Computer Assisted Detection of Liver Neoplasms

Shrinivas Bhosale1, Ashish Aphale2, Issac Macwan2, Kshama Rane1, Prabir Patra1,3
(University of Bridgeport), Priya Bhosale4 (M.D. Anderson University Of Texas),
1 Department of Biomedical Engineering, 2 Department of Computer Science and
Computer Engineering, 3 Department of Mechanical Engineering, 4 Department of Diagnostic Radiology

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 compute 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.

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
tumor 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 assess 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 x 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.

Region Labeling
- The technique used for region finding algorithm is breath-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 deform 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 adjacent 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

\[ C(x, y) = w_p f_p (x, y) + w_q f_q (x, y) + w_r f_r (x, y) \]

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
valid for volume measurement using the previous segmented liver region.

\[ V = \sum_{i=1}^{N} \left( L_p \times L_c \times Y \right) \text{of} \ S_i \]

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.

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Automated Retrieval of CT Images of Liver Lesions on the Basis of Image Similarity
Sandy A. Napel , PhD Christoph F. Beaulieu , PhD , MD, Cesar Rodriguez , MD, Korenblum , MS, Hayat Greenspan , PhD, Yongjun Ma , PhD, Daniel
Jungyu Cui , MS, Fajing Xu , MS, Ankit Gupta , BS, Daniel
L. Rubin , MD, MS
Image Analysis for Liver Tumor Ablation Treatment Planning
Yrjo Hame, Tuomas Alhonnoro and Mika Pollari