AbstractID: 6940 Title: Reducting of motion artifacts in cone beam CT using a patient specific respiratory motion model

Purpose: Respiratory motion degrades the quality of cone beam computed tomography (CBCT) images in the thorax and abdomen and limits its localization accuracy. We describe a method of reducing motion-induced artifacts in CBCT images in the thorax using a patient-specific model to estimate 3-dimensional respiration-induced motion.

Method and Materials: The patient-specific model is derived from, and applied to, the same CBCT data, thus avoiding inconsistencies caused by changes in patient's breathing pattern when using different image sets. The CBCT scan uses a 1-minute gantry rotation while recording patient respiration with an external monitor. The projection images are sorted into 4 to 6 phase bins according to the respiratory signal. Each phase bin is reconstructed to produce a series of 3D images. Nonrigid image registration calculates a series of deformation fields that maps each 3D image to a reference image at end expiration. A principle component analysis (PCA) reduces noise and redundancy in the deformation fields. The resultant deformation fields correct each 3D image by morphing it to the reference motion state. The corrected 3D images are combined to obtain a high-resolution CBCT image. We evaluate the model by comparing CBCT images before and after motion correction, in patients receiving radiation treatment for lung cancer.

Results: Motion-corrected CBCT images show less respiration-induced blurring and streaking artifacts compared to standard CBCT. Fine-detailed features in lung tumor and airways become visible, and the liver boundary is more discernable.

Conclusion: Preliminary results indicate that the proposed method is a potentially useful tool for improving CBCT image quality and localization accuracy in the thorax. Repeating the process at other phase bins can yield a high quality respiration-correlated (4D) CBCT image set for evaluating respiration-induced motion.