

AbstractID: 11806 Title: Tracking of thoracic tumor using EPID for respiratory gating purposes: a retrospective feasibility study

Purpose

Conventional respiratory gating relies on an external surrogate which might provide suboptimal tracking of the tumor in many cases. In the present study, an attempt has been made to exploit the density differences between the tumor and its surrounding lung tissue to gate treatments directly using electronic portal imaging device [EPID].

Material & Methods

Varian Trilogy unit equipped with EPID [AS1000, resolution 1024x1024] was used. During treatment, a custom designed image acquisition template captured the portal images. The treatment plan along with the raw scan data and structures was also exported. DRRs for each field with the tumor [hereafter referred as nodule] projection overlaid on it, were also exported and were used as a shaped prior. Nodule was segmented in each portal image using a level set segmentation algorithm which includes an energy term that is minimized when the shape of the segmented region matches the shape prior.

Results

The nodule segmentation algorithm was evaluated on a series of 20 portal images of a nodule located just above the diaphragm. The nodule has an average distance from the center of the portal of 5.68 mm with the standard deviation, minimum, and maximum distance of 1.79, 2.44, and 9.13 mm, respectively. The distance between the nodule and segmented region center was 1.98 mm and the standard deviation, minimum, and maximum distance being 0.96, 0.13, and 4.12 mm, respectively. The average & maximum position error between the portal and nodule center could be reduced by 35% & 45%, respectively, using the nodule segmentation algorithm. Present runtime of 4 seconds will be reduced to real-time as the algorithm is being ported to graphic cards [GPUs].

Conclusion

The proposed method utilizes the tumor motion directly, thereby, eliminating an external surrogate system and its associated inaccuracies and offers promise for respiratory gating treatment delivery.