AbstractID: 12697 Title: Lung CBCT motion deblurring using tumor tracking in rotational cone-beam projections

Purpose: To develop an algorithm for the removal of motion blurring artifacts from CBCT images of lung tumors using knowledge of a tumor's motion on the day of treatment acquired by tracking the tumor in rotational cone-beam projections. **Method and Materials:** DRR templates derived from 4DCT were used to track lung tumors in rotational cone-beam projections. Tracking results acquired during a CBCT scan were used to estimate a motion pdf. This pdf was incorporated into a deconvolution algorithm which removes motion artifacts from the reconstructed CBCT volume. Deconvolution is performed through iterative minimization of a cost function $E = \| f * g - i \|_2^2 + \lambda \| g \|_{TV}$, where i is the original CBCT image, g is the deblurred image, f is the motion pdf, and λ is a weighting parameter. The second term is a total variation norm regularization defined as $\| g \|_{TV} = \int |\nabla g(x)| dx$. The algorithm is tested on physical phantom and patient data. For the phantom, CBCT scans were acquired for moving and stationary phantoms. Deconvolution was performed on the image of the moving phantom, which was then compared to the image of the stationary phantom. For patient data, deconvolution is performed on a CBCT acquired on the day of treatment, then compared to 4DCT acquired during simulation. **Results:** Images of the physical phantom show a good match between deblurred, and stationary cases. Line profiles show that the correct tumor dimensions are recovered. For the patient case, motion artifacts are significantly suppressed in the deblurred volume, which appears qualitatively similar to the 4DCT. **Conclusion:** An algorithm has been developed to remove motion blurring artifacts from CBCT tumor images based on a tumor's tracked motion during the CBCT scan. The algorithm successfully recovered motion-corrected images in a phantom study, and removes some artifacts in the patient case.