AbstractID: 13447 Title: Reduction of irregular breathing artifacts in respiration-correlated CT images using a respiratory motion model

Purpose: Respiration-correlated CT (RCCT) images produced with commonly used phase-based sorting often exhibit discontinuity artifacts between CT slices. Displacement-based sorting reduces artifacts but missing image data (gaps) may occur. We investigate the application of a respiratory motion model to produce an RCCT image set with reduced artifacts. **Method and Materials:** Input data consist of CT slices from a cine scan acquired while recording respiration by monitoring abdominal displacement. Model-based generation of RCCT images consists of 4 processing steps: 1) sorting of CT slices according to respiration signal displacement to form volume images at 10 motion states over the cycle; 2) deformable registration between a reference image at one motion state and each of the remaining images; 3) generation of the motion model by applying a principal component analysis to establish a relationship between displacement field and respiration signal at each motion state; 4) application of the motion model to deform the reference image into images at the 9 other motion states. Evaluation is in cine scans of a body phantom programmed to move according to a patient respiratory signal, and in patient thoracic scans. **Results:** Comparison in phantom shows that object distortion caused by variable motion amplitude in phase-based sorting is visibly reduced with model-based RCCT. Artifacts in patient images at different motion states are also reduced. Comparison with displacement-sorted images as a ground truth shows that the model-based images closely reproduce the ground truth geometry at different motion states. **Conclusion:** Preliminary results in phantom and patient images indicate that the proposed method can produce RCCT image sets with reduced artifacts relative to phase-binned images, without the gaps inherent in displacement-binned images. Further study is needed in phantom and patient cine CT scans, including ones with more highly irregular breathing patterns. Research supported by NIH/NCI grant R01 CA126993.