

Semi-automated Segmentation Pipeline for Analysis of Knee Joint Kinematics

A comparision with manual based segmentation



#### Motivation: Relevance of knee kinematics

- Knee osteoarthritis (OA) affects 10% men and 13% of women aged 60 and older (Zhang et al., 2010)
- Altered tibiofemoral kinematics in OA patients can potentially accelerate disease progression (Farrokhi et al., 2014)
- Even in ACL-deficient knees without instability symptoms, knee kinematics are altered (Yang et al., 2018)
- Understanding tibiofemoral kinematics is key to assessing knee joint function





#### Tibiofemoral kinematics

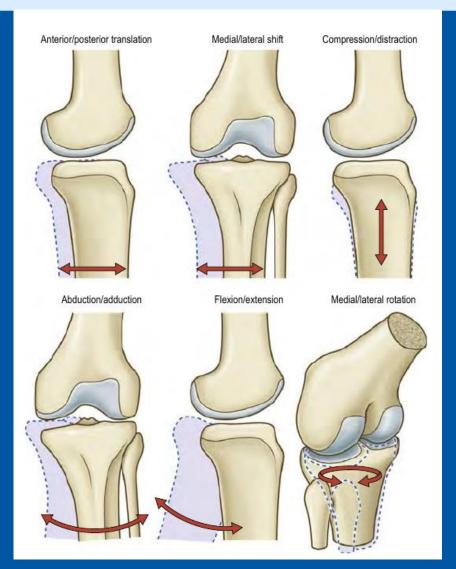
#### Six Degrees of freedom

#### 3 Rotations

- Flexion-Extension: ~160°
- Medial-Lateral: 25-30°
- Abduction-Adduction: ~5°

#### 3 Translations

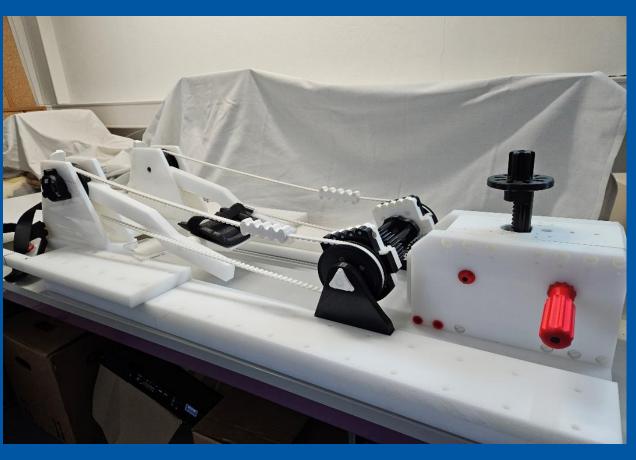
- Anterior-Posterior: 5-10 mm
- Meidal-Lateral: 1-2 mm
- Compression-Distraction: 2-5 mm

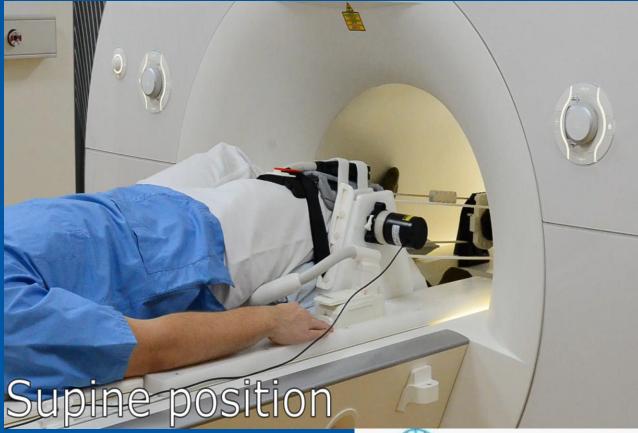


(Credit: Gray's Anatomy 42nd ed.)

