

# DETECTION OF LIVER CANCER IN CT SCAN IMAGES

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## Abstract-

Now days computer aided diagnosis is widely used. Image processing techniques which are widely used, are the most significant and integral part of such diagnosis, in several medical areas. It is an important tool for diagnosis and treatment planning. Medical image segmentation can be used for several different tasks such as liver, brain tumor diagnosis. Liver cancer is one of the most commonly diagnosed cancer types. In this paper we present a liver cancer region segmentation method by analysis of computed tomography images. It mainly consist of three stages, first pre-processing is done in order to enhance the image quality by using median filter. Second by using region growing technique image segmentation is done and some morphological operations are applied in order to get proper liver region. Finally we analyze the segmented image for the detection of cancer.

**Index terms:** Liver cancer, segmentation, region growing method.

## I. INTRODUCTION

Liver cancer is considered one of the major causes of death in humans. The death rate is directly related to its growth at the time of detection. Early detection of tumors is essential for increasing the survival chances of patients. In human body healthy cells reproduction is stable and also they die in a stable and orderly manner. But some cells starts to grow in an uncontrolled manner producing tumor. There are two types of tumors one is benign tumor and the other is malignant tumor. Benign tumor is the one which does not spread to other organs while the malignant tumor may invade and destroy healthy surrounding tissues or spread to other organs. Computer aided diagnosis is an important tool in such diagnosis. The output information includes both detection of unusual information and diagnostic information on the bases of comprehensive analysis of existing rules. The image segmentation is an important part of such CAD system. In automatic diagnosis of liver cancer the first important step is liver segmentation. Liver segmentation is a complex and difficult part due to inter personal and intra personal variation in geometric properties

of liver such as liver size, shape etc. There are large variations in liver size, shape between different persons, even the same person have variations if he has undergone some liver operations. Also some neighboring organs such as kidney, spleen, stomach etc. have similar intensity values as that of liver which causes difficulties in accurate liver segmentation. Direct liver extraction without pre-processing may also extract undesirable boundaries resulting from its adjacent organs as fault positive/negative errors. Few literatures about this research topic have been proposed. The various approaches are as follows:

Intensity based approaches: In intensity based approach the method which is most commonly used is the one with threshold. In this method depending on the intensity of the gray level the threshold is decided by using the histogram. The region outside the threshold value is discarded that is non-liver region [2, 3, 4]. But this technique directly affects the result. The nearby regions are not considered. Prior knowledge based approaches: In this technique the anatomical knowledge about the liver size and position that is below heart at its right etc. is used to segment the liver region properly [5]. Active counter models: It is the most widely used method in liver segmentation [6, 7]. Despite of the consistency and simplicity there are some problems with this technique. If the initial position of the snake is not close to the desired contour in image it will not give the correct result. This problem affects every time whenever there are concavities or sharp corners in gray level image.

## I. PROPOSED METHOD

In this paper we present a segmentation method based on region growing. For the segmentation of intensity images there are mainly four techniques first threshold techniques, boundary based methods, region based methods and hybrid techniques. In threshold techniques, all the pixels whose values lie within certain range belong to one class. Such methods neglect all of the spatial information of the image and

do not cope well with noise or blurring at boundaries. Boundary based method: is based on the concept that the pixel values change rapidly at the boundary between two regions. In this method a gradient operator is applied. Converting the edge pixel at the boundaries to the region of interest is a difficult task. The region based methods: use the postulate that the neighboring pixels within one region have similar values. The method compares each pixel with its neighbor if the criteria s satisfied the pixel is said to belong to the same class or to its neighbor. The hybrid techniques: combine boundary and the region criteria.

In region based segmentation each of the pixels in a region is similar with respect to some characteristics or computed property such as color, intensity or texture. If the similarity criteria are not met accurately it produces undesirable results. Following are some of them

- I. The segmented image may be smaller or larger than the actual
- II. Over or under segmentation of the image
- III. Fragmentation

Region growing is a simple region-based image segmentation method. This method examines neighboring pixels of seed point and determines whether the neighboring pixel should be added to the region [8, 9]. This process is repeated until all pixels belong to some region. Region growing approaches uses the important fact that pixels which are close together have similar gray values. This method often gives very good segmentation results.

*Basic concepts of seed point:*

The first step in region growing is to select a seed point. The regions are then grown from these seed points to adjacent points depending on similarity criterion. Since regions are grown based on the similarity criteria the information which is provided by the image is very important such as intensity threshold value, histogram of the image etc.

Important issues about region growing are:

- The selection of suitable seed point
- The similarity criteria
- The value of minimum area

Some advantages and disadvantages of region growing

Advantages:

- It can correctly separate the regions that have same properties we define.
- It can provide the original images which have clear edges the good segmentation results.

- Need a small numbers of seed point and then grow the region a simple concept.
  - Good noise immunity
- Disadvantages:
- The computation time is large.
  - Noise or variation of intensity may result in holes.

**II. DESCRIPTION OF THE METHOD**

Image pre-processing:

Median filter is used in pre-processing step in order to enhance morphological definition of the input image by sharpening discontinuities, and removing noise in homogeneous regions while preserving object boundaries and fine details.

