AbstractID: 5714 Title: Knowledge-based Auto-contouring in 4D Radiation Therapy

Purpose: In this work we develop a strategy of automatic contouring to relieve the effort of organ segmentation in 4D radiation therapy. The method adopts a novel technique of control volumes to achieve robust contour mapping among a series of 4D CT images.

Methods and materials: For a given patient, segmentation of tumor and sensitive structures was manually performed for one of the breathing phases by a physician. Along the segmented contours a number of small control volumes (~ 1cm) were selected. To obtain contours on another CT phase we mapped the control volumes collectively to this phase using rigid transformation, which served as a good starting contour for further adjustment. The final positions of mapped control volumes were determined by minimizing the energy function consisting of two terms: intensity similarity between the mapped volumes and the original volumes in the selected phase; elastic potential energy preventing control volumes from movement. The approach was tested with the 4D CT images of 5 lung cancer patients.

Results: For the patients the knowledge-based approach of automatic contouring worked well even for CT images with significant deformations. In the lung case the contours have the average error of less than 2mm and a maximum error of 5mm for noisy anatomical structures. A significant reduction of time compared with manual contouring was achieved.

Conclusions: The auto-mapping of contours in 4D radiation therapy was implemented with control volumes. The method provides an efficient way for 4D segmentation with high accuracy.