

A Survey on Different Methods for Liver Segmentation

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ABSTRACT: Liver Cancer is one in every of the speediest growing cancer in the world. The early detection and diagnosing of liver tumor growth is vital for the hindrance of liver tumor growth. More than 30% of cancer deaths may be prevented by avoiding risk factor, early detection, accurate diagnosis, and effective treatment. Segmentation of liver from medical images from the abdominal space is vital for diagnosing of tumor and for surgical procedures. Accurate detection of the type of the liver abnormality is very essential for treatment designing which may minimize the fatal results. However accurate results can only be obtained by computer aided automation systems. Many different techniques are developed for the detection of liver cancer the abnormal lesion size and form. This paper reviews various liver tumor detection algorithms and methodologies used for liver tumor diagnosis. A comparative analysis is performed. Also explores the applicability of the techniques in liver segmentation of CT images.

Keywords- Level set Segmentation, K- means clustering, liver cancer, CT image.

I. INTRODUCTION

Liver tumors or hepatic tumors are tumors or growths on or in the liver. Several distinct types of tumors can develop in the liver because the liver is made up of various cell types. liver cancer tends to occur in livers damaged by birth defects, alcohol, or chronic infection with diseases such as hepatitis B and C, hemochromatosis (a hereditary disease associated with too much iron in the liver) [1].

New liver cancer cases 39,230 adults (28,410 men and 10,820 women) in the United States in 2015. Death due to liver cancer in USA, 2015 is 27,170 deaths (18,280 men and 8,890 women). The survey was done on the basis of survival rate. If the person has survived for 5 years then the survival rate is chosen as 5 years. The first year survival rate for people with liver cancer is 44%. And fifth year survival rate for people with liver cancer is 17%.

Liver cancer is one of the most popular cancer diseases and causes a large amount of death every year. The chances for liver cancer in men and women have increased to 40% and 23% respectively.

Image segmentation is another useful tool used in the field of image processing. the main purpose of the this idea is to capture like characteristics of an image and bring them out to where they are more visible than they were before. Segmentation of images is used to provide information such as structures of organs, identifying the regions of interest i.e locating tumors, abnormalities etc. the liver is the largest gland ant he largest internal organ in the human body, liver is dark red, wedge-shaped gland approximately eight and half inches long. Early detection

and accurate analysis of liver cancer is an important issue in practical radiology. Liver lesions are the injury, wound, disease or tumor to the liver tissues. CT scan can identify the liver lesions by difference in pixel intensity from that of the liver. Manual segmentation is very time consuming and tedious process, were as the automatic segmentation is very challenging task due to the factors like indefinite shape of the lesions and low intensity

contrast between lesions and similar to these of nearby tissues. The irregularity in the liver shape,size between the patients. Various automatic/semiautomatic techniques for liver tumor segmentation have been developed.

II. LITERATURE OVERVIEW

R.Rajagopal. et al. [2] proposed a novel system for detecting and segmenting liver lesions. It utilizes otsu's thresholding method and is employed in median filtering using mathematical morphology. Morphological filtering is applied to extract the regions shap I,e edges. Only erosion is used. And gabor transform filter used for edge detection process. It yields accurate results for different types of liver tumors with ease and without manual interaction. It can also be improved by neural network and fuzzy algorithm.

Gang Chen. et al. [3] multiple initialization, multiple-step LSM are used. The multiple-initialization curves are first evolved separately using the fast marching methods and LSM, which are combined with a convex hull (CH) algorithm to obtain a rough liver contour. Parallel propagation using FMM and LSM based on these initial curves are implemented. Combination of the partial segmentation results using a CH algorithm. Smoothing

the primary liver contour using LSM. Multiple-initialization LSM is much faster, can cover more liver regions. Overcome the leakage and over segmentation problem. An automated perfusion analysis method is proposed to automatically conclude liver perfusion curves. The under segmentation problem still exists on lower sharp corner regions due to the low-gradient definition of the lower half of the liver regions in the abdominal MRI's

Chen Zhaoxue. Et al. [4] Simple line search method for plane domain segmentation to extract binary image composed of isolated white pixel clusters mainly from the liver part based on the histogram distribution and spatial characteristics the liver is obtained. Gaussian blurring technique is introduced to connect the isolated pixel clusters. Thresholding The blurred image after the post-processing step of mending holes and size filters. Liver image registration between slices so as to increase accuracy of the perfusion computation and measurement.

