

Application of the SlicerRT toolkit for image-guided radiation therapy research

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Abstract. *Purpose:* Interest in adaptive radiation therapy research is constantly growing. The available software tools are usually tied to expensive proprietary applications. Although there are free open-source software applications and algorithms to solve particular problems of radiation therapy (RT) research, each of these standalone tools is limited to a specific purpose, development environment, and input/output data formats. To address these limitations, we propose SlicerRT, a customizable, free, open-source RT research toolkit.

Methods: SlicerRT is an open-source extension for the widely used 3D Slicer platform. SlicerRT provides functionality specifically designed for RT research, in addition to the powerful tools that 3D Slicer offers for visualization, registration, segmentation, and data management. The feature set of SlicerRT was defined through consensus discussions among a large pool of RT researchers, including both radiation oncologists and medical physicists. The development processes used were similar to those of 3D Slicer, which ensure traceability and professional quality of the resulting software and its distribution and user support mechanisms.

Results: Modules have been created for importing and loading DICOM-RT data, computing and displaying dose volume histograms for anatomical structures, creating accumulated dose volumes and isodose surfaces, and comparing dose volumes. Testing environment was set up to automatically test the modules for regression and against results of other applications.

Conclusions: An open-source software platform has been created and tested to support RT research. SlicerRT aspires to be an open-source toolkit for RT research, providing fast computations and convenient workflows for researchers. It is a medium into which RT researchers can integrate their methods and algorithms, and conduct comparative testing. SlicerRT also provides a general image-guided therapy infrastructure to assist clinical translation of experimental therapeutic approaches.

Keywords: Radiation therapy, treatment planning, 3D Slicer, DICOM-RT