Integration of SlicerRT into the Radiation Therapy Clinical Workflow

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3D Slicer (Slicer) is a powerful open source software package that is currently being adapted for application in radiation therapy (RT). This version of 3D Slicer is known as SlicerRT (Pinter et al. 2012). Preliminary investigation by our group has demonstrated superior rigid and deformable registration of KVCT planning images to daily MVCT and KV CBCT images that could potentially be utilized for adaptive radiation therapy (ART). The goal of this project is to investigate the potential of developing an open source module of SlicerRT that could be integrated seamlessly into a RT record and verify (RV) system (Mosaiq) for on-line creation of deformed contours from daily cone beam CT (CBCT) images. Integration of on-line structure information combined with *in vivo* dosimetry could allow for daily dose accumulation of organs at risk and targets that would inform adaptive re-plans.

Implementation of SlicerRT into the radiation therapy clinical workflow will eventually require interfacing with elements from the RV system (i.e. Mosaiq). Hence, the main objective will be to coordinate general input / output file storage locations that will feed back and forth from a *streamlined* clinical version of SlicerRT for on-line deformable registration. The streamlining process includes the development of: 1) pre-set input / output locations for DICOM-RT files 2) automatic "triggering" of optimized site-specific rigid and deformable registration routines and 3) dose accumulation and target / organ at risk violation reporting.

Here we report on our work regarding optimization of site-specific deformable registration routines (Goal 2). Specifically, using daily head and neck (HN) CBCT images, we perform a systematic analysis of various registration parameters including cost function routine, image subsampling rate, maximum iterations, grid spacing and stage progression to automatically generate deformed contours that agree with physician drawn standards. Quantitative agreement will be assessed using a dice correlation analysis with the trade-off in agreement assessed relative to total registration time. The analysis will be compared relative to a commercial deformable registration program (mimVista).

The long term goal of this project is to provide an open-source adaptive RT module that could be seamlessly integrated into any RV system and augmented for each department's clinical needs. As an example, we present preliminary work on how such a module could be utilized for *in vivo* EPID dosimetry currently being developed at the Odette Cancer Centre (OCC).

References

Pinter C, Lasso A, Wang A, Jaffray D, Fichtinger G. 2012 SlicerRT: radiation therapy research toolkit for 3D Slicer. *Med Phys.* 39(10):6332-8