

RADIATION ONCOLOGY

Plastimatch, 3D Slicer, Slicer-RT, RTK

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Disclosures

No conflict of interest

I participate in sponsored research and beta testing agreements with Elekta and IBA Dosimetry

Disclaimer

"The Software has been designed for research purposes only and has not been reviewed or approved by the Food and Drug Administration or by any other agency"

What's on my desktop?

- CERR
- ConquestDICOM
- Cygwin
- dcmtk
- Emacs
- Firefox
- gcc
- gimp

- KeePass
- Inkscape
- LibreOffice
- Octave
- perl
- Synergy
- VirtualBox
- 3D Slicer

Why open source?

- Freedom!
 - Software can move with scientists
 - No license files needed

- Open development process
 - Documentation
 - Mailing lists
 - Source code management
 - Bug tracking

Today's outline

Plastimatch

plastimatch.org



slicerrt.org





openrtk.org

Plastimatch

- plastimatch.org
 - Registration
 - Segmentation
 - Analysis
- Open source since 2007



Atlas-based segmentation



Plastimatch scripting

- Command-line oriented
- Highly configurable
 - Multi-resolution schema
 - Cost function
 - Algorithm
 - Optimization
 - ROI
 - Regularization
 - Stopping criteria

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Registration co	mmand the refere	ence
The registration comma	and file uses the "ini file" fo	ormat. There are two possible sections: GLOBAL, and STAGE. There should be exactly one
JLOBAL Section, and th	ere can be multiple STAGE	sections.
n general, the GLOBAL	section defines the input fi	iles and output files for a single registration. Each STAGE section defines a single
Processing stage within	a registration pipeline.	
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Documentation on http://plastimatch.org



Voxel-specific stiffness



Multi-atlas segmentation



3D Slicer

- Medical image analysis and visualization platform
- Since 1997
- \$50M in funding
 (>2,000 years of labor)
- Professionally engineered
- 1,000+ analysis functions
- 200K downloads for 4.4
- <u>www.slicer.org</u>









Tour of 3D Slicer



3D printing



3D printing



Developing slicer modules

- Three kinds of modules:
 - Command line module
 - Scripted module
 - Loadable module

Command line module

User interface is generated by slicer



Command line module



(1) Slicer writes your input files, then launches your executable (3) Slicer loads your output files

(2) Your executable runs, and it writes output files

SlicerRT ecosystem





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SlicerRT use case: Dose accumulation



SlicerRT use case: Gel dosimetry analysis



• Simplified user interface

Collaboration with KGH, Kingston, ON

Alexander et al., IC3DDose, 2014 Talk at World Congress: SP057.3





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OCAIRO

GelDosimetry



SlicerRT use case: Proton dose calculation

- External beam planning
 - Arbitrary dose engines
 - Using same user interface
 - Potentially replace TPS
- Evaluate plan

Collaboration with MGH, Boston and CRO, Italy Desplanques et al., MedPhys, 2014 Poster at World Congress: PS04.087







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• RTK = reconstruction toolkit

openrtk.org

RTK Features

- Support for scanners: Elekta, Varian, IBA
- Flexible 3D geometry
 - Any source / detector positions
- Forward- and back-projectors
 - Multi-threaded CPU and GPU
- FDK and SART reconstruction algorithms
- Short scan and offset detector weightings
- Scatter correction
- Numerical phantoms

Results: Catphan acquisitions



Data available online: http://midas3.kitware.com

Working example

```
// FDK reconstruction filtering
typedef rtk::FDKConeBeamReconstructionFilter<ImageType>
        FDKCPUType;
FDKCPUType::Pointer feldkamp = FDKCPUType::New();
feldkamp->SetInput( 0, imageSource->GetOutput() );
feldkamp->SetInput( 1, rei->GetOutput() );
feldkamp->SetGeometry( geometry );
feldkamp->GetRampFilter()->SetTruncationCorrection(0.);
feldkamp->Update();
```

```
// Writer
typedef itk::ImageFileWriter<ImageType> WriterType;
WriterType::Pointer writer = WriterType::New();
writer->SetFileName( "output.mha" );
writer->SetUseCompression(true);
writer->SetInput( feldkamp->GetOutput() );
writer->Update();
```

4D CBCT



Links



plastimatch.org





slicerrt.org



openrtk.org