords: Liver Segmentation, K-Means Clustering (KMC), Fuzzy C-Means Clustering, Spatial Fuzzy Clustering (SFCM).

I. INTRODUCTION

The Liver was situated in abdomen along with other visceral organs, spleen, pancreas, kidneys and intestine. The mortality and morbidity of liver diseases were supposed to be moderately greater than other fatal diseases.

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There is extensive increased death rate due to liver structural defects and efficient complications worldwide. Most likely the medical treatments for liver disorders are not so encourage except the defect is individual at an early stage [1].The research purpose is to analyses the major problems in robust liver segmentation and also the method used for resolving them. The general principle of the CT scan images is used but creates harmful effect for human body and hence an alternate technique are accomplished but in specific Magnetic Resonance Imaging (MRI) is an advanced method for robust liver segmentation has done on the foundation of a priori information about the image namely the shape and position of liver. Nowadays, technologies exhibit great impact on liver tumor treatment to minimize the patients from disorders. The most well-known tools for creating visualize representation of both external and internal of the body which is utilized in this medical field are medical imaging modalities[2,3].In this segmentation field,technology has oriented to computerized characteristic of functional structure and tissue categories in medical images. The image is made into partition without an overlapping is said to be image segmentation whereas the component present in the regions are homogeneous which related to some features namely texture and intensity. The image domain gets represented as “I”. So, the problem segmentation is to dictate the set $S_k$which is the subset of “I”. Therefore, union of segment is said to be the complete image of “I” and there are various segmentation method to discover those sets which suits for anatomical structure with defined or image with the interested regions. The sets “I” is said to be pixel classification, when the connected regions get removed due to limitation. Hence, the sets are represented as classes. Pixel classification produce more beneficial goal in medical image than classical segmentation. This is more beneficial during the region of class with same tissue belongs to the disconnected required to be identified. The total amount of classes “Y” is calculating using pixel classification became a complex task [4]. The most frequent “Y” value which assumed is considered created on the analysis of prior knowledge. The image get partitioned based on the correlation of both exhausted and whole region is said to be image segmentation which the major

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objective of this study whereas every interested region get spatially adjacent and the pixel present in the region are homogeneous with associated predefined basis. The enormous similarity features involves the intensity values, color, texture, surface normal, range and surface curvatures. There are various diagnostics have done on the foundation of actual segmentation with digitized images. The medical image segmentation is required for the application which includes boundary estimation of the objects, abnormal tissue classification, analysis of shapes and detection of contour. Therefore, these applications can be approached on the basis of K-means, Neural Network, Fuzzy logic and so on [5]. In the field of image process, image segmentation along its performance calculation plays a vital role due to difficult medical imaging whereas the medical imaging segmentation is still became a challenging problem [6].The clustering using fuzzy techniques plays a significant role in the area of medical image segmentation. The most frequent technique of fuzzy is implemented on the basis of fuzzy clustering using algorithm of C-Means that has defined centroid sets and also computed the value of membership for each centroid presented in the image pixels [7, 8].

II. LITERATURE REVIEW

The Liver was situated in abdomen along with other visceral organs, spleen, pancreas, kidneys and intestine. The mortality and morbidity of liver diseases were supposed to be moderately greater than other fatal diseases. There is extensive increased death rate due to liver structural defects and efficient complications worldwide. Most likely the medical treatments for liver disorders are not so encouraged except the defect is individual at an early stage [9]. One of the significant processes for visualizing human tissue is image segmentation especially in the anatomy of clinical with MRI. In the method of segmentation from CT, liver segmentation with semi-automatic and automatic were constructed to overcome the complexity in liver segmentation with manual [10]. Therefore, results of clustering get varied based on image pixels features and parameter settings of cluster techniques. The clustering technique on the basis of FCM has resulted the comparison of image segmentation in CT is based on the features of image intensity and the textures [11]. Hence, the study has performed the clustering on the image of gray level histogram which has recreated using MR to acquire a matrix membership with fuzzy via iteration operation. The filter has employed as a final for modifying the matrix of membership partition. The improved segmentation result can be accomplished by this technique with less time consumption [12]. This paper proposes a segmentation method on the foundation of color which utilizes the technique of K-means clustering and also FCM clustering whereas K-means clustering is an impulse method utilized for image partitioning with K clusters which generate accurate results for segmentation only during the defined image get applied using the region of homogeneous based on color and texture. Therefore, in medical images no local controls are useful to enforce the spatial continuity [13]. In order to accomplish a precise region boundary, each realistic image dispersion get computed using the segmentation of FCM clustering. The Convolutional Neural Network (CNN) classifier technique is used for process of classification where as it help to adept the categorization between the tissue which is normal and abnormal. The proposed technique has the capable of segmentation with several types of hard image in multimodal medical accurate is determined through the results [14]. In the case of huge amount of data however, it is challenging to do a manual segmentation of the CT images. Hence, the minimal and no need of supervision for completely automated method whereas the requirement of manual segmentation gets eliminated. This study has evaluated spatial FCM clustering which get compared with set of unified level technique for segmenting the liver from the image of CT [15].The efficient liver analyses with segmentation of liver with fully automated are significant. The technique has performed on the basis of CT datasets and the algorithm performed is calculated by the ROI namely sensitivity and F-measures. The quantitative study suggests that the technique can regularly segment the image of liver with more competence and accurateness [16]. The model