S. Luo et al. [5] a three step liver segmentation algorithm. Texture analysis is applied into abdominal CT images to extract pixel level features. Two other main features are wavelet coefficient and haralick texture description are used. here SVM is implemented to classify the data into pixel-wised liver or non liver. Morphological operation is designed as a processor to remove noise and to delineate the liver. It has been proven that wavelets features present better classification the haralick texture descriptors when SVM are used. The combination of morphological operation with a pixel-wised SVM classifier can delineate volumetric liver accurately.

Shraddha Sangewar et al. [6] the segmentation is based on combining a modified K-means segmentation method with a special localized contouring algorithm in the segmentation process in order to divide the image, five separate regions are identified on the T image frames. It provides fast and accurate liver segmentation and 3D rendering as well as delineating tumor regions.

O. Fekry Abd-Elaziz et al. [7] combination of intensity analysis, region growing and pre-processing steps for automatic segmentation of liver and a second region growing process for tumors segmentation. a method for automatic segmentation of liver tumor. Decrease the computation time by removing the regions of other structures. In most techniques liver was segmented using region growing method that started from a seed point automatically selected.

Wenhan Wang et al. [8] a morphological feature of the liver region under various window level setting, applied the region growing algorithm to remove other tissues such

as skeleton, kidney & stomach. a discrete points of the liver region can be acquired. The gradient information based edge correction and three dimensional restoration are adopted to optimize the recovered liver image. And has a lower time complexity but there is likely over segmentation.

Ina Singh et al. [9] Discussed the standard k-means clustering algorithm and analyzes the shortcomings of standard k-means algorithm, such as the k-means clustering algorithm has to calculate the distance between each data object and all cluster centers in each iteration, which makes the efficiency of clustering was not high. This paper proposes an improved k-means algorithm in order to solve this question, requiring a simple data structure to store some information in every iteration, which was to be used in the next iteration. The improved method avoids computing the distance of each data object to the cluster centers repeatedly, saving the running time. Experimental results show that the improved method can effectively improve the speed of clustering and accuracy, reducing the computational complexity of the k-means.

Gambino, O. and et al. [10] proposed an automatic texture based volumetric region growing method for liver segmentation was proposed. 3D seeded region growing was based on texture features with the automatic selection of the seed voxel inside the liver organ and the automatic threshold value computation for the region growing stop condition. Co-occurrence 3D texture features are extracted from CT abdominal volumes and the seeded region growing algorithm was based on statistics in the features space.

III. METHODS FOR TUMOR SEGMENTATION

A. K-Means Clustering

K-means is one of several simplest unsupervised learning algorithms that classify a given knowledge set into bound amount of clusters i.e K-clusters. The idea is to define a K-centroids, one for every single cluster [6]. These centroids must certainly put right into a cunning way, because different location causes different results. So, the best choice is to position them as far as possible from each other. The next issue is usually to require every point belonging to a given knowledge set and associate it to the closest centroid.

When no point is pending, the first step is completed and an early grouping is done. Again re-calculate new K-centroids of the clusters, resulting from the previous step. After having these k new centroids, a new binding needs to be performed between the same knowledge set points and the nearest new centroid [11]. Repeat the steps until centroids don't move any more. In the successive loops, the k centroids change their location detail by detail.

