AbstractID: 1202 Title: Deformable Model-Based Segmentation of 3D CT by Matching Distributions

Linear accelerator systems with cone beam or conventional CT imaging capabilities are becoming commercially available. In this implementation of image-guided therapy, a volumetric CT scan may be performed moments prior to treatment, and analyzed to determine final positional adjustments for accurate targeting. 4-D CT imaging technology is also becoming available, providing volumetric anatomical data for treatment planning during respiration. These new technologies generate 20-30 times more image data and require machine-vision-based algorithms to cope with the tedious task of segmenting multiple VOIs. We present a new algorithm for the simultaneous segmentation of multiple 3D deformable objects in serial CT images. The algorithm uses shape and appearance models for the objects of interest, learned from hand-segmented training images, and is suited for the automatic segmentation of organs in a specific patient from day to day. Our algorithm characterizes a volume of interest by its shape and a probability distribution of the intensities of the pixels within its interior. Comparing a particular model object to the image is as straightforward as comparing two probability distributions, as opposed to other approaches where a pixelwise correspondence between the model and the image is required. This allows for a faster, more principled algorithm. Results of segmentation of the prostate, bladder, and rectum demonstrate completion in about five minutes and agreement with manual contouring within 3mm or less.