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with similarity level set and segmentation control over shape of the liver is proposed by Li C et al [17] whereas this technique can be utilized only for the liver which is healthy.

III RESEARCH METHODOLOGY

Spatial Fuzzy c-means Clustering (SFCM)

The non-parametric and analyzing the cluster data with unsupervised technique can be provided using FCM algorithm whereas various effort from fuzzy clustering have been proposed by Bezdek and some other researchers. In this field, earlier studies have described the issue on the basis of optimum setting in initial condition, measurement of cluster validity and load with high computation. The functional objective of FCM has not taken an account for any spatial requirement among observations. Therefore, membership function with computation has performed sensitivity for the observed image with noise. The algorithm of unsupervised cluster is said to be SFCM on the basis of FCM clustering technique which has investigate the best partition of fuzzy in the universe with the assumption of evaluating every object in related to the few features that is unknown but knowing is applied to the R^2 space.

In this Spatial FCM algorithm, spatial data has incorporated with clustering membership function and definite spatial function as the amount of membership function in the region of every pixel under concern. The spatial functions with ease of creating the actual membership and the result of cluster have endured as unaltered. However, the noisy pixels get deduced noisy cluster weighting using the neighboring pixels labels whereas the neighboring pixels labelling is done using cluster. The spurious blobs and noisy regions can be corrected easily by the pixels of misclassified as a result.

The spatial clustering algorithm involves two processes

The initial process is as similar as general FCM algorithm which has evaluated the membership function in the domain of spectral.

The second process deals with data from each pixel of membership get mapped to the domain of spatial whereas it is computed. The iteration of FCM has processed with novel membership which gets integrated to the spatial function. The block diagram of proposed system as shown in figure.1

System architecture

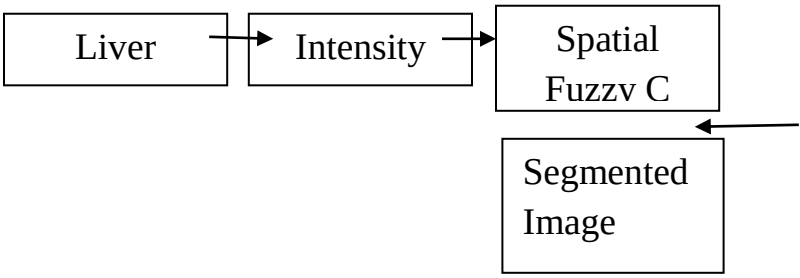

Figure.1 Block diagram

1.The liver image is given as the input to the system, the feature is nothing but the contour of the liver image without tissues.

2.The spatial FCM algorithm is similar to FCM but here the spatial information is defined by spatial function and it incorporated into membership function.

3. This technique has more homogeneous than other methods in order to reduce false blobs, to eliminate noisy spots and it has fewer sensitive to noisy compared to other techniques. This will work for both single and multiple feature data in noisy image segmentation with spatial information. At the end of the SFCM, we obtain a clustered segment with improved accuracy.

