Master internship 2021

Analysis of functional connectivity at rest in intraoperative neuroimaging

Introduction

Intraoperative neuroimaging is developing as an indispensable means of **assistance for surgical procedures**. We are working on the development of innovative **optical imaging** methods for a **translational medical application**: the identification of brain functional areas during neurosurgery. These works are based on clinical collaborations with **Jacques Guyotat** (neurosurgeon in Hospices Civils de Lyon) and **Fabien Schneider** (researcher in Saint Etienne hospital) for the developement of a **new optical imaging method** inspired from fMRI: **the functional connectivity at rest (resting state)** [1, 2].

Objectives

The objective of this internship is to adapt the resting state technique to the optical imaging setup developed in CREATIS laboratory [3] to study the patient functional connectivity at rest in the operative room.

Resting state imaging is a new technique of public interest because it aims an identification of brain functional areas without patient intervention and could be possibly used under general anesthesia. The development of an optical method would make it possible to reduce the time of neurosurgery operations and improve the surgeon's operating comfort while guaranteeing the patient's well-being. Optical imaging is particularly adapted to an intraoperative context because intrinsic contrasts could be assessed in a non invasive and non ionizing way. However, the use of optical imaging faces to several difficulties related to the quantification and understanding of biomarkers for the analysis of brain connectivity at rest. In order to validate this new imaging method, the fMRI and optical resting state maps will be compared to the electrical brain stimulation identifications performed by the neurosurgeon.

In this project, the work will be based on preliminary studies conducted with the collaboration of Jacques Guyotat, which have generated several publications [3, 4, 5]. The internship work will also rely on the expertise of Fabien Schneider on the analysis of brain connectivity at rest [6, 7]. A proof of concept has already been developed during Charly Caredda PhD thesis, see Fig. 1-B.

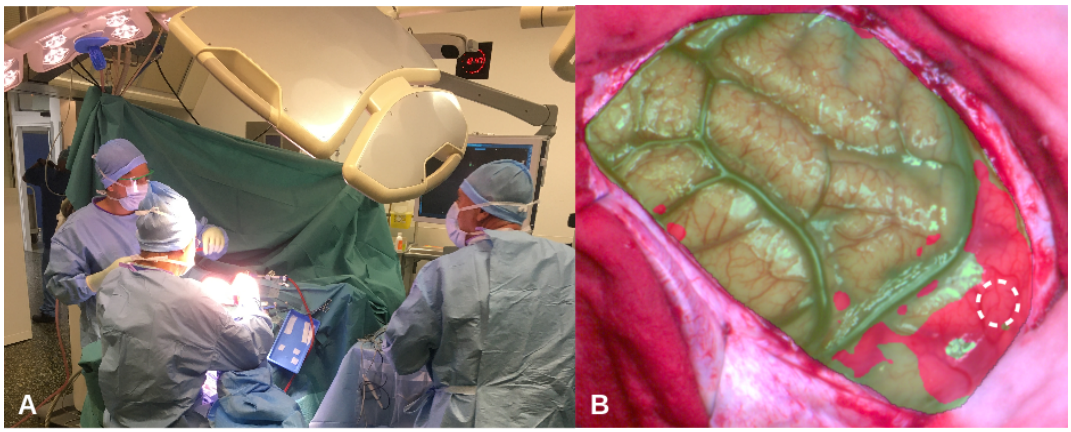

Figure 1: A - Neurosurgey operating room in Hospices Civils de Lyon. B - Preliminary result of identification of brain areas connected at rest. The cerebral cortex represented in red indicates strongly connected areas, the unconnected areas are represented in green. The dotted white circle indicates the functional area identified by the neurosurgeon.

Internship objectives and candidate profil

The person recruited will mainly work on modeling and signal/image processing. He/she will perform *in vivo* experiments on humans in a neurosurgery operating room at the Hospices Civils de Lyon. The prerequisites are therefore those of a physicist and/or engineer with a specialization in modeling and/or signal processing with a strong attraction for multidisciplinarity in the medical and biomedical fields.

Scientific environment

In this project, three structures will be involved in the scientific supervision : CREATIS laboratory, Hospices Civils de Lyon and Saint hospital.

The supervison committee will be composed of specialists in each component of this internship subject:

- Clinical medical optical setup (Bruno Montcel and Charly Caredda)
- Resting state connectivity (Fabien Schneider)
- Medical practitioner (Jacques Guyotat and Fabien Schneider)

Contact

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References

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