Visualization
NPGR023

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http://cgg.mff.cuni.cz/~pepca/

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Visualization course

- **Lecturers / slide authors**:
  - Josef Pelikán, CGG MFF UK
  - (Martin Horák, Hospital Na Homolce, 1. LF UK)
  - (Václav Krajíček, CGG MFF UK)
  - (Ján Dupej, CGG MFF UK)

- **NPGR023: 2/1 Z, Zk**
  - 2-hour lecture every week
  - 2-hour lab every other week

Brief syllabus I

- **general data visualization**
  - data types, methods and goals of data presentation, user interaction, steering, ..
- **volume data acquisition**
  - Computer Tomography (CT)
  - Magnetic Resonance Imaging (NMR, MRI)
  - Magnetic Spectroscopy (MRS), PET, SPECT
- **data segmentation**
  - focused on segmentation of 3D data (medical app.)

Brief syllabus II

- **volume data visualization**
  - grid → isosurface
  - lighting models used in volumetric rendering
  - Direct Volume Rendering (DVR)
- **real-time volume rendering**
  - speedup techniques, ray-based methods, 3D textures
  - transfer functions
  - GPU/CUDA utilisation

Brief syllabus III

- **data analysis basics**
  - dimension reduction (PCA, SVD), cluster analysis
  - modeling (Procrustes, Bookstein, Gaussian mixture models)
  - discriminant analysis (LDA, SVM, ROC, ..)
  - classification (naïve Bayes)
  - time series
- **machine learning approaches - brief**
  - prediction, forecasting, extrapolation
  - recommendation systems
  - data mending

Brief syllabus IV

- **visualization on the web**
  - interactive data presentation
  - Data-Driven Documents (D^3)
  - HTML5, JavaScript, d3.js library

Resources

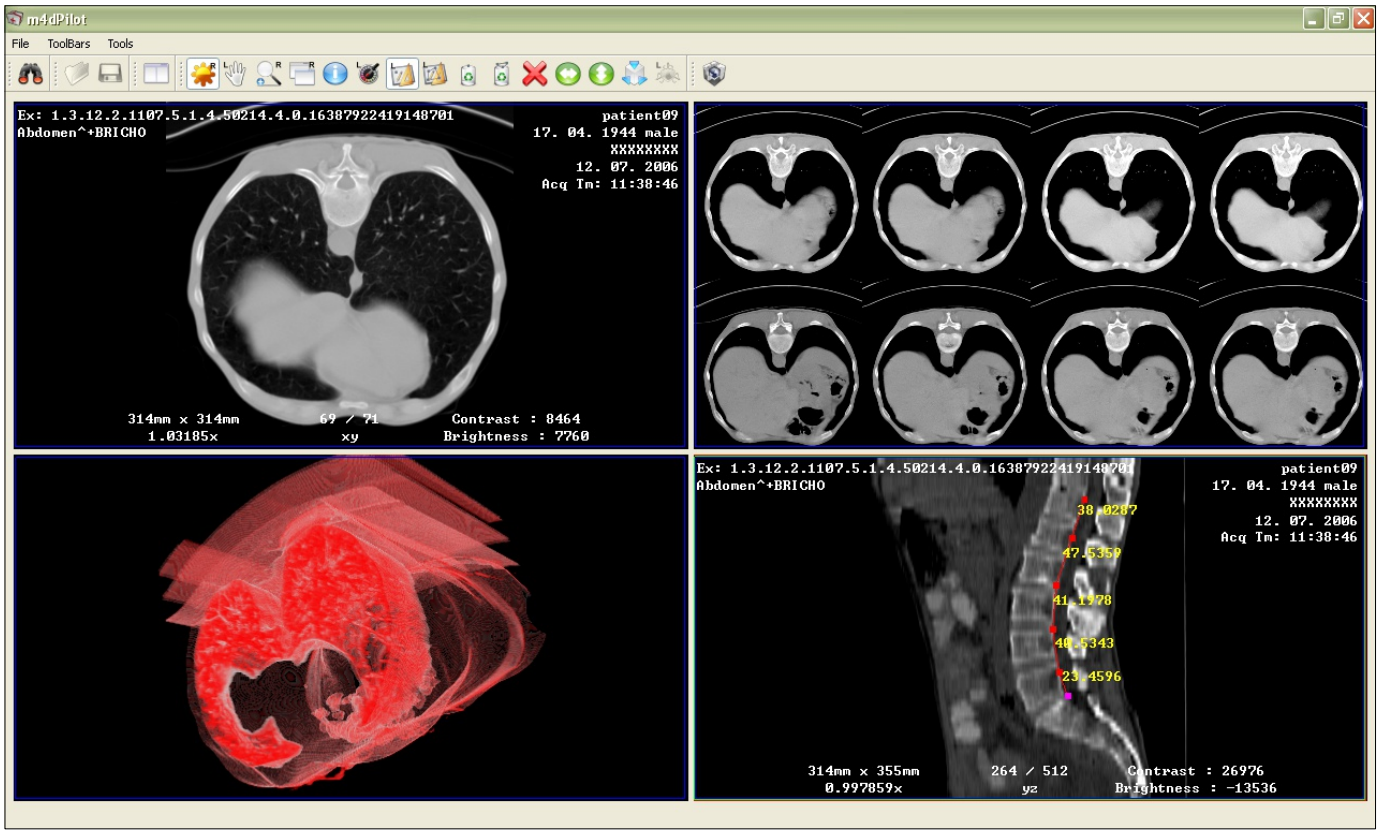
- Engel, K., Hadwiger, M., Kniss, J.M., Rezk-Salama, C., Weiskopf, D.: ***Real-Time Volume Graphics***, A K Peters, 2006
- Weiskopf, D.: ***GPU-Based Interactive Visualization Techniques***, Springer, 2006
- Hansen C. D., Johnson, C. R.: ***Visualization Handbook***, Academic Press, 2004
- d3.js library: **http://d3js.org/**

