SlicerRT – Radiation therapy research toolkit for 3D Slicer

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Purpose: Interest in adaptive radiation therapy research is constantly growing, but software tools available for researchers are mostly either expensive and closed proprietary applications or free open-source packages with limited scope, extensibility, reliability, or user support. To address these limitations, we propose SlicerRT, aspiring to be an open-source toolkit for RT research, providing fast computations, convenient workflows for researchers, and a general image-guided therapy infrastructure to assist clinical translation of experimental therapeutic approaches. It is a medium into which RT researchers can integrate their methods and algorithms.

Methods: SlicerRT was implemented as an extension for the widely used 3D Slicer medical image visualization and analysis application platform. SlicerRT provides functionality specifically designed for radiation therapy 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 with a large pool of RT researchers, including both radiation oncologists and medical physicists. Established development processes (see https://www.assembla.com/spaces/slicerrt) as well as testing and validation environment ensure software quality. Standardized mechanisms of 3D Slicer were applied for documentation, distribution, and user support. The design and architecture of SlicerRT was outlined in **[1]**. Current OCAIRO and CCO funding ensures continuous development for several years, so SlicerRT functionality is expected to continue growing.

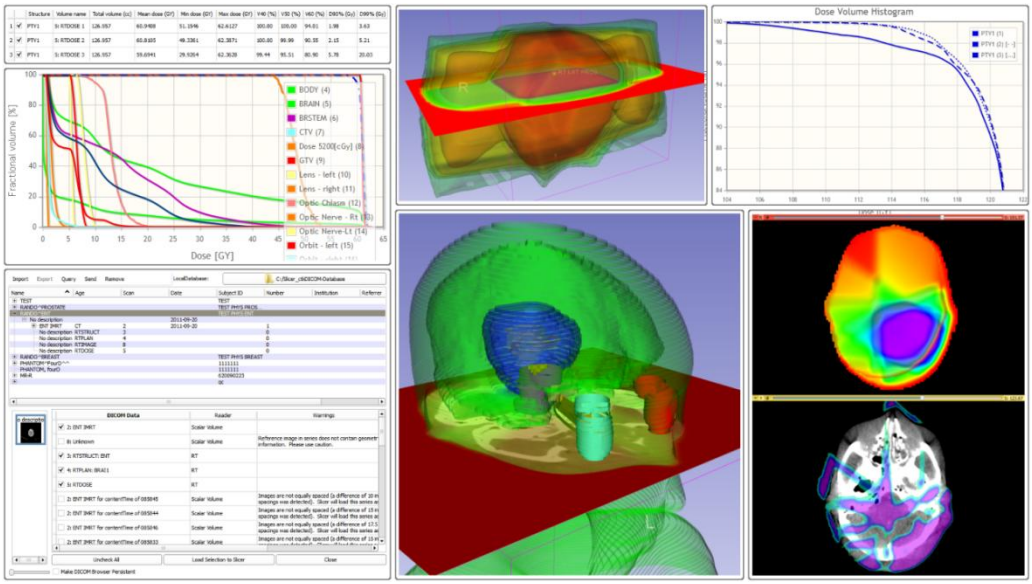

Fig. 1: A montage showing various SlicerRT user interfaces and outputs. Starting from the upper left corner, advancing downwards then right: dose volume histogram (DVH) metrics, DVH chart, DICOM-RT import, isodose surfaces, visualization of head&neck structures, DVH comparison, dose comparison

Results: Modules have been created for importing and loading DICOM-RT data, handling various contour representations, computing and displaying dose volume histograms, creating accumulated dose volumes, comparing dose volumes and contours, visualizing isodose lines and surfaces, performing morphological operations on contours, registering two images using multi-stage B-spline deformable registration or landmark deformable registration. Several modules use algorithms from the Plastimatch library **[2]**. Fig. **1** shows the user interface or output of various modules. SlicerRT is available for download through the Extension Manager component of 3D Slicer 4.2 or later (freely downloadable from http://www.slicer.org).

[1] C. Pinter, A. Lasso, A. Wang, D. Jaffray, and G. Fichtinger, "SlicerRT: Radiation therapy research toolkit for 3D Slicer", Med. Phys. 39(10), 6332/7 (2012)

[2] Sharp G.C., Li R., Wolfgang J., Chen G., Peroni M., Spadea M.F., Mori S., Zhang J., Shackleford J., Kandasamy N.: Plastimatch - An open source software suite for radiotherapy image processing. In Proceedings of the XVI'th International Conference on the use of Computers in Radiotherapy (ICCR), Amsterdam, Netherlands.