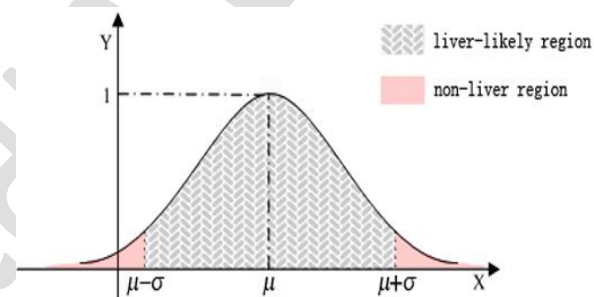


Figure 1: Gaussian function

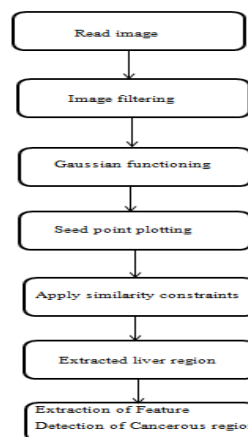


Figure 2: Diagram of the proposed system

Along with the filtering we introduced Gaussian function so that the output image will be more adaptive for

liver segmentation. The Gaussian function is a symmetric bell shaped curve as shown in Fig.2. Here,  $\mu$  is the mean whereas  $\sigma$  is the variance. The pixels with the intensities in the range  $\mu-\sigma$ ,  $\mu+\sigma$  have higher probability to fall in the liver region. Otherwise they are deemed as non-liver pixels.

Segmentation of liver using region growing:

Along with liver segmentation method we are combining prior knowledge about the liver. That is the information regarding the location of liver in abdomen, its size and intensity distribution. The region growing process starts with plotting of seed point  $SP$  which is obtained automatically. Mean of the input image is calculated whose coordinates are denoted as  $(x_c, y_c)$ . The region is then grown from this seed point  $SP^n$  by adding the neighboring pixel whose satisfies the similarity constraints given by equation (5).

$$| I^n(x, y) - \mu^n | < \sigma^n \quad (5)$$

Where  $I^n(x, y)$  is the intensity value of pixel  $(x, y)$ .  $\mu^n$  represents the average intensity value of the grown region while  $\sigma^n$  is the standard deviation value. This can be calculated as follows:

$$\mu = \frac{1}{N} \sum_{i=1}^N I^n(x_i, y_i)$$

$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (I^n(x_i, y_i) - \mu)^2}$$

Extraction of features for segmentation of liver cancer region

Image features extraction stage is very important in image processing techniques. After the segmentation of liver region the features can be obtained from the segmented liver region. The features used are

- Area of interest
- Contrast enhancement.

The first feature is used to eliminate isolated pixels and a very small candidate. This eliminates a good number of extra regions. The second feature contrast enhancement, in this less than 15 HU has a very high predictive value for benignity (99%).

### III. RESULTS AND DISCUSSION

We have performed experiment on variety of CT images. Figure 4, shows an abdominal CT scan image of a patient with

liver tumor. The liver is located along the left half of the image. With the help of pre-processing and region growing method the liver is segmented from CT image. The segmented liver is shown in Figure 5. Our experiment was performed on CT data sets stored as JPG images, 512 by 512 pixels with a 12 bit gray level resolution. The results showed that the tested images had fast and reliable segmentation. After segmentation is performed we can locate the cancerous region by using the feature extraction as it can be seen in Figure 6. The efficiency of the proposed system is better. We developed a technique for automatic segmentation of CT liver image.



Figure 3: Abdominal CT image

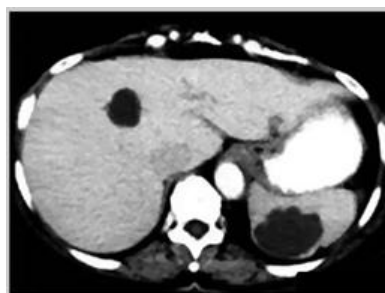


Figure 4: Enhanced image

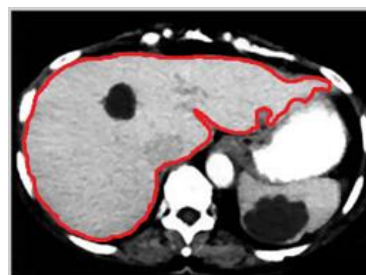


Figure 5: Segmented Liver Region

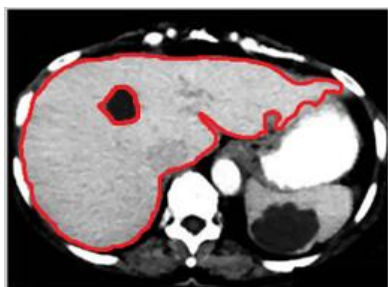


Figure 6: Cancerous region



Figure 7: Normal liver

#### IV. CONCLUSION

The Liver region segmentation is a challenging task due to the large variations in liver size, shape and similar intensity of the neighboring organs. In this paper, we proposed automatic liver region segmentation from CT images based on region growing method, which can be a useful tool in medical image segmentation. Region growing method is a rapid, robust and easy to use in image segmentation procedure. It also requires the input of control point known as seed points. The proposed system identifies the cancerous region accurately. The experimental results show that the efficiency and the accuracy of the proposed system.

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