Computer Assisted Detection of Liver Neoplasms

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Abstract

Imaging is currently performed in oncologic patients for staging. Images are evaluated by radiologist and lesions with the liver are detected manually. Currently there is no software available which is able to detect and measure tumor volumes automatically. We are developing a software that may be able to detect tumor and give volumetric measurements automatically. Using this software a radiologist may be able to compare computer generated volumetric data in serial imaging of the patients over time, which may help in assessing progression or regression of disease and help in treatment planning.

Figure 1:- Flow chart of the CADLN

(a)   (b)

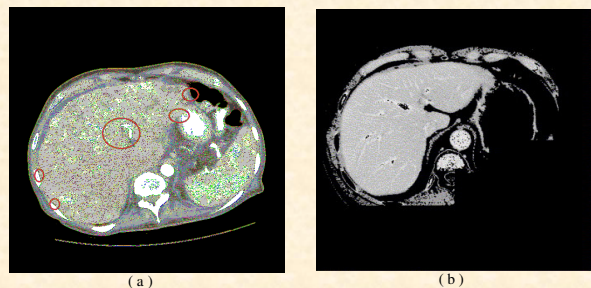Figure:- (a) Liver with different Pattern structures   (b) Threshold of the liver

(c)   (d)

Figure:- (c) Liver with saddle like structures   (d) Initial Liver Boundary

Introduction

The scanning technologies that exist today generates about images ranging from 400 to 1500 per patient. It is cumbersome and time consuming for a radiologist to study each and every image and read it . There is a need of revolution to be carried out in the image processing segment to help radiologist come up to a decision much faster than what they can do it today. By using some image processing algorithms we can try to make this process faster for them. By use of image processing algorithms we will not only develop 3D view of the organ but also we will develop and generate 3D view of tumor and prepare volumetric data of the tumor.

Apart from that we will develop case comparative study of the patient so radiologist can compare two image sets of the same patients over time.

In this case comparative study we should be able to compare two sets of data of the same patient, and be able to asses change in tumor size and volume which may help in appropriate treatment planning of the patient.

MAIN TEXT

Image Simplification:- ROI blocks, we divide the abdominal CT image into non-overlapping blocks of 64×64 pixels.

Morphological Filtering:-Image simplification classifies each pixel into clustered liver class and scattered non-liver class. Accordingly, we perform mathematical morphology filtering to reduce scattered class and detect liver object.

$$(f \ominus kB_n)(x,y) = \{(((f \ominus B_n) \ominus B_n)\cdots \ominus B_n)(x,y)\},$$
$$(f \oplus kB_n)(x,y) = \{(((f \oplus B_n) \oplus B_n)\cdots \oplus B_n)(x,y)\},$$

Region Labeling:- The technique for used for region finding algorithm is breadth-first search approach. To reduce the noise of these kinds and detect the coarse liver region, we use as 4-connected region-labeling algorithm. After performing of the region-labeling algorithm, the largest labeled region is marked as the region of the liver.

Clustering Algorithm:-This algorithm is used to filter the adjoining non-liver organs and muscles that are still remained. In order to filter we use Region classifying by the modified K-means algorithm .

Contour Based Liver Segmentation:- This algorithm is designed to deforms the initial liver boundary within the search range to find clear and final liver contour. In order to get rid of saddle like patterns or tortuous like structures we classify the entire pattern into the three cases. In the first case, the liver is adjacent to the air region which has low intensity value. The second is the case that liver is touched to the ribs or the kidney which has high intensity value. In the last case in which the liver is adjoined to the stomach or the lung, the intensity value within the liver boundary is distributed through the low gray level. We can get a correct liver contour by finding optimal path which is the minimal cost value. The local cost function combining tree features is defined as

$$l(p,q) = w_D \cdot f_D(p,q) + w_B \cdot f_B(q) + w_I f_I(q)$$

Volume Calculation:- volume measurement of the liver, we calculate the volume by using thickness and interval information of the slice and size of the pixel. The following equation is for volume measurement using the previous segmented liver region.

$$\text{Volume} = \sum_{i=1}^{N-1} (((L_p \ast X \ast Y) \text{ of } S_i + (L_p \ast X \ast Y) \text{ of } S_{i+1})/2) \ast D,$$

Conclusion:-

The system will help the radiologist in finding and detecting and measuring tumor. Apart from this the software will provide volumetric data of the tumor thus helping in treatment planning. The software will help save plenty of time for the radiologist, in this era of image based healthcare. 3D view provides an appropriate insight needed for surgical planning. Case comparative study enables radiologist to monitor the tumor in the easiest way possible.

Acknowledgement:-
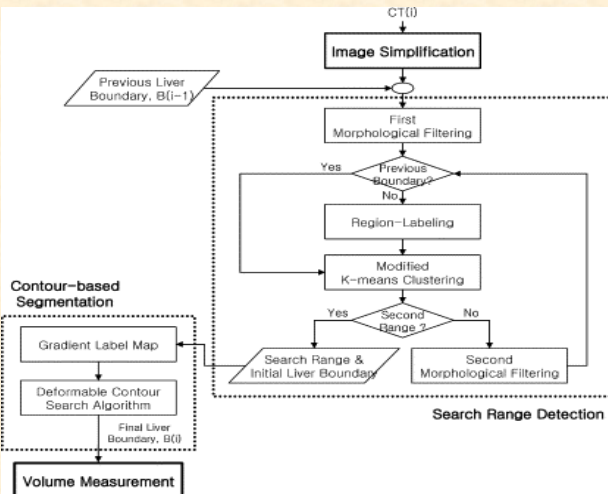
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