

AbstractID: 14135 Title: A multiregion algorithm for robust lung tumor tracking with portal image sequences

Purpose: Methods for online lung tumor tracking during radio-therapy are desirable for a variety of applications that have the potential to vastly improve treatment accuracy, dose conformity and sparing of healthy tissue. Using the MV beam and portal imager for this purpose is preferable as there is no additional imaging dose and the output is the location of the target in the beam's-eye-view.

Method and Materials: We present a multiregion algorithm that utilizes the on-board portal imager of the treatment machine to track lung tumors without implanted fiducial markers. Multiple regions with unique image structures are automatically identified and optimized based on an iterative procedure. Each region is tracked independently throughout the treatment, making the algorithm robust to target deformations, rotations and partial occlusions. To quantify the performance, the proposed algorithm was retrospectively applied to portal image sequences from a dynamic chest phantom study as well as an SBRT treatment performed at our institution. The results were compared to manual tracking by an expert.

Results: For the phantom data the tracking error was found to be smaller than 1mm and for the patient data smaller than 2mm, which was in the same range as the uncertainty of the reference. All optimized regions were able to be tracked on all images in both phantom and clinical sequences. The algorithm allows tracking of 15 regions at 2fps, the rate at which the images are clinically acquired.

Conclusion: We have developed and tested a robust algorithm to track lung tumors on portal image sequences without the use of fiducial markers or user intervention. The algorithm has the potential to be implemented in real time and is not dependent on prior information of the exact tumor motion range during treatment (unlike classification algorithms which generally require this).

Conflict of Interest: Varian Medical Systems Inc.