FW4SPL

FrameWork For Software Production Line

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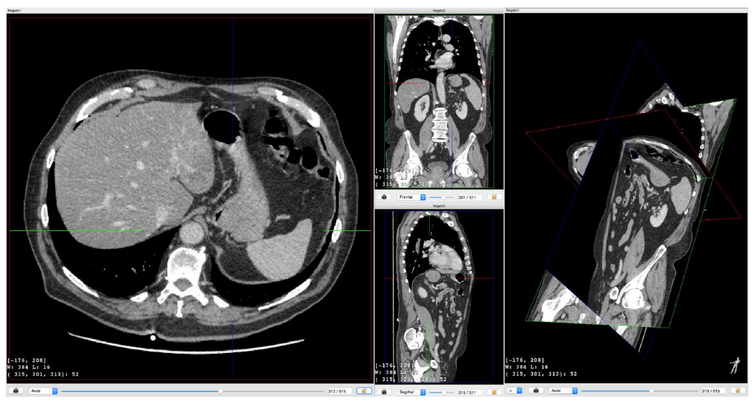
Project description

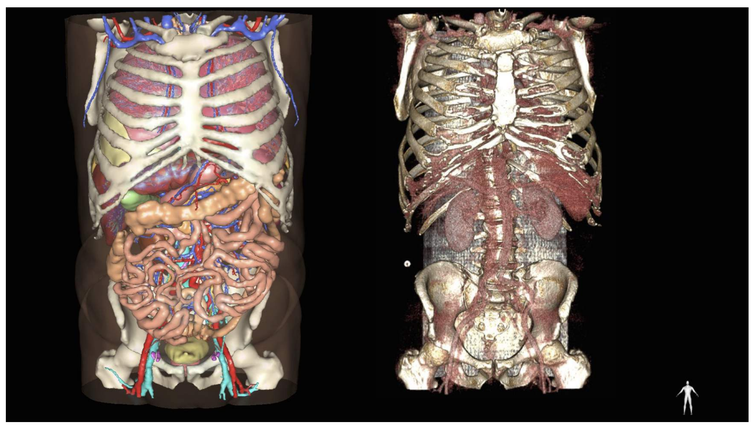
FW4SPL is a framework for fast and easy creation of applications, mainly in the medical field. It includes various features such as 2D and 3D digital image processing, visualization, augmented reality and medical interaction simulation.
It runs on many different environments, is written in C++, and features rapid interface design using XML files. It is freely available under **open source** license.

Visualization and Diagnotic

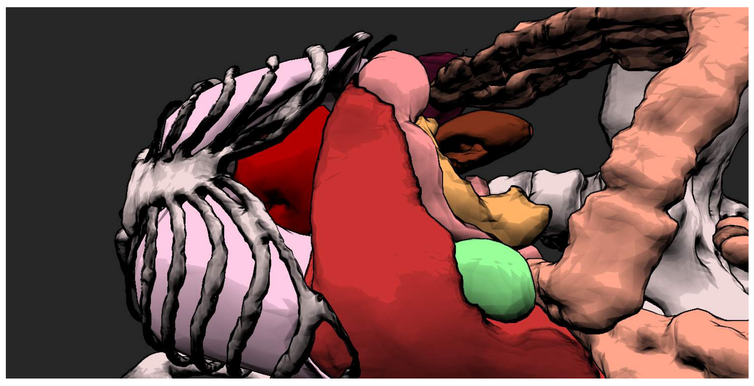
- Visualize medical data (images and meshes):
  - 2D Multi-Planar Reconstruction
  - 3D meshes with optional 3D orthogonal **MPR**
  - 3D volume rendering with editable and pre-configured transfer functions
  - Pre-defined pipeline of **GPU shaders**
  - Measuring tool features and landmarks
- Supports many different formats:
  - DICOM: CT and MRI, surface segmentation
  - **VTK**: images and meshes (.vtk, .vti, .vtu)
  - High-efficiency in-house data format



