AbstractID: 3182 Title: Information Theoretic Contours for Radiotherapy Planning

Purpose: To develop contouring tools that aid in the work of anatomy delineation in CT imagery. Our strategy is to estimate the organ boundary on a CT image using that image's properties and the shape and pixel textures associated with the contour already computed on an adjacent section.

Method and Materials: CT image regions can be effectively segmented using information divergences, which expand or shrink a boundary to maximize the differences between the pixel-sets inside and outside the boundary. Divergences produce non-parametric, statistical inferences generating minimum average error contours, given the data. We constructed an objective function using divergence functions that 1) maximize the match of regions and edges in multiple images, and 2) constrain the flexible contour to minimize differences between the current image and the prior image's region pixel textures and contour shapes. The resulting contour is the result of literally all the information in both the current and prior images.

The novel features of this project are the pixel texture constraint using minimum divergences, an objective function whose term weights may be varied to optimally contour regions in various anatomies in CT, including envelopes of organs that are unresolvable because of patient motion.

Results: The information divergence objective function computes series of contours without user input, beginning from an initial section. The contours can describe discrete anatomic organs, or regions containing the envelope of an organ in which some of the anatomy is distorted or obscured by patient motion. The computed contours adapt well to changes in size and shape.

Conclusions: Nonparametric information theoretic divergences don't require a model (e.g., Gaussian) to make effective estimates of anatomic boundaries in CT images. Their application to RT planning could greatly increase the efficiency of plan preparation.