AbstractID: 14278 Title: Impact of deformable-regsitration-based contour propagation on PET-based treatment response assessment

Purpose: Contour propagation reduces effects of physician variability and the workload associated with manual contouring. However, its effect on PET-based treatment response assessment is unknown. We compared the effects of manual contouring and deformable-registration-based contour propagation on treatment response assessment.

Method and Materials: Thirteen adult cancer patients underwent one pre-treatment and two follow-up whole body PET/CT scans using [^{18}F]FLT, a cellular proliferation marker. Manual contours of tumors were drawn on all PET images by a nuclear medicine physician. Pre-treatment contours were chosen as the reference. Pre-treatment CT was deformably registered to follow-up CTs using the fast-free-form deformable registration. Deformation fields resulting from the registration were used to propagate the reference to follow-up contours. A matching index (M=$\frac{C_{manual} \cap C_{propagated}}{C_{manual} \cup C_{propagated}}$) was used to quantify the overlapped volume of manual and propagated contours. Treatment responses using manual and propagated contours were then evaluated by calculating the relative change of SUV_{mean} (ΔSUV_{mean}) and SUV_{max} (ΔSUV_{max}) between pre-treatment and follow-up scans.

Results: Seven patients having tumors within highly deformable tissues (e.g. lung and abdomen) were observed to have matching indices less than 50%, while the minimum M (5%) was observed in a lung tumor patient. In these seven patients, the average difference in treatment response between manual and propagated contours using ΔSUV_{mean} and ΔSUV_{max} were 20% and 10% respectively. Interestingly, three patients with head-and-neck tumors were insensitive to the different contouring methods. In these patients, the differences in ΔSUV_{mean} and ΔSUV_{max} were less than 5% and the M's were as great as 90%.

Conclusion: In the regions of low deformation tissues (e.g. head-and-neck), contour propagation can potentially replace manual contouring since the difference in treatment responses was insignificant and the matching index was high. However, assistance of manual contour adjustment or improved deformable registration method is needed to fully capture deformation on highly deformable tissues.