AbstractID: 7584 Title: Evaluation of an automatic algorithm based on kernel principal component analysis for segmentation of the bladder and prostate in CT scans of prostate radiotherapy patients

Purpose: to evaluate the performance of an automatic segmentation algorithm used to segment the prostate and bladder in CT scans of patients undergoing external beam radiotherapy.

Method and Materials: A non-linear kernel principal component analysis (KPCA) based algorithm has been developed to model the surface shapes of soft tissue organs in the pelvis of prostate patients. A library of 25 patients, each with approximately 13 CT scans acquired during their treatment, has been manually segmented by a physician. The library is used to both train and evaluate the algorithm. In this preliminary analysis, the training sets consisted of the contours from 8 to 10 scans of a single patient. Evaluation was performed using 3 CT studies previously unseen by the system from each patient, from the beginning, middle and end of treatment. Performance was measured by comparing the volumes and center-of-gravity positions of the generated surfaces with those of the physician-drawn surfaces. The prostate shapes were also compared by generating maps of the surface separation after center-of-mass alignment. Three models were evaluated: a prostate-only model, a bladder-only model, and a joint prostate-bladder model.

Results: All models demonstrate the ability to successfully segment the soft tissue structures in the majority of cases. The average ratios of the prostate and bladder overlap volumes to the references volumes for the first seven patients were found to be 0.829 and 0.868 for the prostate only and bladder only models. The joint model results are similar, the corresponding ratios being 0.853 and 0.844. Surface separations for the two models were similar, the models generally being within 1 mm of the physician-drawn shapes at mid-organ, and along the right and left sides.

Conclusion: Preliminary results from the proposed automatic segmentation method indicate it is sufficiently accurate for radiotherapy applications.