AbstractID: 11298 Title: Image Feature-based Tumor Shrinkage Modeling in Head and Neck Cancer for Adaptive Radiation Therap

Purpose: A novel technique was developed to model the tumor shrinkage/growth in response to radiotherapy in head-n-neck (HN) cancer to better understand the therapeutic process and compute the cumulative dose for adaptive radiation therapy (ART).

Methods and materials: Five HN patients were enrolled in the study. For each case, 8~10 pre-treatment cone beam computed tomography (CBCT) images were acquired using the Varian Trilogy on-board imager. Planning CT and gross tumor volume (GTV) for each patient was used as a template. An image feature based model was employed to establish the correspondence between planning CT and CBCT. Due to the non-conservation of the image contents, similarity based deformable model cannot be solely used. Two-step procedure was adopted: homologous tissue features shared by the planning CT and CBCT were detected and their correspondence was matched using the Scale Invariance Feature Transformation method. This was followed by a registration of the rest points using a basis spline interpolation. A bi-directional mapping was developed to increase the precision of tissue feature correspondence. The proposed model was tested with a number of digital phantoms with introduction of artificial volumetric changes.

Results: The application of the bi-directional feature based model to digital phantoms revealed that the artificial volumetric changes could be modeled accurately. The error of GTV boundary between the modeled and the ground truth was less than 1mm. For the clinical cases, the new algorithm worked reliably for a reasonable volume change (<35%), indicating the time span between two consequent imaging sessions should not be unreasonably far away in order for the model to function properly.

Conclusions: We developed an image feature-based model to derive the tumor change kinetics to better understand the tumor response to radiotherapy. The new model will find its wide spread application in ART for HN cancer.