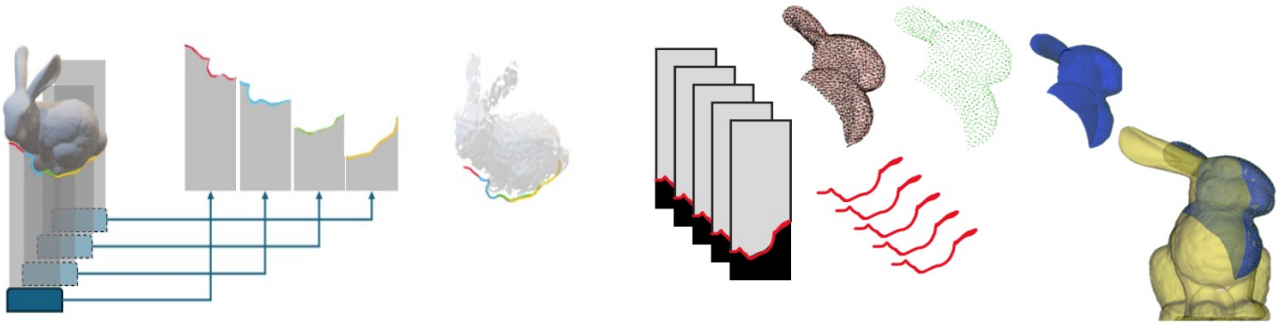
University of Basel, Department of Biomedical Engineering, Hegenheimermattweg 167c, 4123 Allschwil

Master of Science – Biomedical Engineering
Thesis Proposal

Enabling Intelligent Interventions through Ultrasound-Derived Point Clouds

The proposed thesis, will be conducted within the CIAN group at the Department of Biomedical Engineering, University of Basel, in collaboration with IHU Strasbourg (France), aims to advance ultrasound-based guidance technologies for intraoperative interventions. The project will address two main objectives. **First**, the student will develop methods for extracting point clouds from ultrasound scans acquired under different conditions and partial views, and compounding these partial surface representations into coherent full point clouds. **Second**, the work will focus on registering the reconstructed ultrasound-derived point clouds with preoperative 3D models to enable precise intraoperative guidance. Data acquisition will be carried out on phantoms at IHU Strasbourg, with the student actively participating in additional acquisition campaigns. The core contributions will lie in developing ultrasound segmentation and point cloud extraction pipelines, as well as investigating and implementing robust point cloud registration strategies. In addition, the student will have the opportunity to design and 3D-print customized phantoms for validation experiments. The ultimate goal of the thesis is to provide new tools to improve surgical navigation and decision-making in orthopedics and related interventions, contributing to the broader effort of enabling intelligent, ultrasound-based guidance systems in the operating room.



Part 1: US segmentation and multi-view point cloud extraction **Part 2: Point cloud registration**

Nature of the Thesis: Programming : 70%, Documentation: 20%, Experimental: 10%

Specific Requirements:
Good programming skills (Python or/and MATLAB). Familiarity with deep learning models. Genuine interest in a highly interdisciplinary project.
Group Leader:
Prof. Dr. Philippe Cattin, University of Basel, Center for medical Image Analysis and Navigation CIAN https://dbe.unibas.ch/en/research/imaging-modelling-diagnosis/center-for-medical-image-analysisnavigation/

Supervisors: Dr. Sidaty El Hadramy (University of Basel), Dr. med. Juan Verde (IHU Strasbourg).

Collaborators: This project is in collaboration with: IHU Strasbourg, Strasbourg, France.
Contact :
For more information please contact: Dr. Sidaty El Hadramy, sidaty.elhadramy@unibas.ch.