Personalized Femoral Implant Planning by Automatic Femur Segmentation

Iwan Paolucci, Severin Tobler
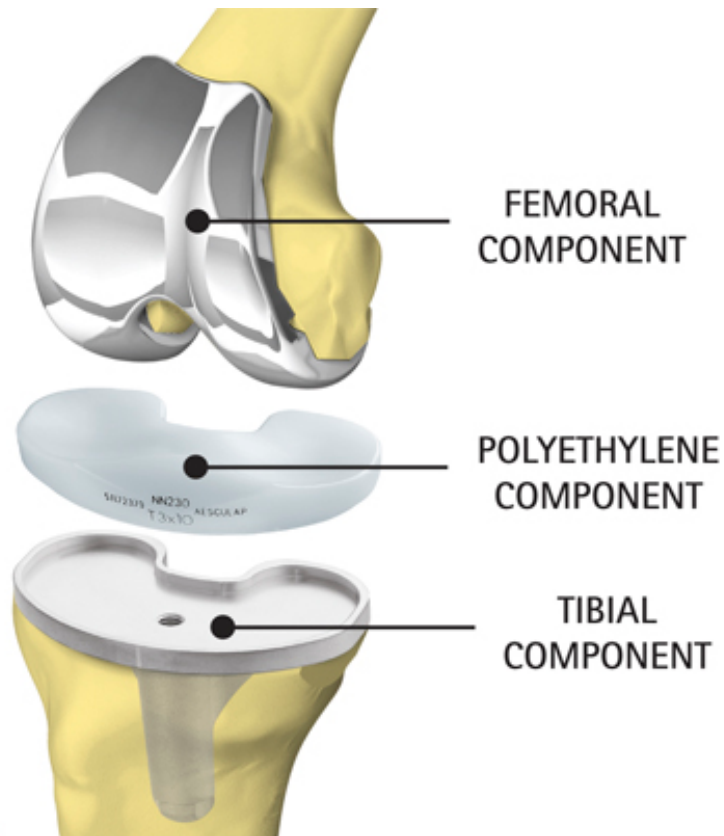
The Tree Nurses

University of Bern
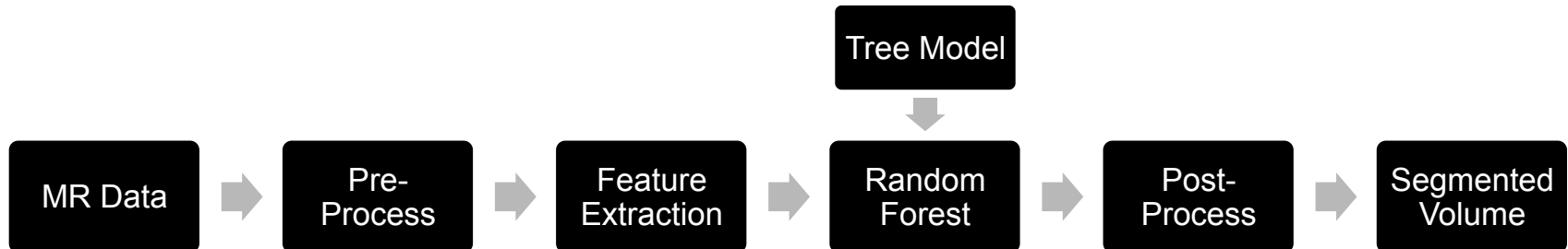
16. December 2015, Medical Image Analysis Lab

