SlicerRT – Radiotherapy toolkit for 3D Slicer

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Introduction

Background

Radiotherapy (**RT**) tools mostly exist in the form of expensive proprietary applications. Although there are open-source software for particular purposes, they all have their own development environment, data formats, etc. This limits the potentials of collaborative RT research.

Objective

The goal is to create a **common software platform** for adaptive radiotherapy, built upon existing open-source visualization and analysis tools to support collaboration through sharing valuable algorithms and datasets, and address shortcomings of existing proprietary RT toolsets.

Methods

Platform

We propose to extend **3D Slicer** (www.slicer.org) to support RT research

- Widely used as a **software application platform** in medical image computing
- Already contains key functionalities
  - Reading DICOM images
  - Visualizing and manipulating datasets
  - Providing advanced methods for segmentation, registration, etc.
- Free, **open-source**
- Extensible by **custom modules**
- **Large user and developer base**

Identifying the requirements

- Discussions with **researchers**
  - OCAIRO investigators at University Health Network, Toronto (UHN)
  - 3D Slicer and CTK (www.commontk.org) developers, and others interested in RT at the 2012 Winter NA-MIC Project Week
- Discussions with **clinicians** at Kingston General Hospital (KGH)

Key features required from a 3D Slicer based RT research platform have been identified. The features are going to be added in an incremental way, the most common and most demanded features implemented first:

- Robust **DICOM-RT import** – reads the outputs of the most widely used RT planning systems (Fig. 3 and 4)
- **Registration** of images taken at different times or using different imaging modalities
- **Dose** calculation and conversion, Dose Volume Histogram (DVH) (Fig. 2)
- Visualizing treatment **plans** and resulting dose distributions
- Improve **overall usability** of Slicer, in order to be suitable for daily use

Design

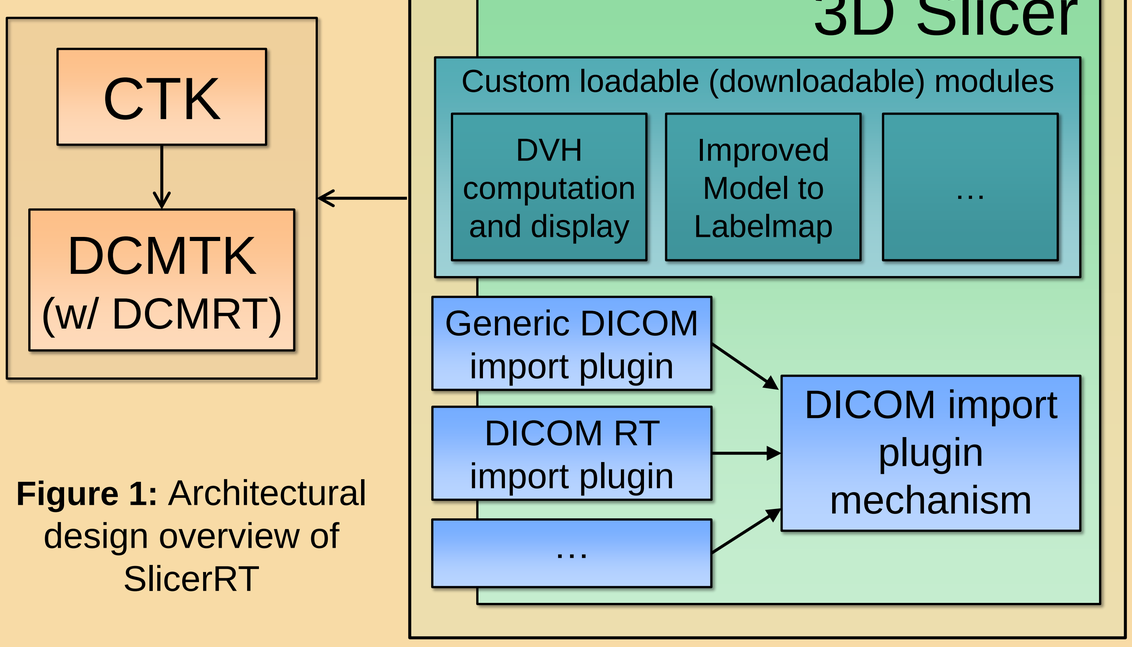

Figure 1: Architectural design overview of SlicerRT

Results

Dose Volume Histogram

Computation and visualization of DVH as a downloadable Slicer 4 extension.

