AbstractID: 10944 Title: Markerless fluoroscopic tracking of lung tumors based on 4D CT

Purpose: To develop a markerless fluoroscopic lung tumor tracking algorithm based on 4D CT generated reference templates.

Method and Materials: Fluoroscopic images were acquired at a sampling rate of 15Hz using an on-board X-ray imaging (OBI) system. Each fluoroscopic image has a resolution of 768 by 1024, where each pixel represents a physical size of 0.26 mm. 4D CT was obtained from phase sorting based on internal anatomic features. DRRs were generated from 10 phases of the 4D CT, of which inhale and exhale DRRs were shifted to cover a greater motion range. These DRRs served as the reference templates for tracking purposes. GTV contours from the 4D CT give the reference tumor positions in the templates. Motion enhancement was applied to both DRR templates and fluoroscopic images. Pearson's correlation was calculated between each fluoroscopic image and each template in a given ROI. The tracking output is the weighted average of the tumor positions in those templates with largest correlation scores, weighted by the corresponding correlation scores.

Results: RMS tracking error ranges between 0.65mm and 0.77mm. Absolute error at 95^{th} percentile ranges between 1.41mm and 1.58mm. These values are well within the error bounds obtained from earlier studies, which require human-marked tumor positions in the fluoroscopic images for training.

Conclusion: This work demonstrates the feasibility of tracking lung tumor fluoroscopically based on 4D CT templates. Future work involves more sophisticated image processing and computer vision techniques to obtain more robust tracking results.