More info

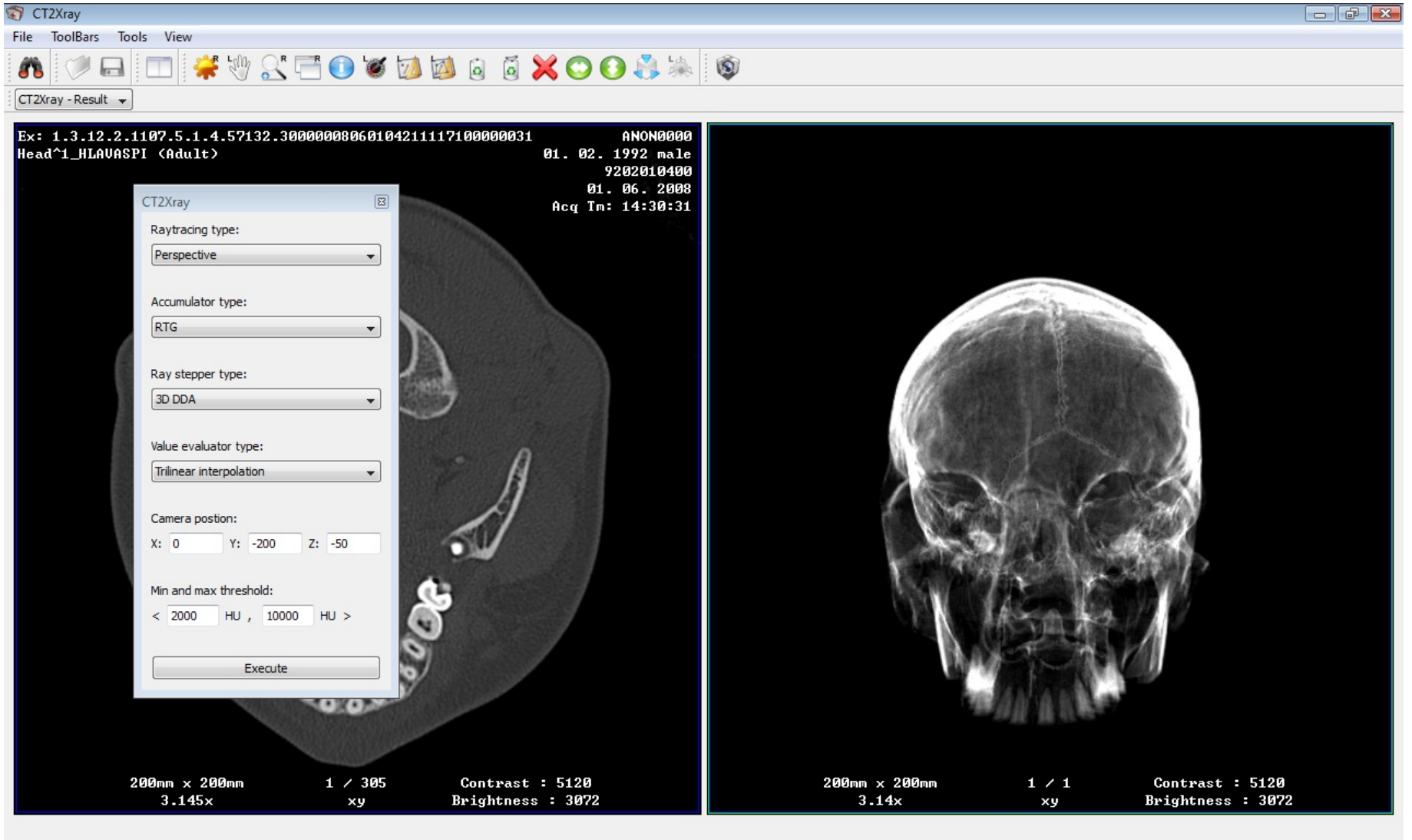
- WWW server of our **CGG**:
  - **http://cgg.mff.cuni.cz/prednasky.cz.php**
  - **http://cgg.mff.cuni.cz/~pepca/**
- WWW pages of the **MedV4D project**:
  - **http://cgg.mff.cuni.cz/MedV4D/**

