AbstractID: 10291 Title: Markerless Lung Tumor Tracking in Rotational Radiotherapy

Purpose: To develop a method to track lung tumors in rotational cone beam projections during rotational radiotherapy and cone beam CT scanning.

Method and Materials: A multiple template based tracking algorithm was developed and used to track tumors in rotational cone beam projections. Templates were generated by creating DRRs of ten phases of 4DCT. These templates were generated for a sequential set of angles matching the projections of a CBCT scan. The position of the tumor in each template was derived from contours drawn on 4DCT. Shifting of the templates was used to allow for a greater tumor motion ranges. The mutual information between projections and templates was computed and used as one parameter in a probability function used to track tumor position. Tumor distance traveled and phase change between successive projections were also incorporated into the probability function. This output was compared to physician specified tumor locations on each cone beam projection. In addition to a patient study, the method was tested on a respiratory motion phantom programmed to exhibit sinusoidal motion in the SI direction.

Results: In the phantom study, the SI motion of the tumor was tracked with a mean absolute error (MAE) ranging from 1.2mm to 1.6mm and a 95th percentile absolute error (P_{95}) ranging from 3.2mm to 3.7mm. For the patient study, the SI motion was tracked with MAE ranging from 1.7mm to 1.9mm and P_{95} ranging from 3.4mm to 3.9mm.

Conclusion: The algorithm has demonstrated the feasibility of tracking tumors in rotational x-ray images. Further development is needed in order to achieve accuracy similar to that of fixed gantry fluoroscopic tracking.