2D and 3D Multi-Planar Reconstruction



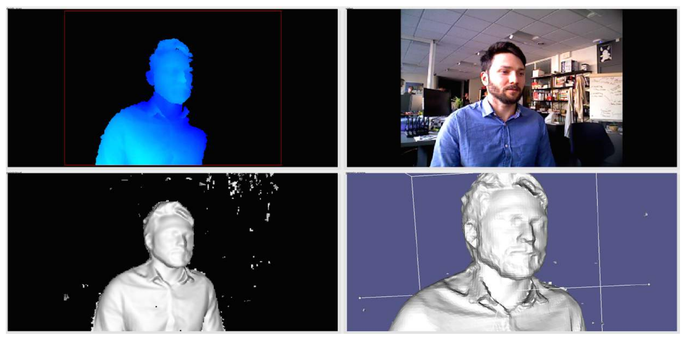
Volume and surface rendering



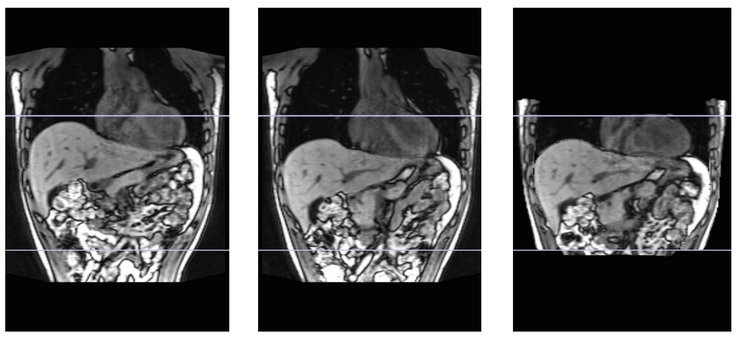
Cel-shading rendering

Example of Patient Registration and Tracking

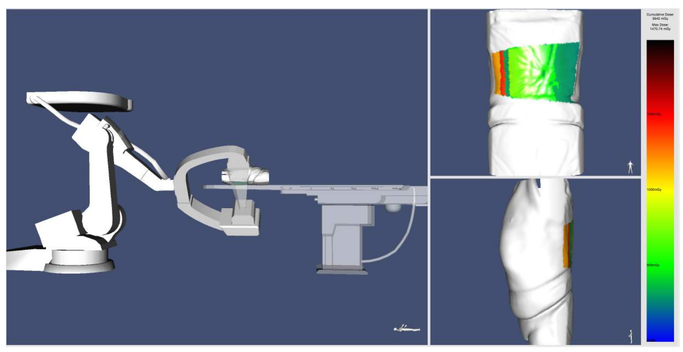
- Plannification of modality source position to reduce patient radiation exposure:
  - Surface reconstruction using **depth sensor**
  - Intra-operative CT tracking
  - **Real-time** peak skin dose measurement
  - X-ray beam characterization
- Structure of interest registration
  - Images acquired at different breathing stages



