A Study of Different Methods for Liver Tumor Segmentation

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Abstract - *Liver Cancer is one of the most serious disease in human body because it cannot detect in earlier stage so the diagnosis of the liver cancer is difficult for prediction therefore detection in earlier stage of liver cancer is the main problem. If it is detected earlier then it can be helpful for the medical treatment, but it is a challenging task due to the cancer cell structure. To reduce such problems, segmentation and detection techniques for scar tissue and normal tissue in liver image is used. Computed Tomography (CT) is highly accurate for liver cancer diagnosis. Manual identification of tumor done by trained physicians is a time consuming task and can be subjective depending on the skill, expertise and experience of the physician. In this paper, the sophisticated hybrid systems are proposed which is capable to segment liver tumor from a liver CT image and detect the scar tissue and normal tissue in liver tumor automatically.*

***Key Words*:Liver Images,Preprocessing,contrast enhancement,adaptive filtering,majority filter,Noise elimination,Feature extraction.**

1.INTRODUCTION

Liver cancer is the most common cancers and it has become the greatest killer which is dangerous for human health. Liver cancer is the malignant tumors which grow rapidly, it always occur at the age of 45 to 65, If patients never seek medical diagnosis until the symptoms occur, it indicate the liver cancer is of a final stage. Therefore, if the liver cancer cannot be diagnosed in early stage and get proper medical treatment, patients often die within half a year after the liver cancer diagnosed. Therefore, how to prevent the occurrence of liver and the treatment of liver cancer of has become the very important issue.

The symptoms of the liver cancer are starts due to excess of fat in liver and it is out of the capacity for save in the liver. At this time, the normal tissues in the liver will change into the warehouse for saving fat so, tissues in the liver cells and around liver cells all becomes fat organizations. Because of this, the liver cells cannot get enough blood supply, and result in absorbing less nutrients and oxygen than they require. It is prone to inflame or necrosis. Liver inflammation will stimulate the proliferation of fibrous tissue in the liver, these fibrous tissues then become scar tissue and surround the liver cells and change into the fake hepatic lobule. After affected by some additional carcinogenic factors, it transformed into liver cancer [2]. Initial phase of liver cancer does not show any disease status. Even some large tumors will also not cause pain or other disease symptoms until late liver cancer. In late liver cancer, tumor is large enough to directly pressure to the large blood vessel and make damage to liver function. Tumors may also break and bleed then cause to abdominal intense pain, even shock and die because loss too much blood.

Liver tissue image segmentation is to segment scar tissue and normal cells in the image, in this study, both of the features are used in judging and segmenting. In general, the scar tissue in late phases of the liver cancer, the distribution area is larger and more closely, and the color is darker than normal cells. The segmentation method consists of five stages, the first stage is pre-processing, main operation is to convert color images of liver tissue to gray scale images. The second stage is the contrast enhancement methods, at this stage, pixel intensity values are used to increase contrast enhancement of image, it makes a clear distinction between scar tissue and normal cells. The third stage is cross adaptive filter, which uses cross mask to scan the entire image, and by adjusting the mask size to improve the effects of ambient light uneven. The mean and standard deviation values are used to set two thresholds, which can convert an image to binary Images and then extract the scar tissue. After aforementioned processing, there is still a little voids and redundant tissues, the fourth stage is using the majority filter to fill these voids and remove redundant tissue. Finally, the fifth stage dealing with small residual noise. In this stage, regional label methods are used to reduce noise.

2. PROPOSED SYSTEM

2.1 Scope:

The proposed method is to reduce the processing time, error of human judgment, and human resources. In this method to automatically cut and extract feature from liver tissue image. This method is also propose a liver cancer phases recognition system to identify the phases of liver cancer, and expect that it can assist expert to diagnose the phase of liver cancer. Another purpose of this study is to determine the effect of the liver cancer drug to patients with liver cancer. Then, it is able to tell the efficacy of this drug to liver cancer. To assist doctors in determining the phases of liver cancer, develop a system that can automatically cut scar tissue in liver tissue image and identify the phase of liver cancer.