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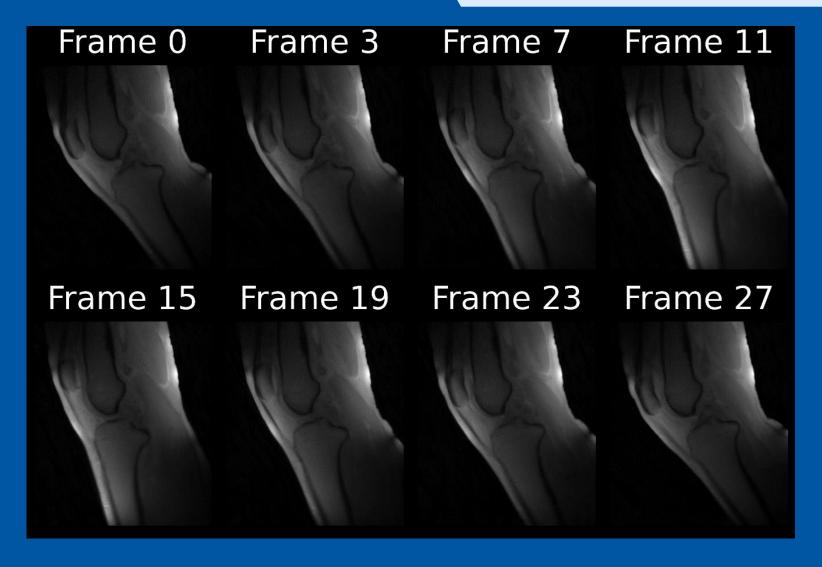
### Knee flexion-extension device

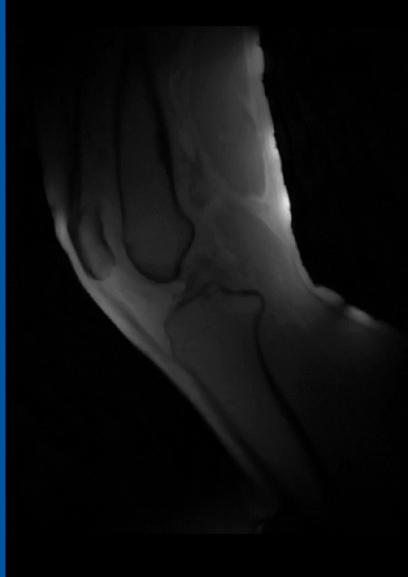




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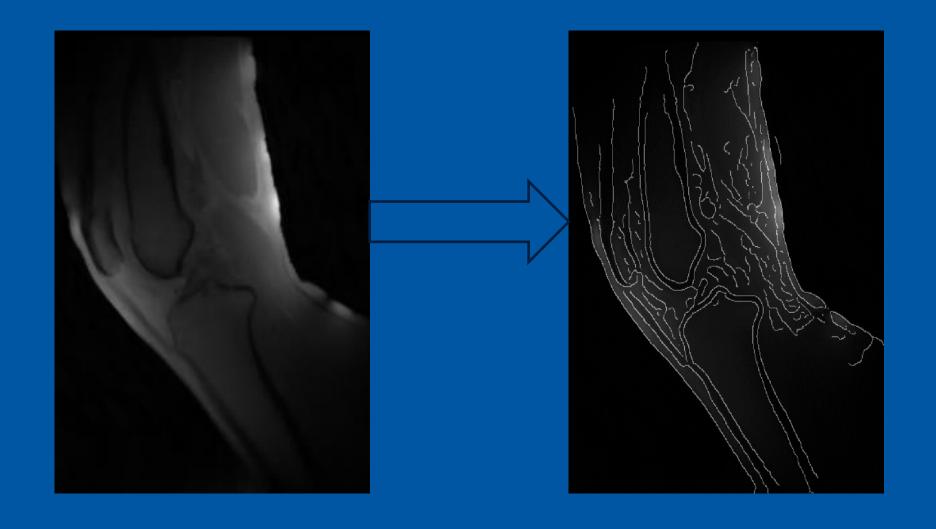
#### Reconstructed frames