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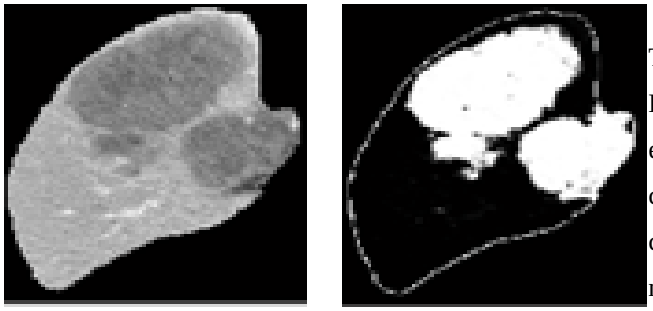
4.The level set method is a numerical technique for tracking interfaces and shapes. Generally, it starts with an initial curve moves towards the normal of the curve, traces the boundary and curve stops by the gradient forces. The level set approaches have the capability in handling difficult changes of topological robust are the main advantages. However, all the method with active contour is totally rely on the provided image gradient to stop the curve evolution. Therefore, these models can able to detect the objects with defined edges using gradient.

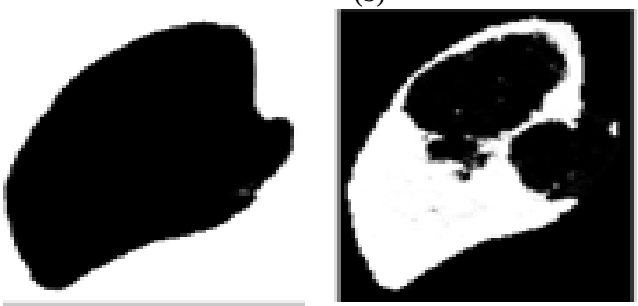
5. According to the function of Mumford-Shah over segmentation. Hence, proposal of new model with level set for active contours for detecting the object where the boundaries are not specified essentially using gradient.

6. The model of active control has general principle further for image segmenting with greater than two regions using the proposal of recent level set with multiphase framework for the issues. The level set function with minimum count and hard topology can be established. In addition, partition used by the phase does not generate “vacuum” and “overlap” which leads to an advantageous.



(a)

(b)

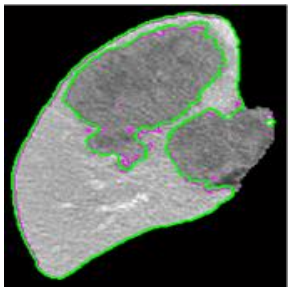


(c)

Figure.2 Initial segmentation by Spatial Fuzzy Clustering

(a)Original Image (b)Image number1(c)Image number2 (d)Image number3(selected cluster image)

Figure.2 shows the original liver image is clustered into 3 clusters indicates the liver image without tumor,background,liver image with tumor by using spatial fuzzy clustering.

Figure.3Region  of Interest

(after 300 iteration)

Figure.3 shows the green color circle indicates one level set function and rose color circle indicates another level set function.

III. EXPERIMENTAL RESULTS

The performance of the proposed spatial FCM with existing K-mean and FCM algorithm get compared on the basis of extraction of time which is shown in Table-1. The time complexity is measured in mille seconds whereas this comparison of algorithm has done for three clusters which mean 3 Number of clusters. The extraction of time seem to be less in K-mean while compared with FCM but spatial FCM is comparatively less than both K-means and FCM algorithm which is shown in Figure.4.

Table.1 Time Complexity of K-Means, FCM and SFCM using Mumford shah model(Proposed algorithm) When Number of cluster varying

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S.No	No of cluster	K-Means Clustering	Fuzzy C-Means Clustering	SFCM using Mumford shah model
1	1	130	260	126
2	2	220	485	214
3	3	370	766	360

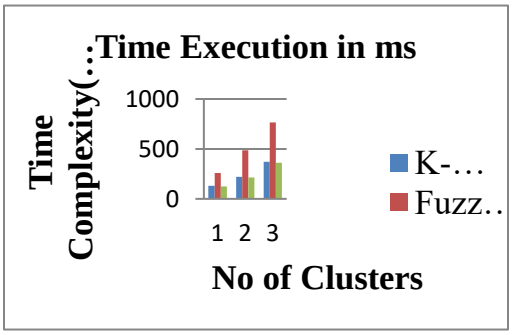

Figure.4 Time complexity of K-Means,FCM and Spatial FCM(proposed algorithm) by varying number of clusters

IV CONCLUSION

In this paper we have described about the improvement of segmentation of liver image. Initially, the segmentation is done by spatial fuzzy c means clustering in order to incorporate the spatial features using membership values. The proposed system is by using mumford shah model,we can detect the interior contours automatically, identify the blurred contours effectively, increase the robustness with respect to noise and improve the overall accuracy of segmentation with lesser number of iterations.From the obtained results we may conclude the extraction of time seem to be less in K-mean while compared with FCM but spatial FCM is comparatively less than both K-means and FCM algorithm.

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