# AbstractID: 6915 Title: A PET Head and Neck Tumor Delineation Approach based on Mumford-Shah Active Contours


**Purpose:**
Existing methods to segment the tumor boundary using PET images have focused on intensity thresholding, which suffers from ambiguity with respect to the threshold selection. In this paper, we present a novel, semi-automatic method for PET head & neck tumor delineation utilizing an energy minimization method--Mumford-shah active contours.

**Method and Materials:**
Mumford-shah method is a region-based active contour model which enjoys a number of attractive properties, such as greater robustness to noise than most edge-based approaches, and flexible initial contour placement. The proposed process begins when an experienced radiation oncologist manually draws a small initial curve (or surface) inside the desired tumor. Then the Mumford-shah active contour model is utilized to expend this initialization to reach an equilibrium state and form the final tumor boundary. In this model, the region-based information is for guiding the energy minimization process. The entire process is adaptive to each tumor and independent of the manual drawn initializations.

**Results:**
We applied this method to a set of simulated, phantom, and clinical PET images. For simulated and phantom images, the results were quantitatively compared with the known sphere sizes. The results show that our method is reasonably robust with errors less than 2.0 mm in the diameter and volume overlap metric higher than 90.0% between the detected volumes and the actual volumes. The results on clinical PET images were deemed reasonably accurate through visual appraisal by an experienced head-and-neck radiation oncologist.

**Conclusion:**
An energy minimization method based on Mumford-shah active contours is applied to adaptive, reproducible, and accurate tumor delineation in PET. Experimental results on simulated, phantom, and clinical PET images demonstrate the robustness, accuracy, reproducibility, and its potential usefulness in clinical radiation therapy planning.