Karlsruhe Institute of Technology

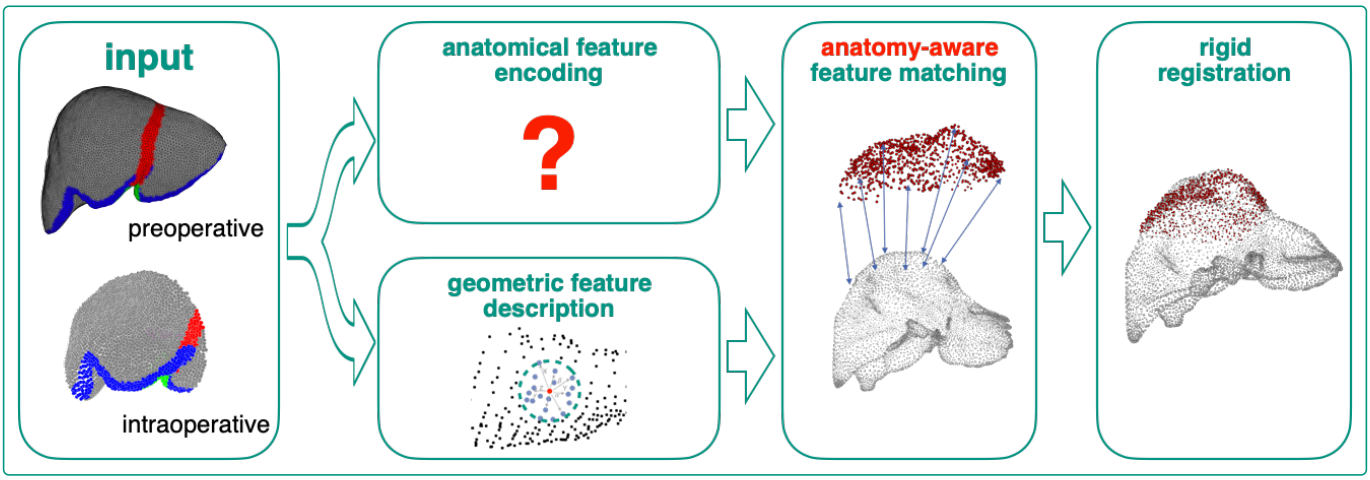
Institute of Biomedical Engineering

Anatomical Landmark-Aware Feature Matching for Laparoscopic Liver Surgery

Master thesis

Motivation

In computer-assisted laparoscopic liver surgery, accurate registration of preoperative 3D models with intraoperative surface reconstructions is essential for reliable surgical navigation. A major challenge is the identification of corresponding points between these surfaces, particularly due to limited visibility, tissue deformation, and the relatively smooth geometry of the liver. Conventional 3D feature-matching approaches primarily rely on geometric information, which may lead to ambiguous or incorrect correspondences. However, anatomical structures, such as the anterior ridge and falciform ligament, provide additional information that could improve matching reliability. This Master's thesis aims to investigate and develop an anatomy-aware 3D feature-matching approach that combines geometric descriptors with anatomical information to establish more accurate and robust correspondences, ultimately improving 3D registration for laparoscopic liver surgery.



Project Description

This Master's thesis focuses on developing and evaluating anatomy-aware 3D feature matching for liver surface registration. The student will explore how anatomical landmarks, such as the anterior ridge and falciform ligament, can be combined with geometric descriptors to improve correspondence matching between preoperative and intraoperative 3D point clouds. Different strategies, including semantic filtering and weighted similarity measures, will be implemented in an existing Python-based registration pipeline and evaluated on synthetic and potentially clinical data. The project encourages independent ideas and provides experience in formulating research hypotheses, designing experiments, and critically analyzing results.

Notes

Programming knowledge in Python advantageous.
Motivation & fun are highly desirable.
Application documents: Curriculum vitae and transcript of records

Research Area

3D Computer Vision, Machine Learning, Feature Matching

Course of Studies

BME, ETIT, Computer Science, Computational Engineering, ...

Starting Date

As soon as possible

Posted Date

13.11.2026

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