Introduction

> Goal: DICE 0.95 with 0.05 std

Methods – Algorithm Pipeline

Tree Model

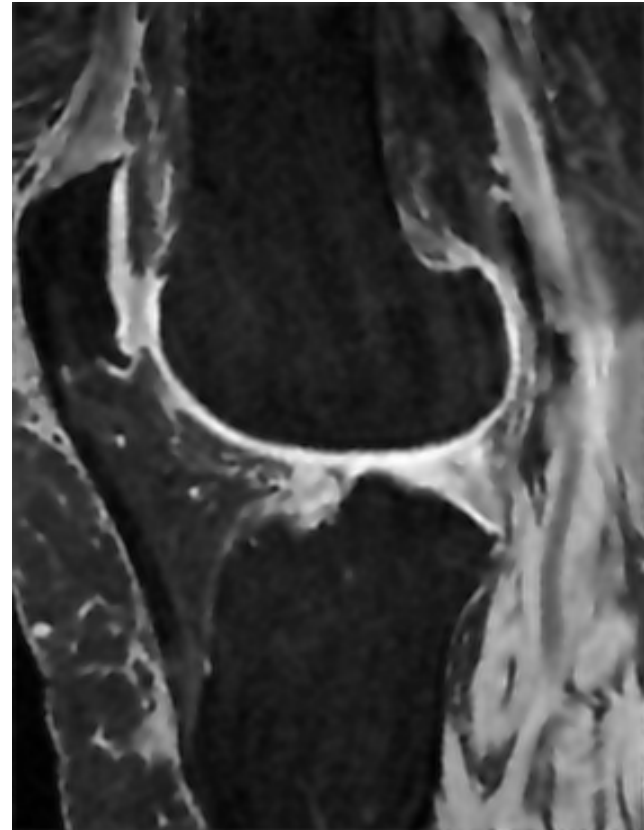MR Data → Pre-Process → Feature Extraction → Random Forest → Post-Process → Segmented Volume

Methods – Pre-Process

> Normalization
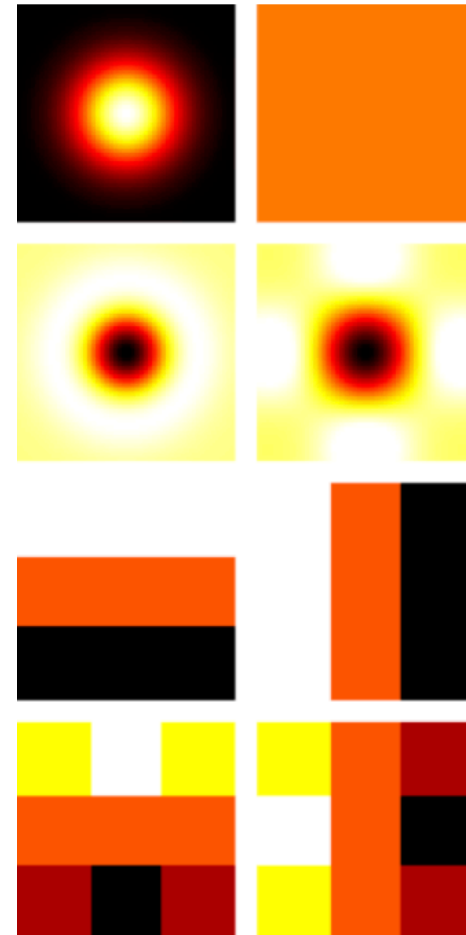
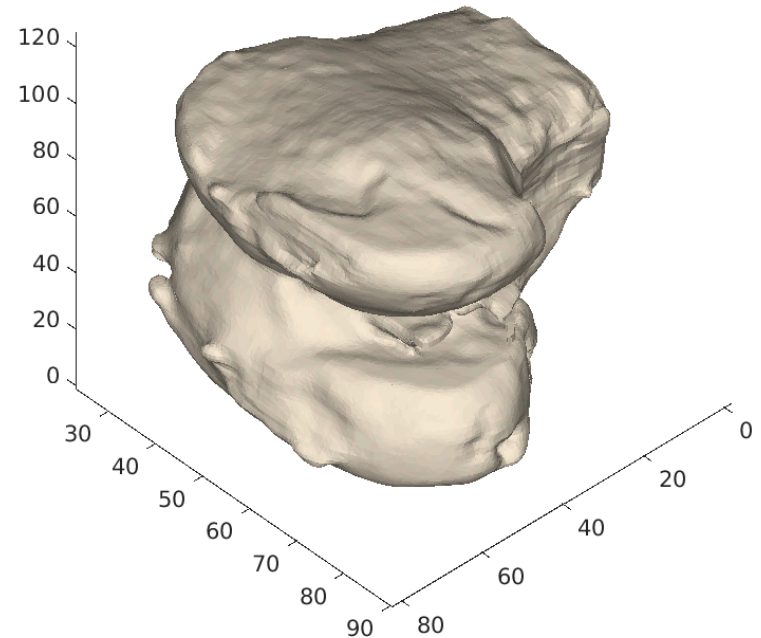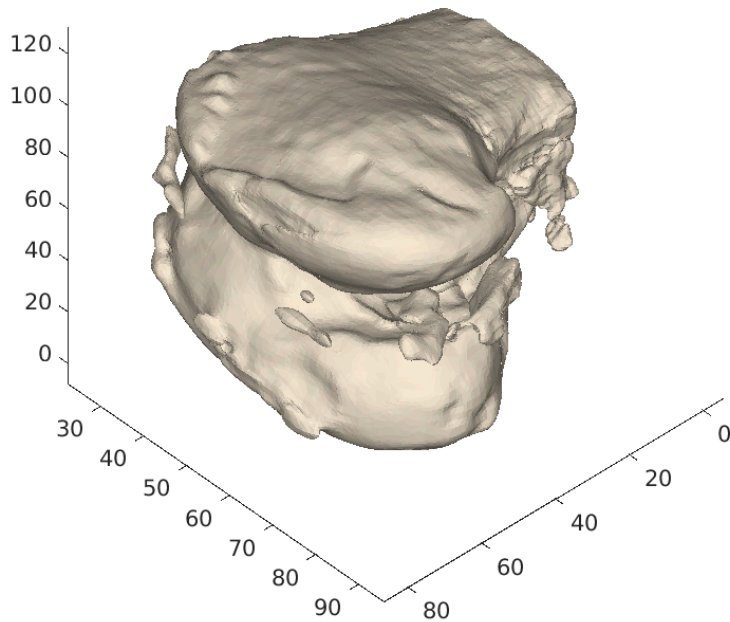$$I_n = \frac{I - \mu}{\sigma}$$

