Elsevier Editorial System(tm) for Medical Image Analysis
Manuscript Draft

Manuscript Number: MEDIA-D-09-00276

Title: Quantifying Variability in Radiation Dose Due to Respiratory-Induced Tumor Motion

Article Type: Special Issue: IPMI'2009

Corresponding Author: Mrs. Sarah Geneser, Ph.D.

Corresponding Author's Institution:

First Author: Sarah Geneser, Ph.D.

Order of Authors: Sarah Geneser, Ph.D.; Jacob D Hinkle; Robert M Kirby, Ph.D.; Brian Wang, Ph.D.; Bill Salter, Ph.D., DABR; Sarang Joshi, Ph.D.

Abstract: Hypo-fractionated stereotactic body radiation therapy (SBRT) employs precisely conforming high-level radiation dose delivery to improve tumor control probabilities and spare healthy tissue. However, the delivery precision of SBRT render dose accumulation particularly susceptible to organ motion, and respiratory-induced motion in the abdomen may result in significant displacement of lesion targets during the breathing cycle. Sensitivity of dose deposition to respiratory-induced organ motion represents a significant challenge and may account for observed discrepancies between predictive treatment plan indicators and clinical patient outcome statistics. Techniques intended to resolve and compensate for respiratory-induced organ motion have been investigated, yet few have reached clinical practice. Improved treatment planning and delivery of SBRT requires an accurate prediction of dose deposition uncertainties due to respiratory motion. We introduce a means of characterizing the underlying variation in patient breathing patterns, construct a model of organ motion from acquired CT images, and calculate the resulting stochasticity in dose accumulation.