Patient surface reconstruction



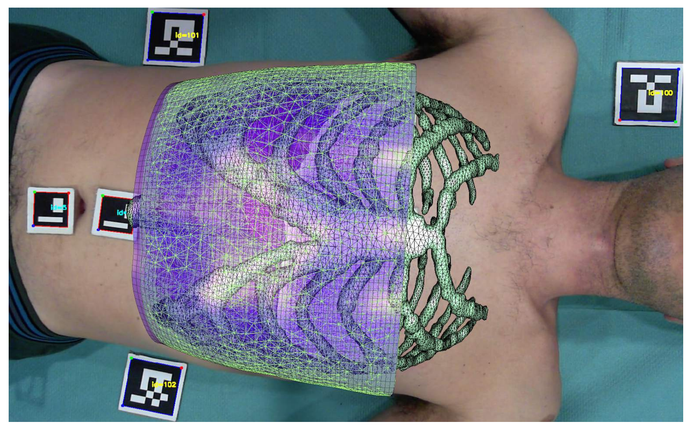
Expiration | Inspiration | Simulated



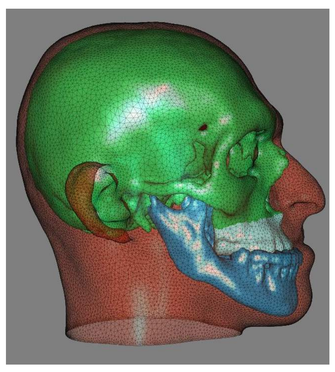
Dosimetry mapping on specific patient

Example of Medical Simulation and Augmented Reality

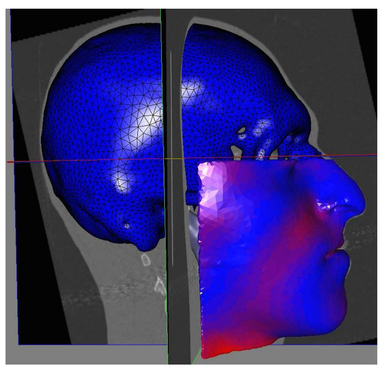
- Patient virtual model on intra-operatating video overlay:
  - Optical **tag tracking**: mono/stereo registration
  - Timeline and synchronisation features
  - Desktop-assisted tracking for tablets: desktop sends additional out-of-field position information to the tablet
- Simulation application:
  - Face simulation after maxilo-facial surgery
  - Organ movement during breathing
  - **Ultrasound** imaging from CT images



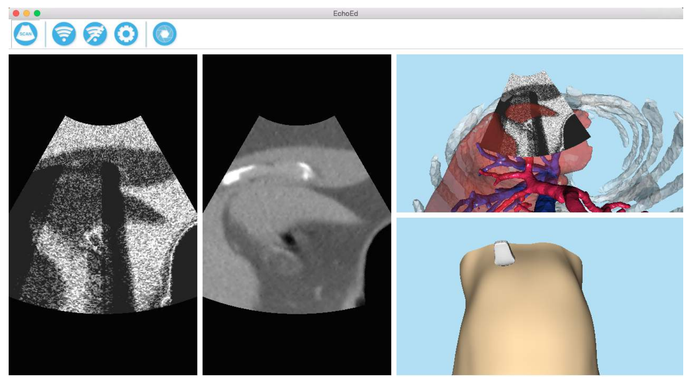
Breathing simulation



Pre-operative modeling



Simulated face

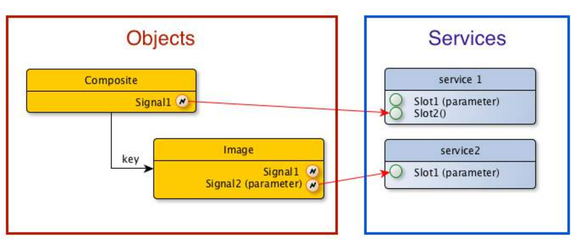


Opensource echograph simulator using a smartphone as a probe

Software Design

FW4SPL uses a **component-based architecture** and leverages many existing software libraries. The 3 main architecture concepts are:

- Object-service: objects represent data and services represent functionality
- Signal-slot communication
- Components: an individual component is a module that encapsulates a set of related services (or data)



Platforms, langages and extensions

- Used in **ISO13485** process and software - CE class 2a certified
- Builds with **CMake** - Written in **C++** (Python extension)
- Communication with **DICOM** (Query,Retrive,Store,MPPS) and OpenIGTLink
- **Cross-platform**: Windows, Linux, MacOSX and Android
- **OpenSource** (LGPL license) and available on Debian-Med

Outlines for futures developments: pattern recognition by monocular video analysis, support for IOS and web platform (JS/WebGL)

Open Source repositories and FLOSS Libraries

github : https://github.com/fw4spl-org - **blog** : http://fw4spl-org.github.io/fw4spl-blog/ - **documentation** : http://fw4spl-doc.readthedocs.org/