> Noise removal
  — 3D Wiener filter

Methods – Feature Extraction

> Relative position (3D)

> Standard deviation

> Entropy

> Gaussian

> Average

> Laplacian of Gaussian

> Laplacian

> Prewitt (horizontal and vertical)
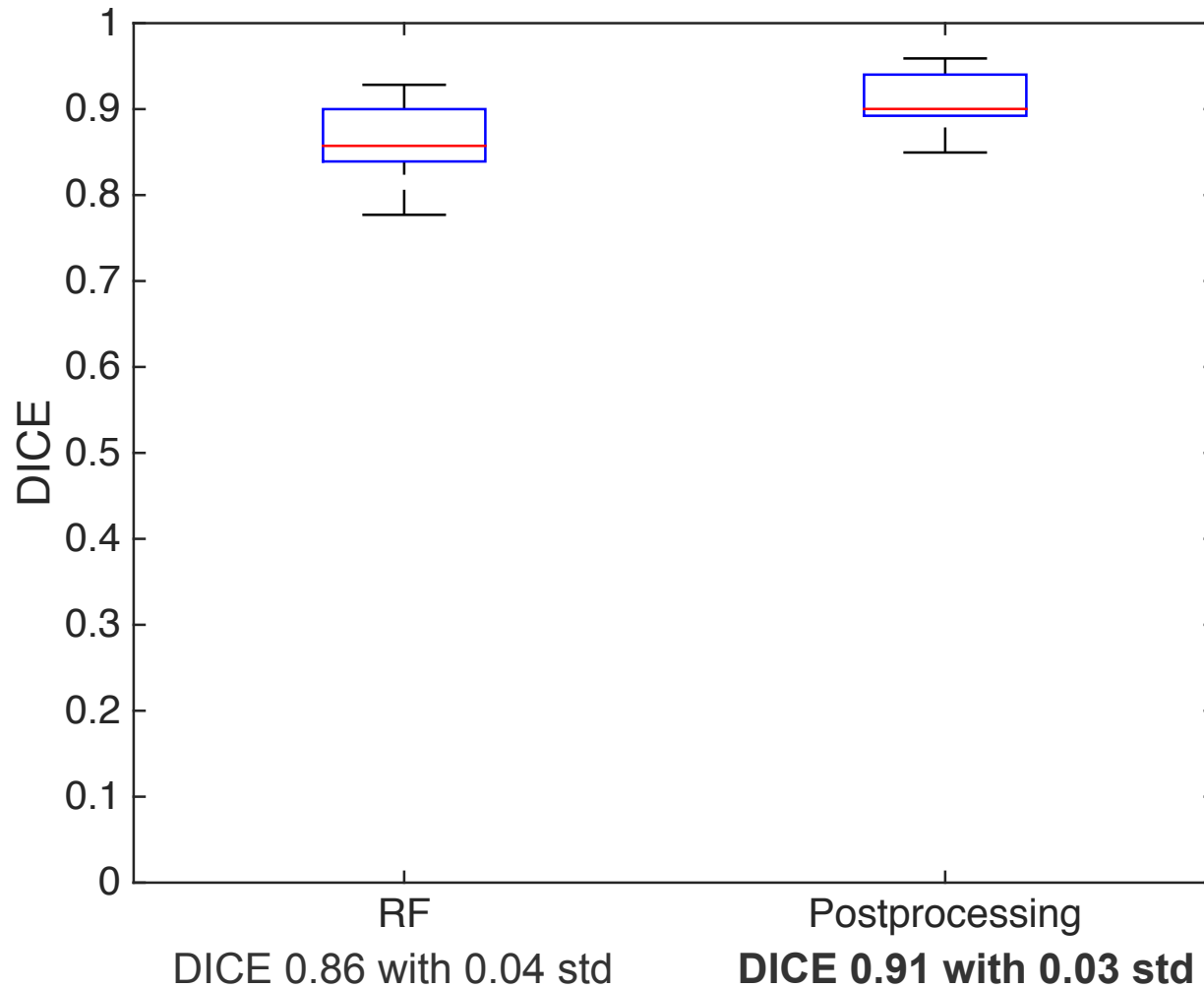
> Sobel (horizontal and vertical)

