Abstract ID: 16165 Title: 3D tracking of interfraction and intrafraction head and neck anatomy during radiotherapy using multiple kinect sensors

Purpose: The process of daily measurement and validation of tumors and normal structures with onboard imaging provides information useful for reducing patient setup uncertainty errors. However, the use of daily on-board CT imaging greatly increases the radiation dose to critical structures that lie within the CT volume. We now present a quantitative skin surface 3D imaging that when coupled with quantitative patient-specific biomechanical models determine the tumor and normal organ deformation caused by routine patient head and neck misalignments. Incorporating such modeling and imaging could substantially decrease the number of cone-beam CT scans required for patient setup and ultimately the daily CT scan dose.

Methods:The quantitative skin surface 3D imaging that monitors the patient anatomy are developed using multiple Kinect sensors. A set of 4 3D cameras are used for illustration purposes to track the patient anatomy externally. Of the 4 cameras, 3 of them are used to track the patient's anatomy contour (e.g. face, hands etc) using depth and intensity based contour tracking. Such an approach provides a set of 3D contours for each anatomical region from each camera. The 4th camera employs a marker less face recognition and tracking for delineating the region of the patient's face. The location of the face is then shared among the camera controllers in real-time and the anatomical contour that closely matches the face region is selected. Once selected, all the contours are then integrated to form a single 3D representation of the anatomy and overlapping contours are cleaned using Voronoi data re-sampling.

Results:The unified 3D representation presents a quantified 3D surface image within a precision range of 0.3 cm at an acquisition rate of 30 frame-per-second.

Conclusions:Daily measurement of 3D skin surface with the proposed imaging system is feasible for reducing patient setup uncertainty errors while minimizing radiation exposure risk.