2.2 Flow chart:

Basic flow chart of content based liver cancer phase recognition system.
The proposed work involving steps:

Selection of liver images: The user will provide the CT liver images of different phases.

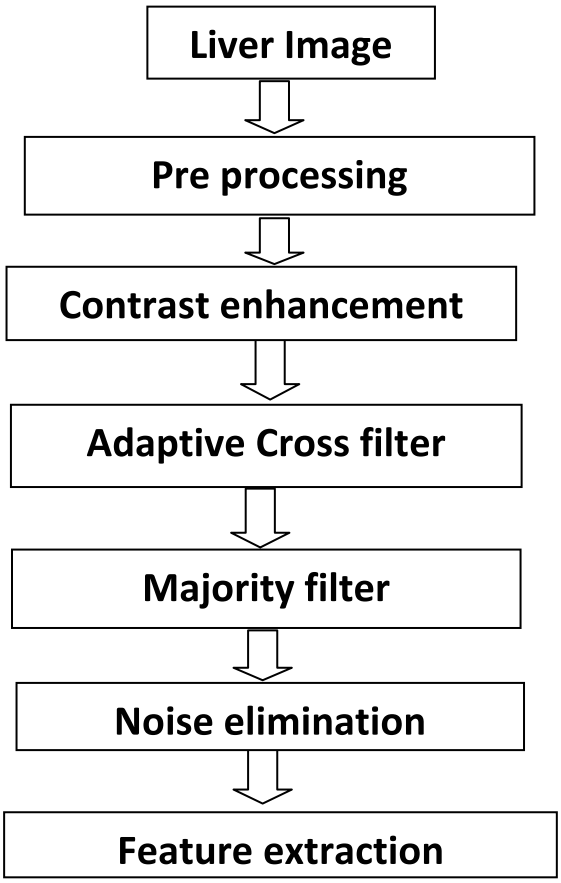

Fig -2: Flow chart of proposed system.

Segmentation: Liver tissue image segmentation is to segment scar tissue and normal cells in the image. The segmentation method consist of five stages.

Preprocessing: The main operation is to convert color images of liver tissue to gray scale images. Convert a color image into the image of the RGB model and HSV models.

Contrast enhancement: The second stage is the contrast enhancement methods , at this stage, pixel intensity values are used to increase contrast enhancement of image, it makes a clear distinction between scar tissue and normal cells.

Adaptive cross adaptive filter: The third stage is cross adaptive filter, which uses cross mask to scan the entire image, and by adjusting the mask size to improve the effects of ambient light uneven. The mean and standard deviation values are used to set two thresholds, which can convert an image to binary Images and then extract the scar tissue. After afore mentioned processing, there is still a little voids and redundant tissues.

Majority Filter: The fourth stage is using the majority filter to fill these voids and remove redundant tissue.

Noise elimination: Finally, the fifth stage dealing with small residual noise. In this stage, regional label methods are used to reduce noise.

3. FEATURE EXTRACTION

In order to identify the liver cancer phases of the liver tissue image, this study extract features of the G component image and images which have been segmented. Assume μG, σG are mean and standard deviation of G component image pixels, respectively. For the images which have been segmented, this method extract three feature values RA、Dscar, Dnormal , RA is a ratio of scar tissue and normal cells area, Dscar and Dnormal represent the average distributed distance of scar tissue and normal cells respectively. Since these five feature values are significantly different in the different phases of liver cancer image, they are used as important features in the recognition. This study of features is in the future scope. This paper proposed only the part of segmentation scar tissue and normal cells which cut out in segmentation stage to calculate the ratio these two areas, called RA.

