AbstractID: 9391 Title: A trajectory estimation method of moving target from cone beam CT projection images

Purpose:
The aim of this work was to develop and investigate a method for trajectory estimation of a moving target from cone beam CT projection images. It can be useful for assessment of respiratory tumor motion just before or during treatment, and for developing further respiratory compensation strategies.
Method and Materials:
Six lung tumor trajectories with range of motion larger than 10 mm, acquired using a CyberKnife system, were used to simulate CBCT acquisition. To reconstruct 3D positions from projected positions, the two nearest angular projection images with the same SI-projection positions were used for triangulation. With the triangulated positions, a linear correlation was assumed for tumor motion. LR and AP positions were then derived from SI positions using the linear model. The estimated 3D tumor positions were compared with the known positions. To demonstrate the real simulation, CBCT projection images for a seed-embedded moving phantom were acquired using a Varian OBI system. A 3D motion platform was used to drive the phantom with one of six trajectories. The marker position from each projection image was extracted using Varian RPM-Fluoro application.
Results:
The mean estimation errors were within 0.3±1.8 mm while errors of up to 4 mm were observed. In general, higher correlation coefficients with SI-motion provide better estimation of AP and LR positions. Applying the center offset of OBI imager (xOffset=-2 pixel, yOffset=0 pixel), the remaining uncertainty associated with gantry sag and marker extraction (~1 pixel) was within ~0.5 mm.
Conclusion:
The proposed method provides useful information for tumor motion characteristics such as the mean position, range, and principal direction of motion which can be useful for respiratory compensation treatments.
Conflict of Interest:
Research supported by Varian Medical Systems.