AbstractID: 10415 Title: A Fast Deformable Model based 3D Registration Algorithm for Image Guided Prostate Radiotherapy

Purpose: To present a novel and fast registration method based on soft tissue, i.e., prostate, to capture the transformation between the planning 3D CT images and treatment 3D cone-beam CT images for external beam radiotherapy of the prostate. **Method and Materials:** We present a global-to-local shape registration framework as well as an automatically segmentation method in the 3D CBCT images. The global registration is based on mutual information method and the local registration is based a deformable superquadric framework to minimize the Euclidian distance of the corresponding nodes from global transformation. The method is applied on 6 datasets consisting of both planning CT and CBCT images of prostate patients. The target volumes delineated by a same radiation oncologist were chosen as the gold standards and were compared with the segmented and registered results. **Results:** The quantitative segmentation results are summarized in Table 1 and 2 of the supporting materials. Table 1 shows the distance-based estimator and volume-based estimator between the segmentation results of our algorithm and those of the gold standards. The mean distance ranges from -0.17 mm to -0.85 mm and the overlap ratio ranges from 79% to 91%. These results demonstrate reasonably good agreement between the segmentation results and the gold standards. Table 2 shows that the mean overlap ratio ranges from 85.2% to 95% of the prostate volumes after registration. On the average, the entire segmentation and registration time was about 2 minutes. **Conclusions:** We present a novel and fast deformable registration method to capture the transformation between the planning and treatment images for external beam radiotherapy. We also present the promising results of our method applied to clinical datasets. These preliminary results show that the proposed method is robust and reasonably fast for the registration of the deformable soft tissue of prostate.