Methods – Post-Processing

> Morphological opening
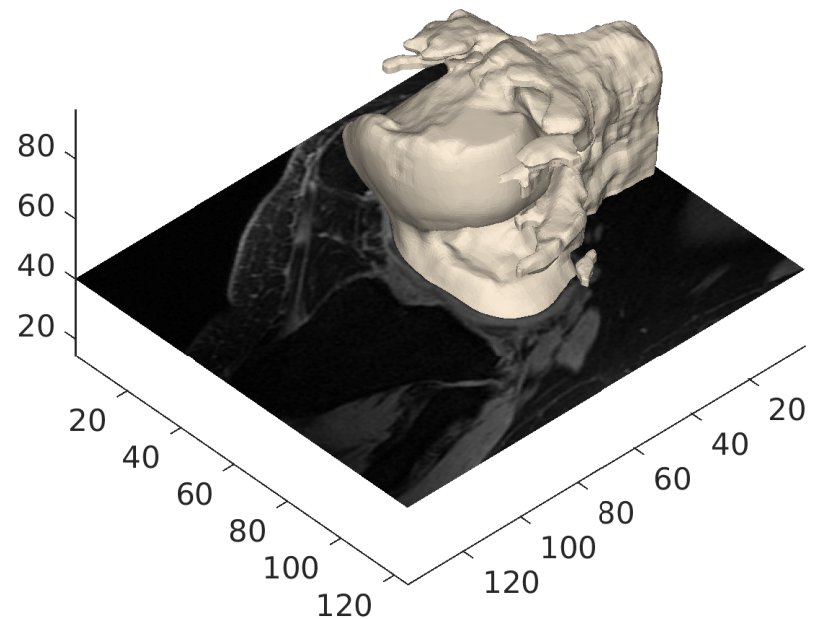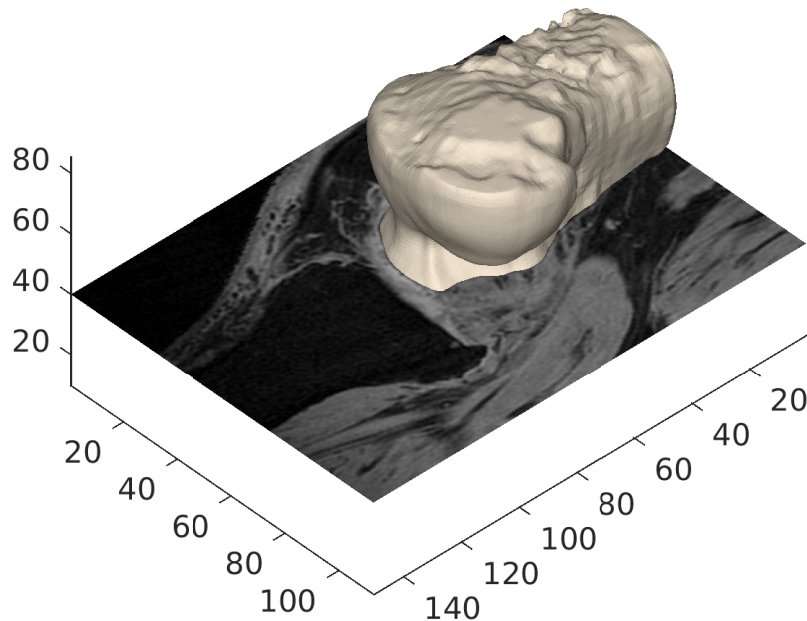> Keep largest area / volume
> Fill holes

