

## Tracking moving structures of interest in trans-abdominal ultrasonography

IRCAD and IHU are two partner institutes aiming at creating new tools for the surgery of the future, notably through a common Research and Development team.

IRCAD (Institut de Recherche contre les Cancers de l'Appareil Digestif) constitutes a reference in the domain of assisted digestive surgery, specifically in the area of minimally invasive surgery, via the use of Augmented Reality and Virtuality and Augmented Reality. The IHU (Institut de Chirurgie Guidée par l'Image) in Strasbourg develops an innovative surgery to improve medical care of the patients, with a personalized approach combining the best minimally invasive technologies with the latest progress in medical imaging. For many projects, the R&D team of the IHU works jointly with the R&D team of IRCAD.

Transabdominal ultrasonography (US) is a real-time medical imaging technique. Comparing it to more traditional imaging approaches like CT-Scan, it is non-ionizing for the patient, thus harmless, and less costly. However, the resulting images are often difficult to interpret, due to artifacts, and only in two dimensions. In this context it can be complicated to track structures of interest (as can be seen in Figure 1 left and middle).

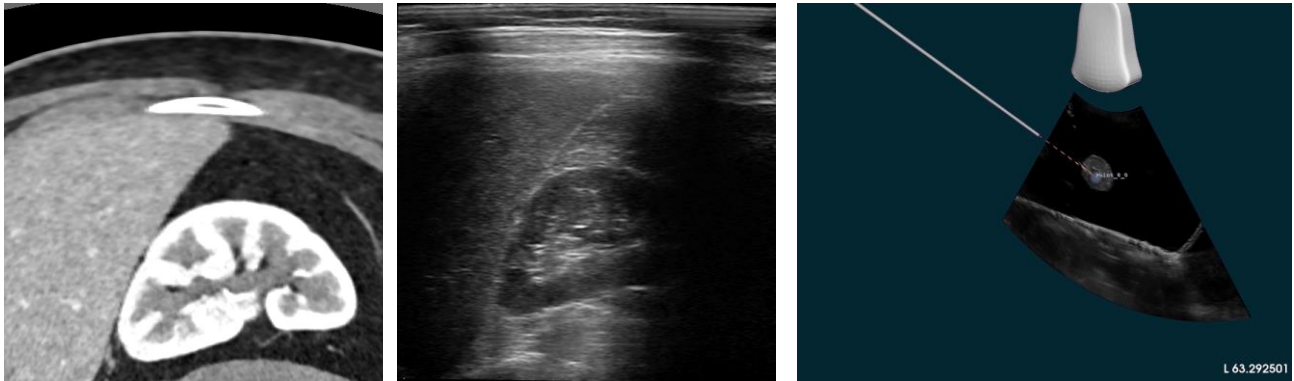


Figure 1: Comparison of CT (left) and US image (middle) on the liver and kidney.  
The figure on the right shows a 3D visualization of the tracked US probe in a 3D view.

The main objective of the internship would be to implement methods that allow to track organs and tumors in a 3D view (like the one displayed in Figure 1 right). The US probe is tracked via an electromagnetic tracking system, allowing us to get the 3D position of the probe in real-time. Tracking a feature will consist in focusing on a specific region while the patient breathes, extract it and model its movement in the 3D view. This will allow the surgeon to track structures of interest, while still being able to focus on other regions of the patient.

Software at IRCAD uses an internally-developed Open-Source framework: Sight, previously named *fw4spl* [1]. This framework is a collection of portable C++ libraries, with a component-oriented architecture. The components are independant and reusable modules (visualization, tracking, GUI, algorithms) assembled to build software.

The intern will thus have good skills in C++ development. The student must also be able to develop into a large code base, work independently and be proactive. Contributions to other Open-Source software is a plus, that can be mentioned while candidating, especially for projects related to image processing/rendering.

### Tutors :

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**Gross salary** : 1100 €/months

**Stage duration** : 6 months

**Beginning of the internship** : 1<sup>er</sup> trimester of 2019

**Place** : IRCAD – Strasbourg – City Center

### Skills :

Windows/Linux  
C++  
Image processing :  
VTK, ITK, OpenCV