It is classified as a pixel-based image segmentation technique because it involves the selection of initial seed

points. This technique starts with initial—seed points and then examines neighbouring pixels (using either 4-connectivity or 8-connectivity) to find out perhaps the pixel neighbours ought to be added with the region. The method is iterated on, within the very same manner as general data clustering algorithms. The region growing algorithm is

Described in as: (i) Select several seed points. Seed point selection is dependent on some user criterion (for example, pixels during a specific gray-level range, pixels equally spaced on a grid, etc The first region begins as the complete precise location of the seeds. (ii) The regions area unit then grownup from these seed points to adjacent points according to a location membership criterion.

The criterion might be pixel intensity, grey level texture or color. Due to the fact the regions are grown on the building blocks of the criterion, the image data itself is very important. For instance, if the criterion were pixel intensity, examine all the adjacent pixels of seed points. If they are of the same intensity value with the seed points, classify them to the seed points. it's for sure an iterated process until there's no modification in two successive iterative stages. The appropriate alternative of seed points is simply a major issue.

B. Level set method

This methodology will handle topological changes and outline the problem is in higher dimension, however this technique is time overwhelming and leads to over segmentation [3]. The Segmentation using level set method this evolves according to a speeding image that is the results of a scanning technique based dynamic programming. The main limitations of this level set method adjust this first segmentation using a speed function which is obtained from the pixel classification algorithm.

Table 1: Survey of different Segmentation

The accuracy here is only sufficient in a small number of cases. The level set method is initially proposed for tracking moving interfaces and has spread across the various imaging domains. It can be used to efficiently address some problems such as curve/surface/etc. propagation in an implicit manner. The central idea is to represent the evolving contour by using a signed function whose zero corresponds to the actual contour. Then, the motion equation of the contour, one can derive a similar flow for the implicit surface that when applied to the zero level that will reflect the propagation of contour. The level set method affords numerous advantages: it is implicit, is parameter free, provides a way to estimate the

Ref No.	Authors	Year	Technique used	Advantages	Limitations
2	R.Rajagopal	2014	Otsu's thresholding, morphological filtering and gabar transform	Accurate results are yields for different types of liver tumors	Can be improved by using neural network and fuzzy algorithm.
7	El-Masry W.H	2014	Invasive Weed Optimization	multi-objective optimization	Computational time complexity is high
8	O.Fekry Abd-Elaziz	2014	Intensity analysis, Region Growing and morphological processing	Decreases the computation time by removing the regions of other structures.	
6	Shraddha Sangewar	2013	Modified K-means with special contouring algorithm	Provides fast and accurate liver segmentation	
11	Amir H. Forouzan	2013	K-Means Clustering and Geodesic Active Contour	Effective Segmentation in Low contrast Images	Used only for low contrast images
10	Wenhan Wang	2012	Region growing algorithm	Lower time complexity	Over segmentation
5	Zhaoxiao Yuan	2010	Fast Marching and Improved Fuzzy cluster Method	Accurate Segmentation of abdominal Images	Over segmentation
9	O. Gambino	2010	Texture Based region growing	Accurate Recognition and segmentation	Processing time is high
4	Suhui Luo	2009	Texture analysis and combined morphological operations	the combination of morphological operations with pixel-wised SVM classifier can delineate volumetric liver accurately	
3	Gang Chen	2009	Level set method	Multiple-initialization LSM is much faster, covers more liver regions, overcome the leakage and over segmentation.	LSM is the difficulty in automatically determining the number of initialization, under segmentation still exists on lower sharp corner regions.

a change of topology, and is intrinsic. It is used to define

an optimization framework. One can conclude that it is a very convenient framework for addressing various applications of computer vision and medical image analysis. Research in various level set data structures has led to very efficient implementations of this method.

IV. CONCLUSION

In this paper, a survey on various image segmentation techniques has been done. the K-Means algorithm is limited to only initial number of k-clusters. Wrongly selected clusters lead to erroneous results Therefore in future, level set method for segmentation is suggested which will overcome the problem of K-Means clustering.

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