

AbstractID: 3161 Title: Investigation of a 3D gradient based method for volume segmentation in Positron Emission Tomography for Radiation Treatment Planning

Purpose: Over the past few years Positron Emission Tomography (PET) is being used to supplement radiation treatment planning by assisting physicians in the determination of gross tumor volume. A number of studies have also been investigating the new possibilities that PET offers, such as guiding the delivery of a non-uniform dose in the tumor volume. Defining the surface of the tumor is an essential step in these applications; hence we investigated the use of a 3D gradient based technique for tumor volume segmentation.

Method and Materials: We applied the gradient based technique to FDG-PET images obtained with a PET/CT scan of NEMA 2001 body phantom, with three spheres of different diameters whose FDG concentration was varied against an essentially constant surrounding activity. We measured the volume of the spheres gravimetrically, calculated them from the CT scan and we also estimated them from the PET images using three segmentation methods: 1) simple intensity thresholding on the raw PET data, 2) intensity thresholding on the background subtracted PET data and 3) a previously described 3D gradient based method. The obtained volumes were compared with the CT volumes.

Results: The percentage error on volume estimation from the gradient based method varied from 15-38%. It had precision and accuracy similar to the background subtracted thresholding over the whole range of volumes and backgrounds, while it was less accurate than simple thresholding for low background activities, but worked better in regions of high background activity where the simple thresholding fails.

Conclusion: We have successfully applied a gradient based volume segmentation technique to a set of phantom images. This method does not require any *a priori* information, only involves minimal user interaction and most importantly does not depend directly on image intensities. The results are promising, but further work is needed to validate its clinical use.