

AbstractID: 13186 Title: Registration and Active Shape Model-based Segmentation of Lymph Node Regions in Head and Neck CT Images

Purpose: To develop a robust automatic method to segment the level II, III and IV lymph node regions in CT images for head and neck IMRT treatment planning. We developed a technique whereby registration-based methods initialize an active shape model (ASM). **Method and Materials:** An average atlas was first created from 15 H/N patient (training) volumes with minimally enlarged nodes. To build the ASM model the average atlas was registered with each of the training volumes and correspondence of mesh vertices of lymph node surfaces was determined. Once built, the atlas and ASM can be applied to any target patient image. A patient image is first registered to the atlas through global affine, then global non-rigid, and finally local non-rigid transformations. The two non-rigid registrations produce displacements for vertices on the structure of interest and map them from the atlas onto the affinely aligned image. The ASM segmentation is initialized by constraining the displacements and then refined by iteratively adjusting the vertices through a local gray-level model search followed by model fitting until convergence. **Results:** The algorithm was evaluated through a leave-one-out experiment. The model-based and registration-based segmentations were compared with the manual delineations via a Euclidean distance measure applied to their 3D surfaces. The mean distance errors were reduced from 2.60 mm for the registration-based method to 2.36 mm for ASM-based method, and the maximum distance errors were decreased for 13 cases out of 15 cases, with a reduction up to of 47.9%. **Conclusion:** We have found that purely registration-based methods suffer gross under/over segmentation in areas of low CT contrast. The results show that an active shape model approach initialized by the registration result can reduce these deviations.