MedV4D

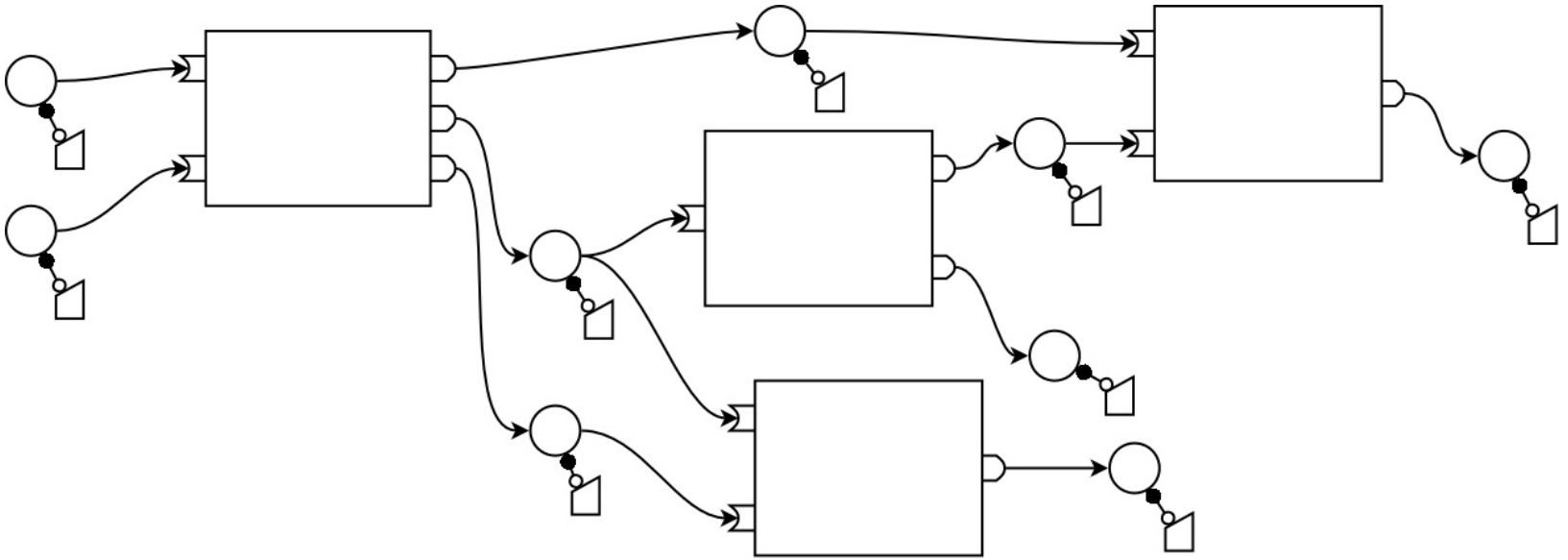
- framework for medical (volume) data
  - loads DICOM files, integration with VTK, GUI in Qt
  - modularity (data-flow), parallel computing,..

