Master's internship – 2023

Real time replanning of tracked needles for computer-assisted percutaneous surgery

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Context :

Intraoperative surgical navigation for percutaneous procedures has been mostly studied independently from trajectory planning. Electromagnetic Tracking (EMT) systems are currently the best option for continuously tracking surgical instruments. However, when not coupled with a planning system, EMT devices alone can't anticipate possible problems happening during the insertion of needles. On the other hand, most preoperative trajectory planning systems have been proposed without any link to intraoperative guidance. Their algorithms are usually based on preoperative images that can be considered as static images.

The purpose of the CRYO-Track project is to go beyond these current limitations on both sides, and link preoperative planning with intraoperative guidance, including an intelligent and real time dynamic update of the guidance using the planning constraints, to improve accuracy and safety.

Work:

The project is part of a collaboration between TU Darmstadt and the ICube institute of the University of Strasbourg.

The objective is to propose and implement a computational method to plan in real time smart adjustments of a current tracked needle during its insertion, to ensure the placement constraints are still satisfied in a deformable environment. The study will build on previous works on preoperative trajectory planning by the French side, on EMT tracking by the German side, and on recent common works of the French-German team on needle guidance based on EMT.

The major aspects of the work are: focus on fast computations to ensure real-time performance of the replanning algorithm, and usability in the OR thanks to an ergonomic display of the trajectory to follow. To validate the approach, experiments will be conducted on a medical gel phantom.
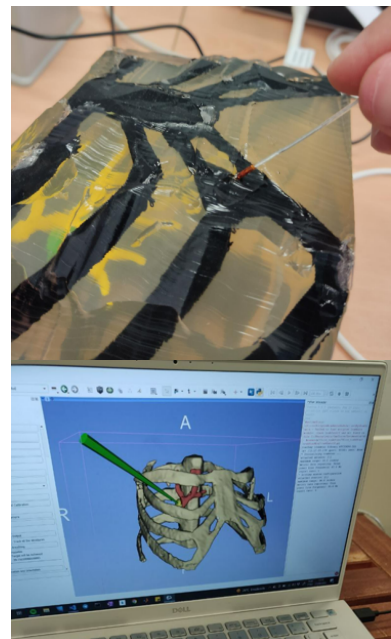
Team and environment:

The internship will be part of a collaboration between three disciplines and co-supervised by experienced researchers from the two research groups.

The intern will be hosted in an office at the ICube Institute, Illkirch Campus of Strasbourg, and have access to all the necessary hardware and IT resources.

The development will be done in C++ or python within the 3D Slicer platform.

Internship duration: 5-6 months, starting January, February or March 2023.

Profile: MSc with a major in computer science, computer graphics, image processing, or related fields. Proficiency in C++ or python is required.

For further information and application, please contact the supervisors.