AbstractID: 11078 Title: Application of supervised spectral clustering for PET tumor delineation: A phantom study

Purpose:
Spectral clustering is a powerful technique for image segmentation. This study investigated the feasibility of using the supervised spectral clustering technique for PET tumor delineation.

Method and Materials:
A phantom was constructed with six spheres filled with ^{11}C featuring simulated tumors of varying size ranged from 0.5ml to 20ml situated in a cylindrical container filled with ^{18}F-FDG. The phantom was scanned for 120 minutes in a PET/CT scanner. For every 2 minute scan, 6 images were reconstructed by using the iterative OSEM algorithm with 5mm-FWHM Gaussian smoothing filter and followed with an anisotropic filtering. The supervised spectral clustering algorithm using normalized cut was then applied to segment the filtered images. Spectral clustering uses the eigenvectors and eigenvalues of a similarity matrix (based on both proximity and intensity) to partition pixels into clusters. Its segmentation performance was evaluated with two metrics: area detection error and area overlap metric.

Results:
The supervised spectral clustering technique partitions the image to a designated number of regions according the measure of the pair-wise affinities between pixels. The spectral clustering has a rather steady segmentation performance of greater than 85% area overlap for images with S/B ratios ≥ 5. The detected area is enclosed in the true area until the S/B ratio drops to the lowest level of 2.

Conclusion:
The preliminary results demonstrate the potential of the supervised spectral clustering method for PET tumor segmentation. Compared with other PET tumor delineation techniques, it segments the PET image with minimal human intervention and is instrument independent.