AbstractID: 7127 Title: A Software Toolkit for Multi-Image Registration and Segmentation in IGRT and ART

Purpose: Extracting information from images for image-guided and adaptive radiation therapy usually involves segmentation and/or registration with a reference image. The purpose of this research was to develop and make freely available a software toolkit for research use that combines several registration and segmentation methods and is applicable to problems involving multiple sequential images.

Method and Materials: Two automatic approaches have been integrated with standard interactive methods. One automatic approach solves PDEs describing visco-elastic flow to register a set of target images with a reference image. Segmentations can then be transferred from the reference image to target images via corresponding deformation fields. The second method segments images via Bayesian posterior optimization of a 3D deformable shape model called an m-rep. User efficiency has been improved by the ability to queue, view, work with, and compare multiple images and segmentations during a single session. The software was developed in C++ and runs on Windows and Linux.

Results: The GUI, including a window with panes for standard orthogonal 2D views linked to a second 3D window, preserves a common look and feel for all three approaches. A set of treatment images of the same patient initially are rigidly registered to a reference image. The images are then segmented by the methods of choice. Unsatisfactory automatic results are edited with conventional methods. Registered images and segmentations are output in DICOM RT format.

Conclusion: The toolkit combines multiple approaches for image registration and segmentation in a system specifically designed to support research on IGRT and ART. A cost-free license to download and use the software is available at http://planunc.radonc.unc.edu.