AbstractID: 3960 Title: Automating Data Processing for Image-guided Adaptive Radiotherapy

Purpose: To facilitate the adaptive radiotherapy process by automating the flow and processing of data required to accurately transfer, integrate and accumulate information such as tissue boundaries and computed doses between serial 3D and 4D patient imaging studies.

Methods: Specific tasks in the data flow for adaptive radiotherapy have been implemented as independent software components that can be instantiated on a single computer or across a network. These components include data access, rigid and deformable image registration, data mapping, and dose accumulation. The data access component retrieves and pushes information to and from a variety of data stores and the other components. The image registration component supports various transformation models (affine, thin-plate spline and B-splines) and intensity-based similarity metrics (sum of squared differences and mutual information) and can handle both global and limited field of view registrations. Required initialization steps are handled using site specific protocols and data-driven image processing. A generalized transformation representation was developed to ensure interoperability with other processing components. The data mapping component operates on geometry and voxel-based information such as tissue boundaries, computed doses and image volumes. The dose accumulation component accommodates different re-sampling and summing schemes. The flow of data from one step is sequenced using simple top-down data flow or a script-based sequencer.

Results: A flexible system that automates many of the steps involved in adaptive radiotherapy has been implemented. This system has been used to map and integrate dose and geometric information from a variety of image studies (serial and 4D CT, multimodality data) and clinical sites (brain, lung, liver, prostate).

Conclusions: Automation of data processing to support the adaptive radiotherapy process is possible for a wide variety of clinical sites and imaging situations. This automation should make more widespread adoption of adaptive radiotherapy possible.

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