

AbstractID: 14303 Title: Automatic Definition of the Gross Tumor Volume using Features Derived from PET/CT Images

Purpose: To develop an automated method of defining the gross tumour volume (GTV) in patients with head and neck cancer (HNC) based on features extracted from analysis of FDG-PET/CT images. Previous attempts to segment tumours for radiation therapy targeting based on FDG-PET image thresholds have had limited success. However, if the texture information available in PET and CT images is used, more accurate and reliable differentiation of abnormal and normal tissues may be possible.

Method and Materials: A CO-registered Multi-modality Pattern Analysis Segmentation System (COMPASS) was developed using a region-of-interest-based Decision Tree K-Nearest-Neighbors (DTKNN) classifier. This classifier was trained using volumes defined as "normal" and "abnormal" by expert observers in images of 40 patients. 14 PET and 13 CT texture features such as coarseness, busyness and left/right symmetrical ratio were calculated for each voxel from corresponding PET/CT images within a window centered on that voxel. Voxels were subsequently classified as "tumor" or "non-tumor" using the DTKNN classifier. PET/CT images of an independent test set of 10 patients with HNC who had tumors and positive nodes contoured by three radiation oncologists were used for evaluation

Results: The sensitivity per patient was $83\% \pm 19\%$ when "true positive voxels" were defined as those voxels identified by at least two physicians as tumor. The specificity was $95\% \pm 2\%$ when "true negative" voxels were all soft tissue voxels not identified by any of three physicians as tumor. Results for COMPASS were significantly better than those for three previously published PET threshold-based methods

Conclusion: An automated segmentation method based on texture classification of FDG-PET/CT images has potential to provide an accurate estimate of GTVs for radiation targeting of HNC. Using COMPASS as a starting point, the time required of radiation oncologists to define GTVs should reduce and inter-observer variability should improve.

Conflict of Interest (only if applicable): None.