Ultrasound Guided Navigation: Application Example in MITK

Alfred Franz, Keno März
Motivation

- Assist in difficult US-guided interventions
- Reduce amount of CT-guided interventions
Motivation

• Assist in difficult US-guided interventions

• Reduce amount of CT-guided interventions
New Mobile & Compact Field Generator

(First prototype: Northern Digital Inc. (NDI) 2011)
EchoTrack: A Combined Modality

Field Generator

US Probe
Setup

Ultrasound probe

Needle

Compact FG

6DoF sensor
How do we implement this with MITK?
Implementation

1. Instrument Tracking MITK-IGT
2. Ultrasound Imaging MITK-US
3. Reusability Microservices
4. Navigation Software MITK Plugin
MITK-IGT: Image Guided Therapy with MITK
Requirements

• Hardware control of tracking systems

• Real-time localization of multiple objects
Application development

Recording, Processing and Visualization of tracking data

Control of tracking devices
Demonstration

- Connect to NDI-Polaris
- Tool Management
- Tool Visualization
- Tracking Instruments
MITK-US: Ultrasound real-time imaging

US Device \(\rightarrow\) Framegrabber \(\rightarrow\) Computer with CAI Software: Data Processing in Real Time

US Device with API Access
Application development

Recording and Processing of US images

Image acquisition and device control
Ultrasound Imaging Pipeline

2D-Preprocessing

Image Source -> Cropping -> Color Conversion

3D-Pipeline

Rendering <-> 3D-Transformation <-> Image Conversion
Demonstration

- Connection to API-device
- Image acquisition
- Device control
- Measurement using MITK
How do we bring it together?
Reusability

- We could reuse on the level of...

  - Classes
  
  - UI-Components
  
  - Instances

#include <mitkUSDevice.h>

Widgets

Microservices
Microservice Concept

- Register instances with service registry
- Other classes can query registry
- Idea: Make filter a Microservice!
Reusing Pipelines with Microservices

myTrackingDevice->RegisterAsMicroservice();
myUltrasoundDevice->RegisterAsMicroservice();
Reusing Pipelines

MITK-IGT

Filter 2

MITK-US

Filter 4

New Plugin
Navigation System
Simultaneous US-Imaging and Needle Tracking in Action!
Summary

- MITK-IGT provides tracking
- MITK-US provides imaging
- Microservices provide platform for reusability
- Navigation takes advantage of full workflow for both modules
Thank you for your attention!

Further information on www.dkfz.de