

AbstractID: 9209 Title: Assessment of PET estimated tumor volume by four-dimensional computed tomography measurements

Purpose: PET imaging is increasingly playing a key role in tumor detection, staging, and radiotherapy target definition of different cancer sites. However, the use of PET delineation in treatment planning of lung cancer is hindered by breathing motion blur artifacts. These artifacts complicate the evaluation of segmentation algorithms accuracy for PET. In this work, we propose to assess PET estimated tumor volume by comparing with four-dimensional computed tomography measurements under different motion conditions.

Method and Materials: We analyzed six NSCLC patients' datasets who underwent pre-treatment FDG-PET/CT scanning and 4D-CT simulations. The 4D-CT were acquired according to a ciné-mode 4D protocol; 25 scans were collected at each couch position while the patient underwent simultaneous bellows and spirometry measurements. Volumetric datasets were rebinned to the following phases: end-of-exhalation, beginning-of-exhalation, mid-exhalation, mid-inhalation, and end-of-inhalation, in addition to computing average CT and MIP datasets. The tumor volume was manually contoured on nine PET and CT datasets by two physicians for each patient to provide a gold standard for comparison. Different PET segmentation algorithms based on SUV thresholding and active contours were evaluated. Motion artifacts were mitigated using a deconvolution-based deblurring approach.

Results: Our preliminary analysis indicates that manual contouring on 4D-CT datasets produced relatively consistent results across the different phases by the two observers. Motion deblurring had varying effects on the evaluated algorithms; it increased the estimated volume by the 40% maximum SUV thresholding and reduced it when applying an SUV cutoff of 2.5. The active contour model produced robust results independent of the blurring effect.

Conclusion: We have investigated a 4DCT approach for assessing the performance of PET segmentation methods in lung cancer. Our preliminary results indicate high sensitivity of thresholding methods and better robustness by active contouring models. Further investigation is required to improve accuracy relative to the 4DCT gold standard.