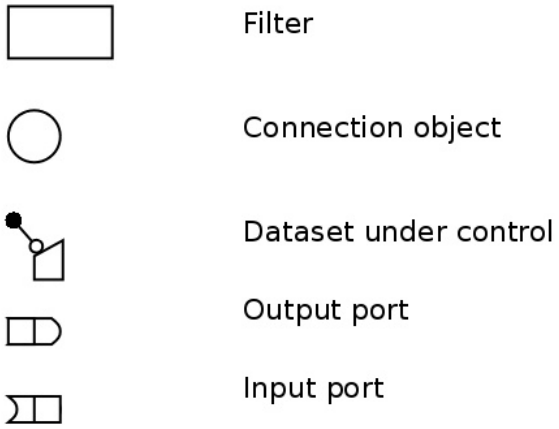


MedV4D


CT2Xray
File ToolBars Tools View
CT2Xray - Result
Ex: 1.3.12.2.1107.5.1.4.57132.3000000806010421111710000031
Head^1_HLAVASPI (Adult)
ANON0000
01. 02. 1992 male
9202010400
01. 06. 2008
Acq Tm: 14:30:31
CT2Xray
Raytracing type:
Perspective
Accumulator type:
RTG
Ray stepper type:
3D DDA
Value evaluator type:
Trilinear interpolation
Camera postion:
X: 0 Y: -200 Z: -50
Min and max threshold:
< 2000 HU , 10000 HU >
Execute
200mm x 200mm
3.145x
1 / 305
xy
Contrast : 5120
Brightness : 3072
200mm x 200mm
3.14x
1 / 1
xy
Contrast : 5120
Brightness : 3072

