AbstractID: 7585 Title: Nonrigid registration of mesorectal region for PET signal follow-up during radiation therapy

Purpose: We wish to achieve maximum registration performance in the region around the tumor for patients with rectal cancer to assess the changes in PET signal due to radiotherapy.

Method and Materials: A nonrigid registration was performed on nine PET-CT images of three patients with rectal cancer. We use a B-spline transformation model with mutual information as similarity criterion. The registration is performed in a multiresolution framework. To exclude the influence of differences in bladder filling, registration was limited to the mesorectum, delineated at planning time, by only calculating the similarity criterion for the control points inside the mesorectum. In the last multiresolution stages of the registration, a small, local volume constraint was used to regularize the deformation field inside the tumor region. Validation was performed by comparing volume overlap (Dice Similarity Coefficient or DSC), centroid distance and volume change of the manually delineated rectum contour for all slices where tumor was actually seen on the FDG-PET.

Results: When using the region of interest, volume overlap increases while centroid distance decreases for all registrations. The mean DSC when using the entire image for registrations was 0.68 compared to 0.79 when only registering inside the mesorectum. The mean centroid distance decreased from 4.40mm to 3.30mm. The mean volume difference decreased from 28.11% to 14.09%.

Conclusion: Results show that by limiting the registration to the mesorectum, a much higher volume overlap for the rectum can be seen. Also, by regularizing the deformation field around the tumor in the last stages of the registration, a slight increase in rectum correspondence is found. The results of these registrations can be used to evaluate the PET signal around the tumor over time.