4. RESULTS & DISCUSSION

Liver tissue image segmentation is to segment scar tissue and normal cells in the image, in this study, both of the features are used in judging and segmenting. In general, the scar tissue in late phases of the liver cancer, the distribution area is larger and more closely, and the color is darker than normal cells. The segmentation method consists of five stage

4.1Pre-processing

In order to make the scar tissue and normal cells of color image liver tissue easier to segment, the first stage of the Pre-processing is change the original image into a gray scale image, and convert a color image into the image of the RGB model and HSV models. Figure 4.1 is the original color liver tissue image $Iorg$,Figure 4.2 to 4.7 is the RGB and HSV model component image of Figure 4.1 From these six component images, and found that, in the G component image IG, gray value difference between scar tissue and normal cells is larger than that in other component, So the G component image will be used in segmentation in this study

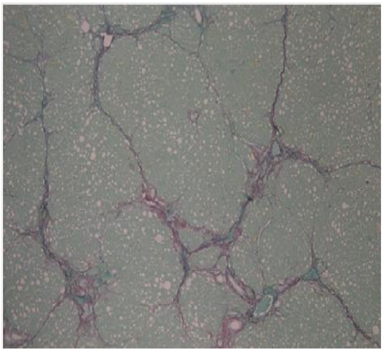

Fig-4.1: Original Image [1]

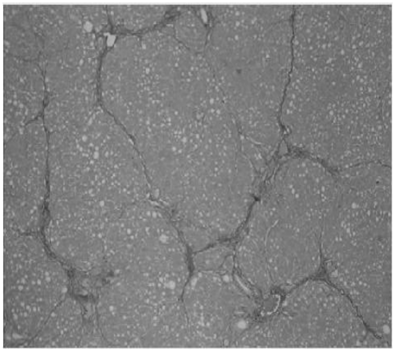

Fig- 4.2: R component of the original RGB color image.

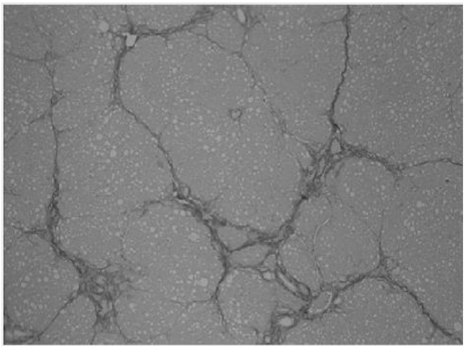

Fig-4.3: G component of the original RGB color image

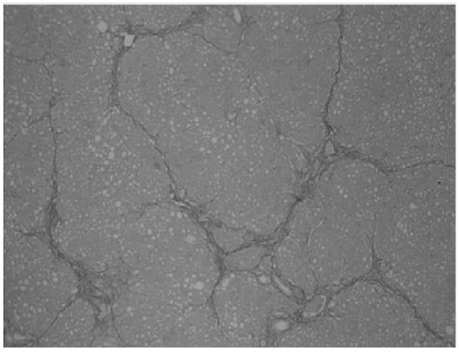

Fig -4.4: B component of the original RGB color image.

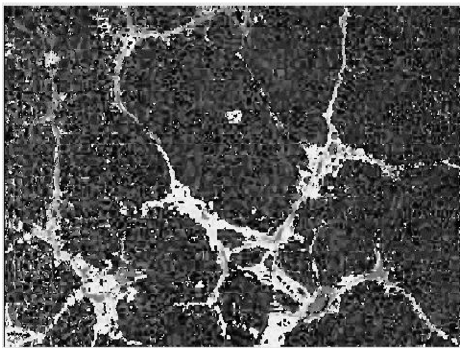

Fig-4.5: H component of the original HSV color image

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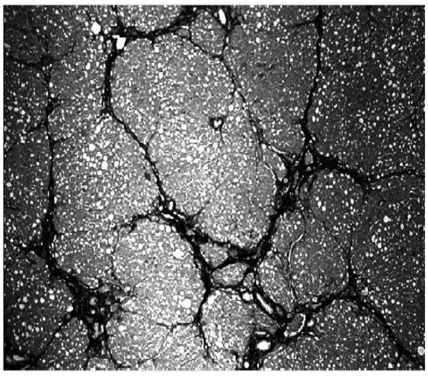