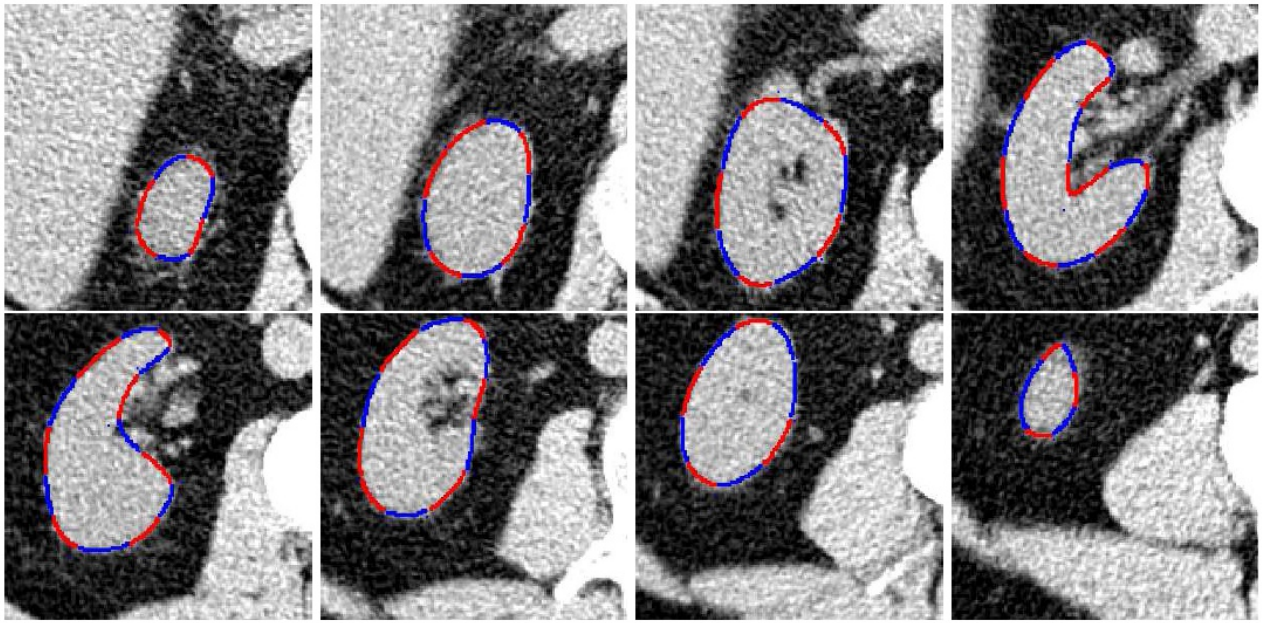
MedV4D

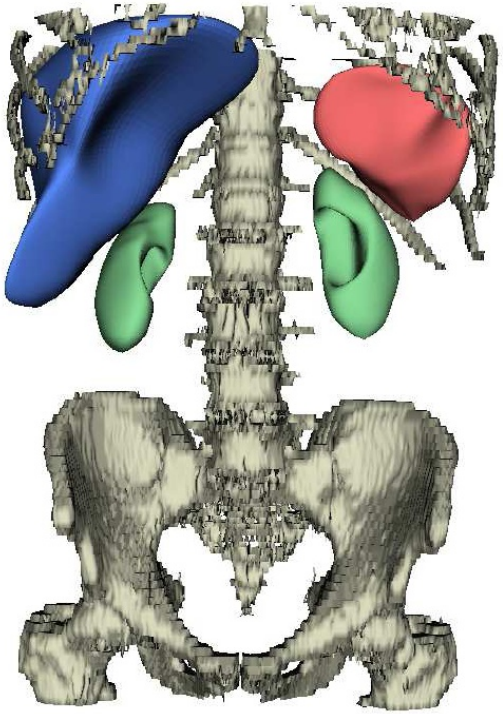



Filter
Connection object
Dataset under control
Output port
Input port

Václav Krajíček

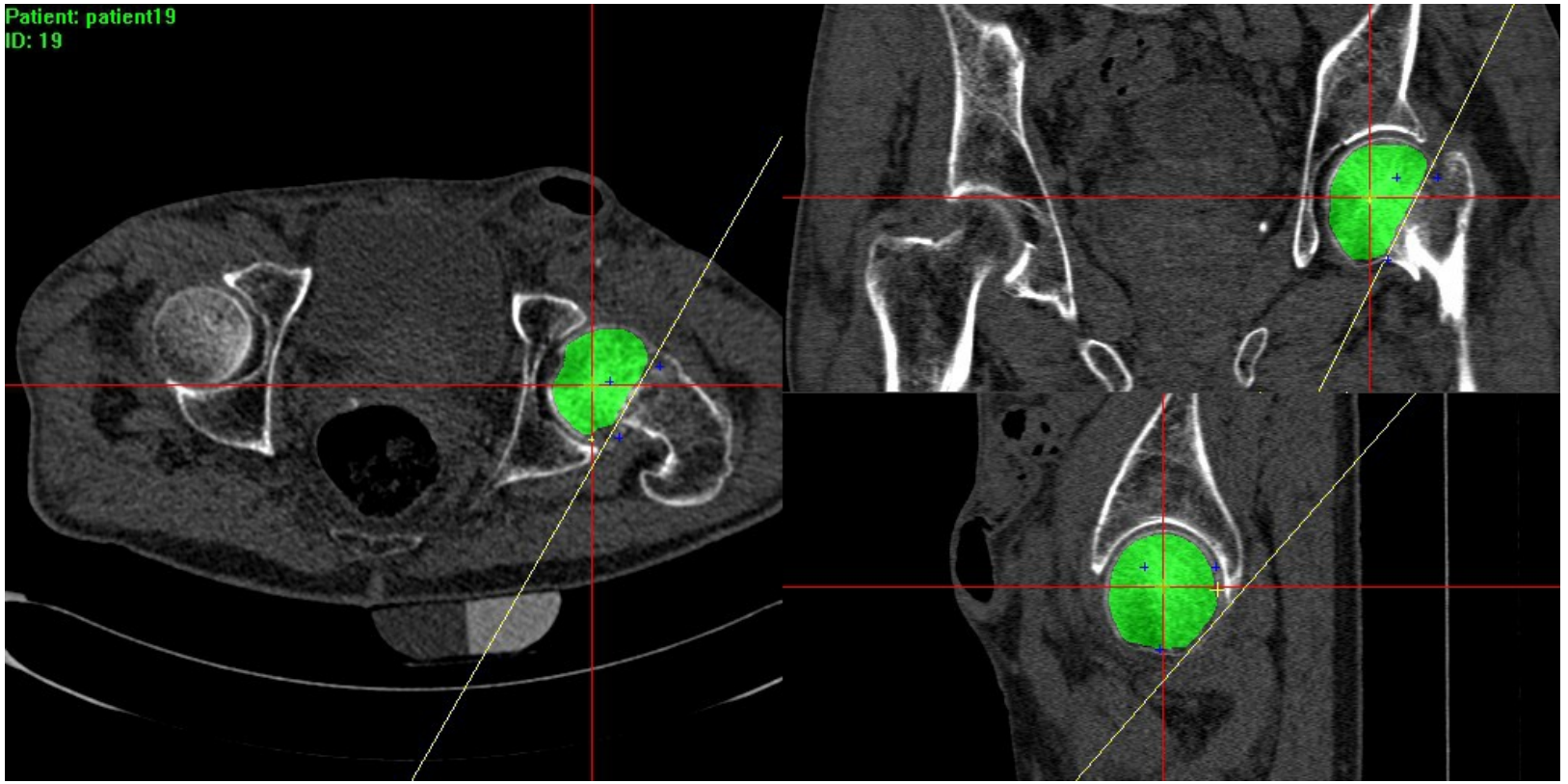
- former PhD student
  - volume data segmentation, geometric morfometrics





Jan Horáček

- Mgr. thesis (M.S. thesis of the year award: 1. place)
  - segmentation of the hip-joint head



Jan Horáček