AbstractID: 6896 Title: A PET Head and Neck Tumor Delineation Approach based on Adaptive Region-Growing and Dual-front Active Contours

Purpose:
To present a novel, semi-automatic hybrid method for PET tumor delineation utilizing adaptive region-growing and dual-front active contours.

Method and Materials:
The process begins when an experienced radiation oncologist manually draws a rough region of interest (ROI) that encloses a tumor. The image voxel having the highest intensity is chosen as a seed point. A region growing algorithm successively appends to the seed point all neighboring voxels whose intensities >= *T*% of the mean of the current region, which is updated after each voxel is added. When *T* varies from 100 to 0, the resulting volumes increase from a small region to the entire rough ROI. With this criterion, a sharp volume increase has been observed at certain *T* values. The process uses the sharp increases as landmarks that are used to define the image intensity level that is used to define the tumor boundary.

However, the tumor volume is found to be slightly larger than the anatomically defined volume possibly due to the partial volume effect. Therefore, we use a dual-front active contour model to refine it automatically. We assign all points on the initial tumor boundary one label, and the seed point another label. Then we propagate the labeled boundaries towards each other. The evolution stops at meeting points that form the final tumor boundary.

Results:
A cylindrical phantom with seven hollow spheres of varying size (8-32mm) was constructed and scanned using a Siemens PET scanner under 12 various conditions. The method was tested on these 84 images with errors of volume overlap metric of 57.4% to 99.0% between the detected volumes and the actual volumes.

Conclusion:
This hybrid method guarantees a reproducible result for a specific image. Experimental results demonstrate the robustness, accuracy, reproducibility, and its potential usefulness in clinical radiation therapy planning.