AbstractID: 10578 Title: MVCT Auto-contouring for Adpative Radiation Therapy

Purpose: We develop a megavoltage computed tomography (MVCT) auto-contouring strategy through contour propagation from planning kilovoltage CT to MVCT. Daily pre-treatment MVCT taken on the Helical Tomotherapy (HT, TomoTherapy, Inc, Madison, WI) can be used to adaptively modify existing treatment plans provided that we have reliable auto-contouring tool so we may realize and maximize the potential for adaptive therapy using HT.

Methods and Materials: The study includes five head-and-neck (HN) and five prostate patients. For each case, physicians outline all regions of interest (ROIs) on the planning CT. Daily MVCTs are acquired during patient setup. Scale Invariance Feature Transformation (SIFT), a feature detection algorithm, is used in contour propagation. Distinctive features from the local area of each ROI are automatically detected on input images and their correspondences are established with the SIFT algorithm. Based on the matched pairs, a spline interpolation is used to register the rest of the points and to obtain a deformation field which is used to warp the contours from the planning CT to the MVCT. Special attention is paid to rectum, bladder and tumor, where contours from various input images may differ greatly. Quantitative assessment of the proposed algorithm is also performed using a number of digital phantoms generated with known vector fields.

Results: The digital phantom experiments show that the propagation error is within 1.5 mm, establishing the high accuracy of the auto-contouring method. For clinical cases, the calculation gives a mean error of less than 3mm in HN patients. For prostate patients, the error for prostate is larger than 4mm in some areas and needs physician's editing of the automatically generated contours. Rectal contour error is within 3mm.

Conclusions: A reliable contour propagation technique has been developed for MVCT image segmentation, a useful tool to maximize the potential for adaptive therapy using HT.