AbstractID: 8990 Title: Jitter reduction in manually delineated clinical target volume (CTV) contours for prostate cancer

Purpose:

Conventionally, prostate clinical target volume (CTV) is delineated by an oncologist slice by slice in the axial plane. When being reviewed in the sagittal or coronal planes, the CTV contours are often compromised by jitters due to the uncertainties and errors induced during contouring in the axial plane. Manual contour revisions in these planes are desired, but labor intensive and tedious. We propose an automatic 3D non-shrinkage surface smooth algorithm to reduce the jitters caused by commonly adopted contouring methods.

Method and Materials:

The first step of our contour smoothing is triangulation of the polyhedral surface or the stack of 2D axial contours. Since the resolution of the CT image is non-isotropic, we revise the triangulation method so that the neighbors for each contour point are found within a sphere of a pre-defined radius. Taubin's two-step algorithm, also known as a low-pass filter design technique, is then applied to smooth the 3D CTV surface. First, each contour point is smoothed by neighbors using a Gaussian filter with a positive weight. Then, a negative weight is used to compensate for the low-frequency component loss in the first step. This procedure iterates for N times to filter out high frequency jitters while maintaining the original CTV volume. The proposed algorithm is evaluated using simulation images and real patient cases.

Results:

For the simulation study, random noises added to the artificial object surface can be filtered well and the original shape is recovered. For the patient study, the CTV contours before and after smoothing are reviewed and approved by oncologists. The jitters in the sagittal and coronal planes are significantly reduced while the overall CTV definition meets our clinical requirements.

Conclusion:

A 3D CTV surface smooth algorithm is proposed and has the potential to improve treatment optimization and target coverage for IMRT.