AbstractID: 5107 Title: Semi-Automatic Contouring for Respiratory Gating

Purpose:

Contouring is very labor intensive, especially in image-guided radiotherapy involving many image sets. To expedite this task, a semi-automatic image segmentation algorithm was developed to obtain lung and tumor volumes at the end-of-exhalation from contours drawn on an image set taken at the end-of-inhalation, and vice versa.

Method and Materials:

The gradient vector flow (GVF) algorithm was first proposed by Xu and Prince. This snake model can dynamically conform to object shapes in response to two kinds of forces: internal force from the contour itself, and external forces from image gradients. The energy cost function composed of these two forces can be minimized based on local GVF information. Different parameters were used for elasticity and rigidity of lung and tumor tissue. A variation of the GVF method is proposed to speed up the convergence. A momentum item $\xi \Delta U^t EXP(-t/T0)$ **was added to the gradient vector calculation, in which** ξ **is a momentum constant and** T_0 **is the initial annealing temperature.**

Results:

Two CT image sets were used to verify the algorithm. The lung and tumor contours drawn at one phase were used as an initial guess for the automatic drawing in the second phase. The GVF was calculated for each slice and some important parameters, like elasticity, rigidity and mass viscosity etc were assigned specific values for the optimization. The GVF calculation converged quickly to 10^{-3} **in less than 5 seconds for a 512 x 512 image. The ratio of overlapping areas drawn by the algorithm to those of the manual approach exceeded 98%.**

Conclusion:

The close match between computed and manually drawn contours, as well as the short computing time indicates the feasibility of this method for clinical use. This method should also be expandable to other applications like image guided radiotherapy. More work is needed for contouring 4D image sets.