

# Master’s Internship: Joint-learning for instruments detection on 2D X-ray fluoroscopic images.

2023-2024

**Context** This project is part of MAAGIE project in collaboration between LIP6, ISIR and Saint-Antoine Hospital.

The main goal of this project is to improve a medical intervention called Endoscopic Retrograde Cholangio Pancreatography (ERCP). This intervention aims to drain the bile ducts in the setting of stones or tumors. For this, endoscopic instruments are monitored thanks to 2D X-ray radiography. Cholangiograms (Figure 1) allow endoscopists knowing the guidewire’s position within the bile duct. However, anatomical variability and lack of 3D information make it very challenging for endoscopists. These limitations can lead to potential mistakes that we propose to reduce by creating a computer-assisted intervention.

However the guidewire is very thin and low contrasted, which makes its automatic detection very difficult. Furthermore the lack of data is challenging for deep learning algorithms.

**Objectives** Previous work [1] has shown the possibility to detect endoscope and guidewire separately, but guidewire detection remains challenging. To improve performance we want to use the hypothesis that guidewire always comes from endoscope.

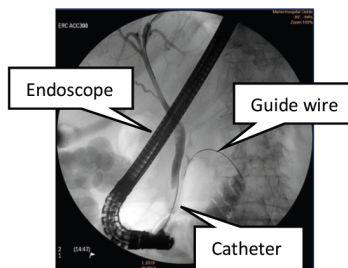


Figure 1: Cholangiogram with endoscope, catheter and guidewire (tool to enhance).

**Missions** You will be asked to apply deep-learning methods as U-Net [2] to detect instruments as one label, then as two labels on images. A cascaded network using joint-learning can be considered depending on advancement.

**Data/Computing** A ready-to-use dataset is available and LIP6 has a computing centre with GPU for deep learning algorithms.

**Candidates** Candidates should have a strong background in computer science and applied mathematics mathematics, and be fluent in Python. Multi-disciplinary profiles and motivation for medical applications are a bonus.

**Practical information:**

- The internship will take place in LIP6 at Sorbonne Université, 4 place Jussieu 75005 PARIS.
- Remuneration: about 600 euros / months
- Duration: 6 months, starting mid-February or March

**Contact:** Garance MARTIN [garance.martin@lip6.fr](mailto:garance.martin@lip6.fr); Isabelle BLOCH [isabelle.bloch@sorbonne-universite.fr](mailto:isabelle.bloch@sorbonne-universite.fr)

## References

- [1] Garance Martin, Saad El-Madafri, Aymeric Becq, Jérôme Szewczyk, and Isabelle Bloch. Instruments Segmentation in X-ray Fluoroscopic Images for Endoscopic Retrograde Cholangio Pancreatography. *Studies in Health Technology and Informatics*, 294:133–134, May 2022.
- [2] Olaf Ronneberger, Philipp Fischer, and Thomas Brox. U-Net: Convolutional Networks for Biomedical Image Segmentation. In Nassir Navab, Joachim Hornegger, William M. Wells, and Alejandro F. Frangi, editors, *Medical Image Computing and Computer Assisted Intervention MICCAI 2015*, Lecture Notes in Computer Science, pages 234–241, Cham, 2015. Springer International Publishing.