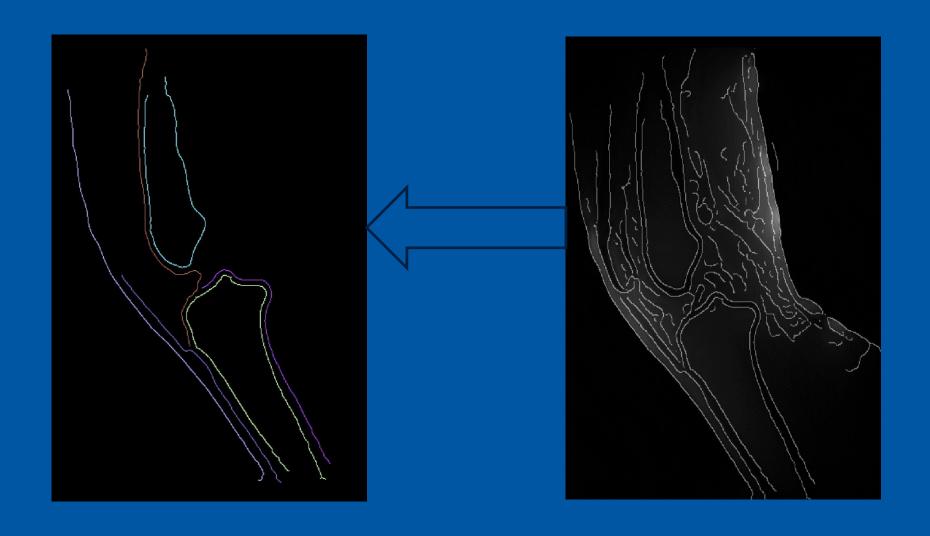


## Methods: Edge Detection



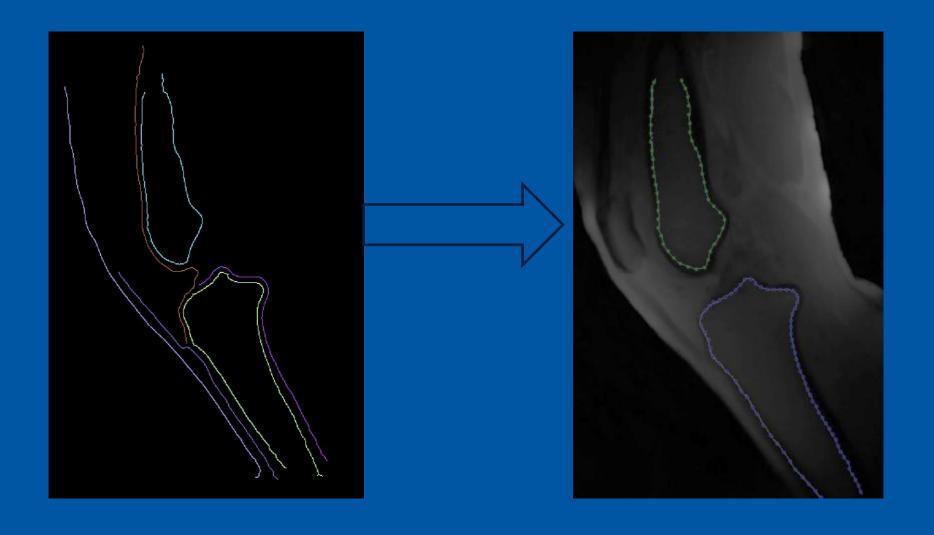


#### Methods: Connected Component Labelling



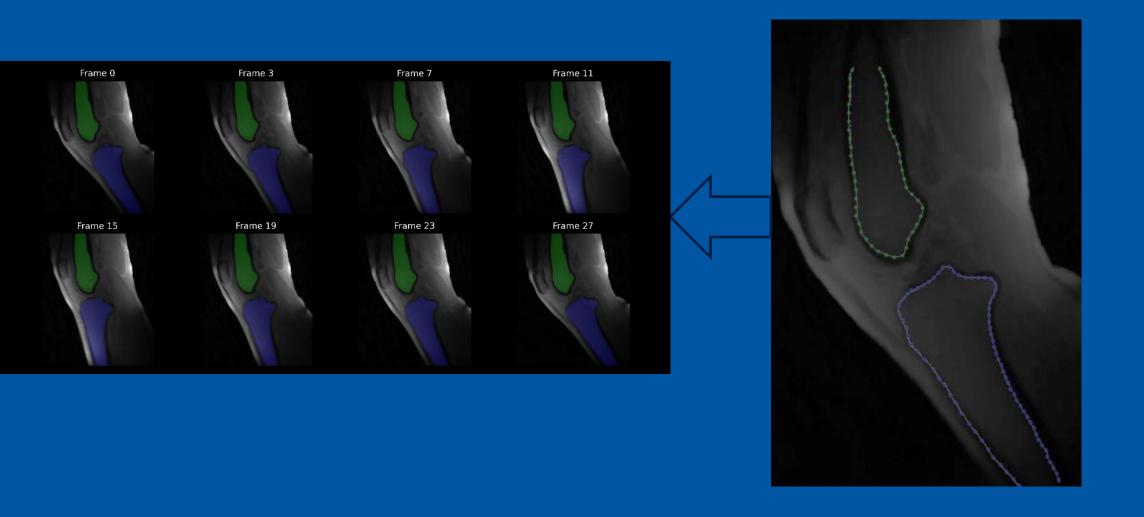


### Methods: Downsample and sorting



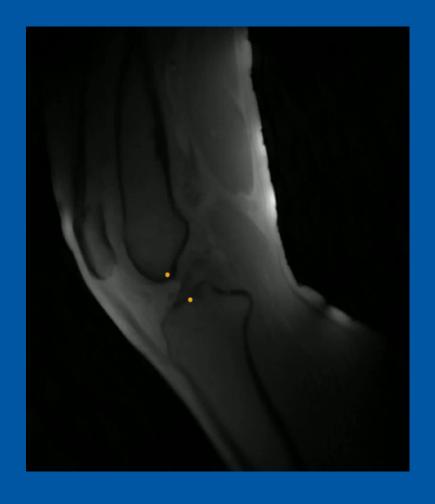


