AbstractID: 1404 Title: An algorithm for automatic target alignment in CT-guided prostate radiotherapy

Efficient and accurate target localization based on CT datasets acquired by in-room CT scanners integrated with the linear accelerator via a common couch requires fast and robust software tools for the local alignment of anatomical regions.

We have developed an automatic algorithm for the calculation of the shifts required to match a planning prostate CT target volume to an anatomical region within a treatment CT. Image correlation between a 3D planning CT template and a 3D search region within the treatment CT is employed. The template combines both anatomical and treatment intent information, since it is extracted from the planning CT with a binary mask corresponding to the target volume. A search region is automatically centered around the expected position of the target within the treatment CT with extents sufficiently large to accommodate the extremes of observable prostate displacements. A cross-correlation similarity measure is calculated via 3D FFT in order to eliminate the need for cost function minimization that can get trapped in local minima. The location of the correlation maximum indicates the best match location of the target template within the treatment CT.

For 9 datasets, the automatically determined shifts were compared to these obtained by manual fusion. The discrepancies did not exceed two pixels in any direction, a value comparable with the intra-observer variability of manual registration. On a 3 GHz PC, the execution time varied between 3 to 10 seconds. The algorithm demonstrated significant potential for fast and accurate prostate target alignment.

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