University of Basel
Department of
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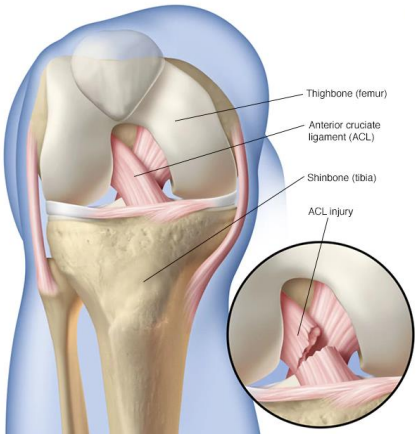
Master of Science – Biomedical Engineering, Thesis Proposal

Deep-Learning Approach for Navigated Anterior Cruciate Ligament Surgeries



The human knee has a complex anatomical structure consisting of four bones, cartilage, muscular tissue, and ligaments. When the knee is moved beyond its natural range of motion, these ligaments might be stretched or in extreme cases even ruptured. The anterior cruciate ligament (ACL) is one such ligament that can rupture, requiring surgical treatment. Performing this surgery is very demanding and requires substantial experience from the surgeon. It has been reported in the literature that misplacements of the tendon transplants often lead to rotary instability possibly requiring re-surgery.

This master thesis aims to support ACL reconstruction surgery by developing intraoperative navigation support. More specifically, the aim is to provide this navigation support using the tools/devices readily available in the already crowded operating room environment. A deep-learning based navigation approach has already been investigated and showed first promising results. To train a better and more robust network, more accurate and especially more ground truth data is needed, which is why the student should first improve the existing data gathering pipeline and then collect new data from porcine knees. Based on this new data, the student will then improve the existing deep-learning approach or develop a completely new one. Furthermore, the existing approach should be extended in such a way that the network is able to recognize whether the searched point is visible or obscured by other anatomical structures.

Nature of the Thesis
Experimental: 30%, Programming: 60%, Documentation: 10%

Specific Requirements
- Experience in deep learning
- Good programming skills (especially Python)

Supervisors
Prof. Dr. Philippe Cattin, *University of Basel, Center for medical Image Analysis and Navigation (CIAN)*
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