AbstractID: 12929 Title: 3D Segmentation and Rigid Registration for Minimizing Breathing Motion Effects in Liver CT Perfusion

Purpose: To develop an automatic framework for 3D segmentation and registration of partial liver volumes acquired with a free breathing dynamic CT scan for perfusion imaging. **Method and Materials:** The free-breathing liver CT Perfusion protocol acquired volumes of 8 cm thick liver sections as two separate 4 cm thick sub-volumes sequentially at a time interval of 2.8 s. A total of 40 volumes were acquired over approximately 2 min to cover the entire portal phase of the liver circulation. The breathing motion correction algorithm consists of 4 sequential steps: 1: Semi-automatic 1D box registration using cross correlation of liver boundaries and liver specific features such as liver hilum or falciform ligament to align liver volumes acquired over time in the cranio-caudal direction and generate a time averaged liver volume. 2: Automatic segmentation of the time averaged liver volume from (1). 3: Automatic segmentation of the liver in all images volumes using the liver contours from (2) as a shape model. 4: Full 3D surface registration of the volumes segmented in (3) to preselected reference liver volume. The framework has been validated by applying it to images with known rotations and translations, as well as images from patient perfusion scans. **Results:** Model based segmentation is capable of segmenting all tested liver images even with poor choices of initial contours with no more than 150 iterations. 3D registration noticeably reduces misalignment artifacts at liver edge due to rotation and in-plane translation compared to only transaxialy aligned images. **Conclusion:** Model based segmentation allows segmentation of high noise low contrast liver images when using a patient specific model generated from a time averaged CT. The multi-step 3D registration improves organ alignment compared to 1D registration and reduces breathing motion artifacts in the calculated CT perfusion maps.