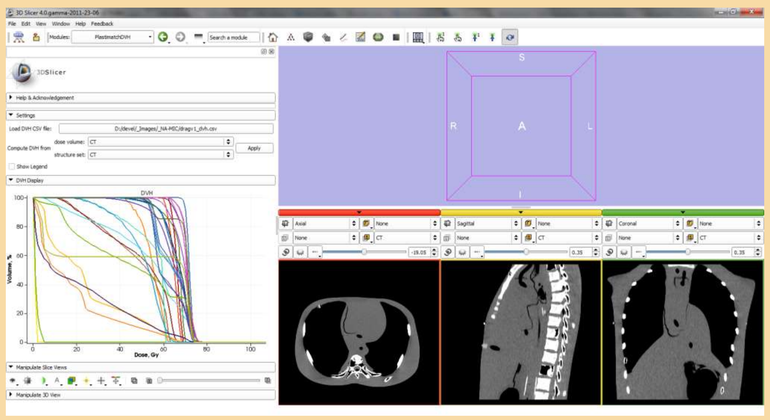

Figure 2: DVH module in Slicer 4

Import DICOM RT tags

Improved retrieval of DICOM RT tags into DICOM module database.

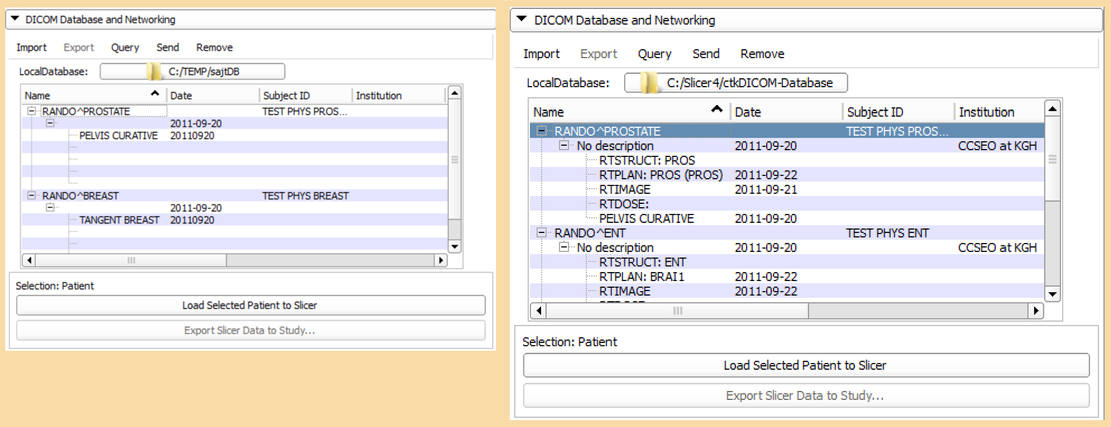

Figure 3: *Left* - Original, *Right* - Improved tags in Slicer DICOM module

Load DICOM RT structure sets

Load contours into Slicer 4 compatible data set and set up visualization

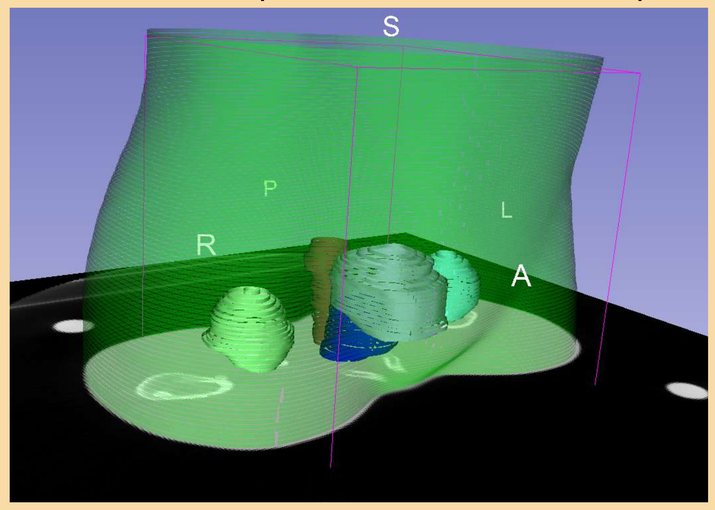

Figure 4: 3D view of loaded RT Structure Sets in Slicer4

Conclusion

SlicerRT is aimed to be a potential medium into which the **researchers can integrate** their methods and algorithms, so their work can be **widely distributed**, utilized and further enhanced by the RT research community, and is **compatible** with tools that are **continuously maintained**. It will also be an infrastructure that assists **clinical translation** of experimental diagnostic and therapeutic approaches.

Acknowledgements

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- Please visit **www.assembla.com/spaces/sparkit/wiki/SlicerRt** and share with us your comments, ideas, and needs.