Fig-4.6: S component of the original HSV color image

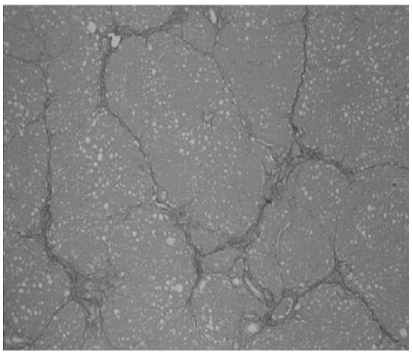

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Fig-4.7: V component of the original HSV color image

4.2. Contrast enhancement

In IG, where the bright area is the normal cells, as shown in Figure 4.3 ; where the dark areas is scar tissue, as shown in Figure 4.3 . In order to get a more clear difference between the light and dark regions, this study uses gamma equalization to enhance image contrast. This method can make the difference between scar tissue and normal cells much more clear. The result of contrast enhancement is shown in fig 4.8

Fig-4.8: Contrast enhanced image

4.3. Adaptive cross filter

Liver tissue Images are subject to the uneven light source around the image, In order to solve the impact of the light source, in this study, and use the regional threshold, however, regional threshold use the grid area filter which spend a lot of time when processing. For this reason and propose an adaptive Cross filter which set two thresholds to convert Ir images into binary images. The result of adaptive cross filter is as shown in fig 4.9

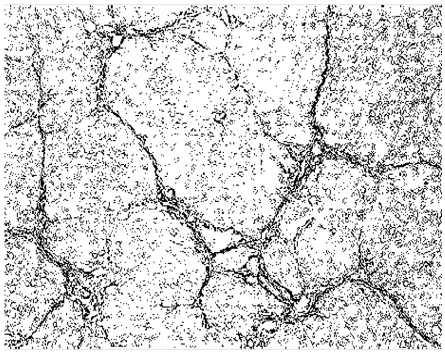

Fig- 4.9: Adaptive cross filter image

4.4. Majority filter:

After extracting scar tissue and normal cells by using adaptive Cross filter the threshold Th, some voids and redundant tissue will leave in images, as shown in Figure 4.9. In this study and use the majority filters to fill the voids and remove redundant tissue. The result of majority filter is as shown in fig 4.10

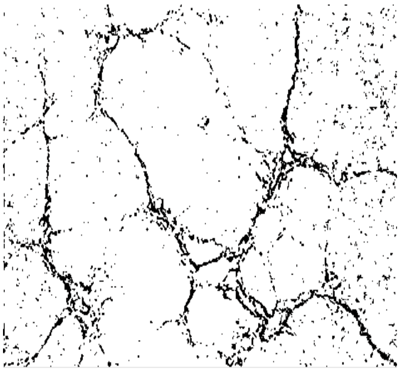

Fig-4.10: Majority filter image

4.5. Noise elimination

After filling voids and remove redundant tissue by majority filter, there are still some noise exists in image of majority filter. Generally, a small area can be regarded as noise but a large area is scar tissue. In the operation of noise elimination, a size threshold will be set to determine the area is scar tissue or noise. In this stage the region labeling methods to deal with the entire *Im*ajority image. The result of noise elimination stage is as shown in fig 4.11

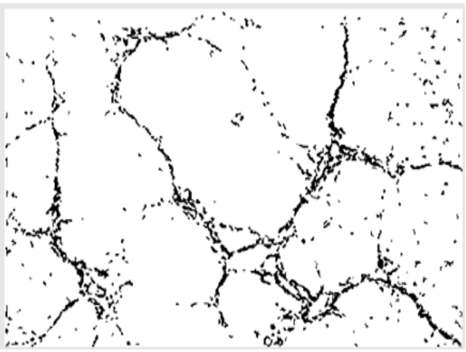

Fig- 4.11: Noise elimination image.

5. CONCLUSION

This work is carried out for image processing technology to enhance the contrast of the liver cancer tissue image and use adaptive re-use cross filter to extract scar tissue and normal cells. After reducing noise by the mode filter, the scar tissue and normal cells can be cut out, and then extract different features of scar tissue and normal cells. The future scope of the study is to extract the features and automatically detect the liver cancer phase.

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