Results
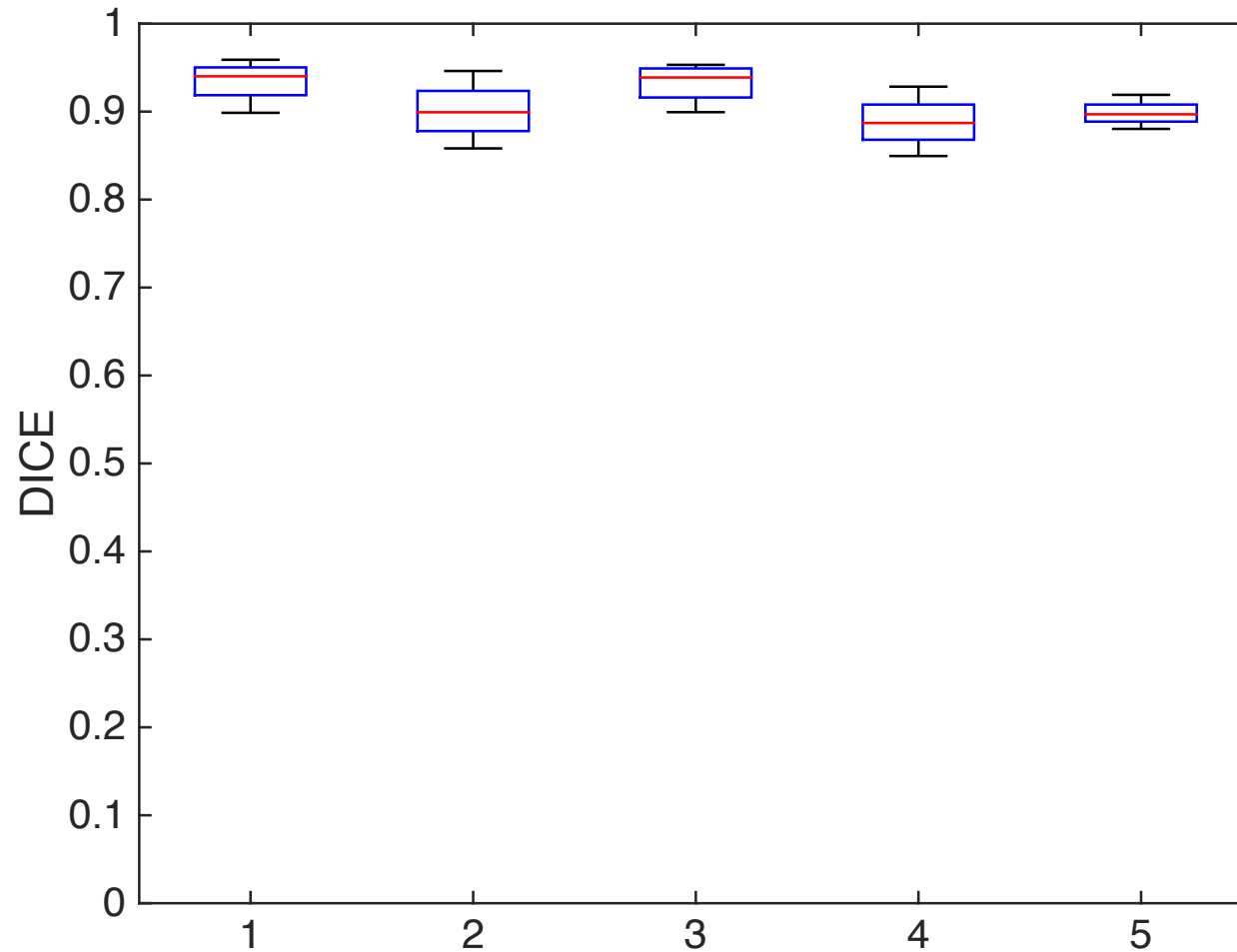
Discussion

> Objective best and worst case:

Outlook

> Include prior information

> Investigate 3D features

> Extend to further bone structure

Thanks for your attention!

Questions?

Results Cross Validation (5 fold)

Random Forest

> 15 Trees

> Leaf size of 1

> Trained on 15 volumes

> 1 % Sample proportion

> 13 Features

> ~ 5 MB