AUTOMATED LIVER SEGMENTATION FOR MULTI-CONTRAST CT IMAGES

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1. AIMS

•Fully automated method
- be automated and able to segment the liver from CT volumes

•Applied on different CT contrast types
- be applied for low- and high– contrast CT volumes from stand-alone CT or PET/CT scanners

2. MOTIVATION OF LIVER SEGMENTATION

•Living donor liver transplantation
- Volume of the potential graft and recipient must be measured to ensure sufficient liver function after surgery
- The measure of liver volume still relies on manual segmentation from expert radiologists

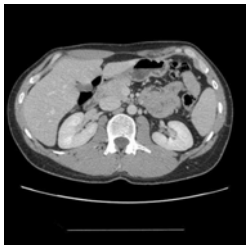
•Radiation liver cancer treatment
- Diagnosis of liver cancer
- Assessment of treatment and therapy response
- Liver cancer surgery planning or navigation

3. CHALLENGES

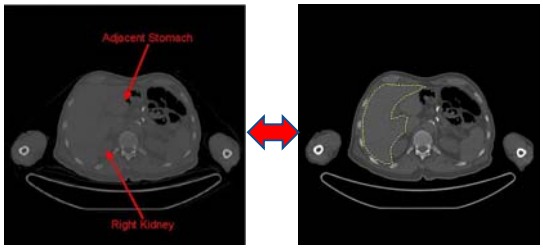
•Complexity of liver shapes and variable liver sizes among patients

•Relatively low-contrast characteristic of CT images from PET-CT scanners
- Compared to high-contrast CT images from stand-alone CT scanners
- More difficulty in detecting gradient differences among neighbour organs

•Similar intensity ranges
- Shared among internal organs (e.g. liver, stomach)
- Result in blurred boundary for internal organs

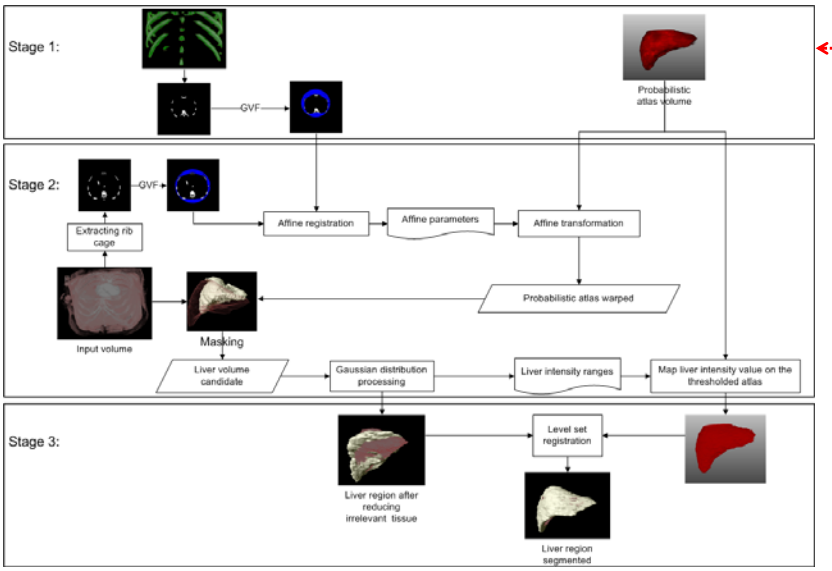


High-contrast CT image

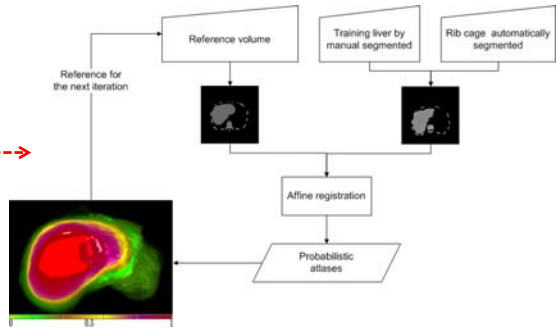


Low-contrast CT images with/without liver contour

4. OUTLINE OUR ALGORITHM



- **Construct an iterative probabilistic liver and rib cage atlases to fully utilize statistical prior knowledge to better predict the shape and size of liver from the target CT volume**



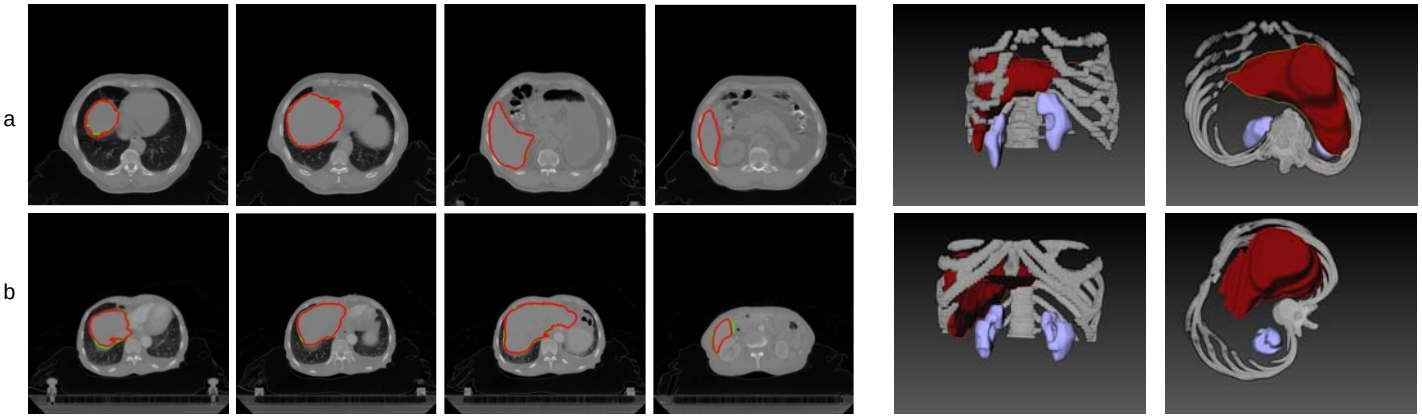
- **Use the relatively rigid characteristics of the rib cage to better locate the mapping position from the probabilistic atlas to the CT input volume**
- **Improve the accuracy of liver segment after the step of tissue classification by using level-set method**

5. EXPERIMENTS

•Our datasets comprised 40 normal studies, including 10 low-contrast and 30 high-contrast CT volumes, which were manually segmented by experienced radiologists.

•25 datasets were randomly chosen to build the atlases and the remaining 15 were used for testing the segmentation performance.

•Our liver segmentation method has been compared with two other methods based on probabilistic atlas [1,2]. Two evaluation criteria were employed to quantify the performance of the segmentation. Our results showed improved segmentation performance and accuracy.



Automated segmented liver results for two CT studies presented by 2D results and 3D demons in row a, b respectively

[1] M. G. Linguraru, et.al., "Automated liver segmentation using a normalized probabilistic atlas," *Medical Imaging 2009, Proc. of SPIE*, vol.7262, pp. 72622R-72622R-8, 2009.
[2] X. Zhou, et al., "Constructing a Probabilistic Model for Automated Liver Region Segmentation Using Non-contrast X-Ray Torso CT images," the Proc. of 9th International Conference for MICCAI, 2006.

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