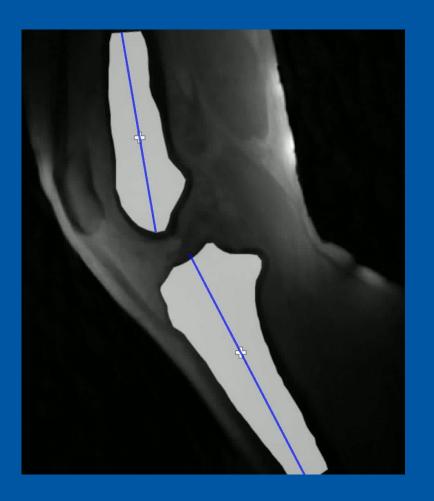
## Methods: Applying transformation





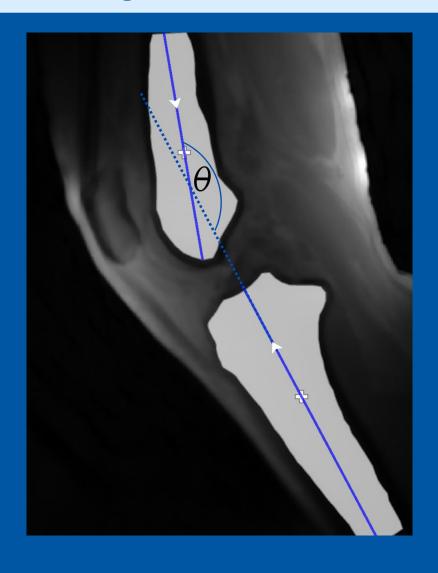
### Parameter extraction and tracking







# Method: Long axis using PCA









Thank you for your attention!





## Supplementary materials

