Klinik für Orthopädie und Sportorthopädie
TUM Klinikum
Technische Universität München

Forschungspraxis (Experimental)

Development of a Femur Statistical Shape Model and Implementation of Landmark-Based Morphing

Background:

Knowledge of femoral anatomy is indispensable when calculating the relative movement of femur and tibia during knee surgery. Commercial navigation systems obtain this anatomy by having the surgeon digitize a small number of bone landmarks with a tracked probe, then use a statistical shape model (SSM) to morph a mean bone shape onto these sparse points — avoiding the need for a preoperative CT scan.

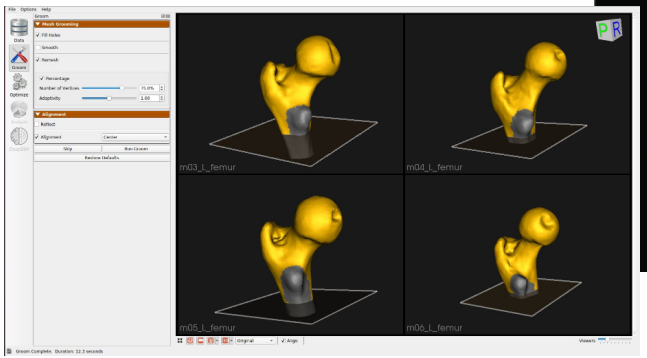
This Forschungspraxis focuses on building this pipeline from scratch: constructing a statistical shape model of the femur from a public bone dataset, then implementing the morphing algorithm that fits the model to a small set of digitized landmarks, enabling patient-specific geometry to be reconstructed relative to a tracker without a CT scan.

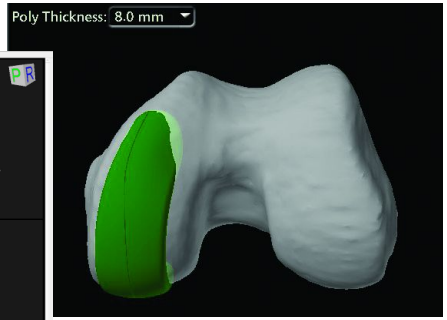
Possible Work packages:

- Familiarization with statistical shape modelling and motion capture systems
- Development of a statistical shape model of the femur
- Implementation of the morphing algorithm to fit the SSM to sparse landmark points
- Data acquisition with different knee mock-ups
- Validation of morphed geometry against ground-truth bone models

Prerequisites:

- Background in Mechanical, Mechatronics, or Medical Engineering
- Python programming skills
- Basic understanding of lower limb anatomy
- Familiarity with point cloud / mesh processing is a plus
- Hands-on "maker" attitude and ability to work with measurements
- Bonus: knowledge of CAD





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