Using 3D Slicer for image-guided therapy research

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Without a strong application platform
- Completely new software was written for each procedure/device
- Each application was developed from ground up
- Significant work investment to integrate new, advanced algorithms

Quick start. Huge waste of time/money/effort overall.

With 3D Slicer as application platform
- New software module for each procedure, common module for several devices
- Applications are built on top of 3D Slicer
- Many new, advanced algorithms are deployed on 3D Slicer

Huge investment at the beginning: learning. Minimal wasted efforts.

Commercial application | Research application
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Fully optimized for specific purposes | Very flexible, fits many purposes, easy to customize/extend
Simple, easy to use | Complex, may be difficult to use
Fast, robust | Might be slower, might have robustness problems
Uses closed source, in-house developed and maintained libraries | Uses state-of-the-art, actively developed open source libraries
Thoroughly tested, fully documented (fully FDA, CE compliant + as high quality as possible) | Tested & documented as reasonable (optimized for quality only)

Image-guided therapy applications in Slicer 3.6

ProstateNav
- Prostate biopsy
- Used on patients

NeuroNav
- Neuro navigation
- Used on patients

PerkStation
- Spine needle insertion with AR display
- Cadaver studies

LiverAblation
IGTPlanning
IGTNavigation

Generic IGT workflow steps
- **Calibration**: register patient/tools/image acquisition device
- **Planning**: import and visualize data, create plan
- **Targeting**: perform the planned intervention with guidance
- **Verification**: evaluate, archive results

Calibration
- Import images (DICOM and other formats)
- Import object models (tools, etc.)
- Mark fiducials
- Register (using image, fiducial points, lines, trackers)
Planning

- Import images, models
- Mark/segment target points, surfaces, volume regions
- Visualize (2D slices, 3D view, reformat, fuse, register)
- Measure (distance, angle, custom)

Verification

- Import images
- Mark reached points, surfaces, volume regions
- Visualize
- Measure
- Export/save data

Examples

- Experimenting: compensate patient motion
- Troubleshooting: found loose screw

Targeting

- Position tracking and real-time tool display (NDI, Ascension, ...)
- Import & display real-time images
- Robot, scanner control

With compatible devices, using OpenIGTLink + IGSTK

Many other features/modules...

Summary

- Flexible, feature rich platform
- Not optimized for a specific procedure: custom module and/or add experienced user needed in the OR
- Continuous improvement, good support, large user and developer community
- No waste: most of the needed functions are already available, mostly built on standard open source libraries
- Several successful examples

3D Slicer is strongly recommended as an IGT research application development platform.