

AbstractID: 10696 Title: Computer-Aided Measurement of Liver Volumes in CT by Means of Fast-Marching and Level-Set Segmentation

Purpose: Measuring the liver volume by manual tracing of the liver boundary on arterial-phase CT images is time-consuming. Our purpose was to develop an automated liver extraction scheme based on a 3D level-set segmentation technique for measuring liver volumes.

Material and Methods: Hepatic CT scans of eighteen prospective liver donors were obtained under a liver transplant protocol. We developed an automated liver segmentation scheme for volumetry of the liver in CT. Our scheme consisted of five steps. First, a 3D anisotropic smoothing filter was applied to CT images for removing noise while preserving the structures in the liver, followed by an edge enhancement filter and a nonlinear gray-scale enhancement filter for enhancing the liver boundary. By using the boundary-enhanced image as a speed function, a 3D fast-marching algorithm generated an initial surface that roughly estimated the shape of the liver. A 3D level-set segmentation algorithm refined the initial surface so as to fit the liver boundary more accurately. Automated volumes were compared to manually determined liver volumes.

Results: The mean liver volume obtained with our scheme was 1598 cc (range: 1002-2415 cc), whereas the mean manual volume was 1535 cc (range: 1007-2435 cc). The mean absolute difference between automated and manual volumes was 128 cc (9.5%). The two volumetrics reached an excellent agreement (the intra-class correlation coefficient was 0.89) with no statistically significant difference ($P=0.13$). The processing time by the automated method was 2-5 min. per case (Intel, Xeon, 2.7 GHz), whereas that by manual segmentation was approximately 50-60 min. per case.

Conclusion: CT liver volumetrics based on an automated scheme agreed excellently with manual volumetrics, and required substantially less completion time. Our automated scheme provides an efficient and accurate way of measuring liver volumes in CT; thus, it would be useful for radiologists in their measurement of liver volumes.