

AbstractID: 6956 Title: Automatic Detection of Positional and Anatomical Setup Errors in CT-based Image Guided Radiation Therapy

Purpose: The primary objective of this study was to develop a novel tool using Kernel Classification that could be used to assist in identifying patients with setup issues that result in unacceptable random and systematic errors.

Method and Materials: Inter-Fraction motion was retrospectively analyzed for 30 H&N patients that were positioned for treatment using megavoltage CT (*MVCT*) images acquired on a helical tomotherapy system. Manual adjustments, in the AP, SI, LAT and Roll planes, were made to ensure correct target alignment from *MVCT* images acquired on the tomotherapy system.

Results: A total of 30 Head and Neck patients were *MVCT* imaged prior to treatment delivery for a total of 992 imaging sessions. All 30 patients had a decrease in the cross-sectional volume due to a combination of weight loss and/or tissue response to radiation. Patient errors ranged from incorrect headrest to a shirt and tie that were not removed before treatment. A Principal Component Analysis was performed and showed that there was a relationship present between the stage of the cancer, the patient's overall percent weight loss, and the mean lateral, longitudinal, and vertical shift values.

The kernel classification technique correctly identified 23 out of the 24 Head & Neck patients as either having normal set-up or problematic setup using their respective shift data sets. These classifications were made using only the shift values from the first 14 treatments. The predictive performance seriously degraded when data from fewer than 14 treatments were used.

Conclusion: This study demonstrated that the kernel regression classification method was able to correctly identify the cause behind IGRT positioning problems for individual Head & Neck patients. The study also validated the fact that IGRT positioning problems cause abnormal problem-specific distributions in the shift data without using the complicated, and generally time-consuming, statistical distribution tests.