AbstractID: 8364 Title: Improving Tracking of Implanted Radio-opaque Markers on MV and kV Imaging with techniques from Computer Vision and Machine Learning

Purpose: Several groups have investigated implanting gold markers into tumors and tracking these markers with kV imaging during a radiotherapy treatment session. Our group has recently published an algorithm robust enough to detect moving markers in implanted tumors on kV and MV images. Our prior work is limited to tumors moving slower than 1.6 cm/s. Here, we expand on our prior work and the work by other groups by using techniques from computer vision and machine learning to improve the performance of the tracking algorithm and remove the need for any data-set/patient specific parameters or breathing wave form data.

Method and Materials: We replace the classification function in our prior algorithm with a support vector machine (SVM) classifier. To drop the need for data-set specific thresholds, we use techniques from computer vision to examine additional features of the fiducial. Once a location is selected as a possible marker by template matching (correlation) we run a Sobel edge detector to trace the outline of the potential marker. With this outline, we can compute a series of morphological parameters, including the area, major and minor axis, and statistical moments. These additional features provide the SVM classifier with enough information to distinguish true and false markers without the need for data-set specific thresholds or weights. To test our new algorithm, we image a moving MV phantom with two implanted markers, moving at various speeds.

Results: We can now track markers on MV images moving at speeds between 1.6 cm/s to 3.14 cm/s with 95% efficiency.

Conclusion: Compared to our prior approach and the approach of other groups, we can now track faster moving fiducials and do not require manual adjustment of threshold parameters.