Master or Semester Project

Functional magnetic resonance spectroscopy at 7 Tesla

Cognitive functioning is an essential aspect of human behavior that encompasses various mental processes such as perception, attention, memory, and reasoning [Fisher et al., 2019]. Over the years, neuroimaging techniques have been instrumental in exploring the neural underpinnings of cognitive functioning and have contributed to a more profound understanding of the human brain [Morita et al., 2016; Sui et al., 2020]. Among these techniques, functional magnetic resonance spectroscopy (fMRS) has emerged as a valuable tool for investigating neuronal functioning. Unlike functional magnetic resonance imaging (fMRI), which primarily measures changes in blood oxygenation level dependent (BOLD) signals, fMRS allows for the assessment of changes in neurochemicals such as neurotransmitters and metabolites in real-time during visual, sensory, or cognitive tasks.

FMRS has been widely used to investigate various aspects of neural functioning, including visual, motor, and auditory tasks. In the context of visual tasks, fMRS has been utilized to study the neural correlates of visual perception, attention, and object recognition. This project will illustrate the potential of fMRS as a powerful tool for exploring cognitive function and to demonstrate its advantages over other neuroimaging techniques. The potential of fMRS to investigate cognitive (dys)function is substantial and holds great promise for the field of neuroscience and clinical practice [Stanley and Raz, 2018]. It provides unique insights into the neural underpinnings of cognitive functioning, and enables researchers to explore the relationship between changes in neurochemicals and behaviour. Additionally, fMRS has the potential to be a valuable clinical tool for evaluating cognitive function in individuals with cognitive disorders such as Alzheimer's disease, ADHD, or schizophrenia. By measuring changes in neurotransmitter levels during cognitive tasks, fMRS provides a direct assessment of the neural function underlying cognitive processes and to help diagnose and monitor cognitive disorders. Moreover, fMRS can potentially be used in the development and evaluation of therapeutic interventions for cognitive disorders, by providing information about the effectiveness of treatments on neurotransmitter levels and cognitive function.

Skills:

Your qualifications, previous experience and background:

- Basic knowledge of MR principles.
- Basic knowledge of neuroscientific concepts.
- Programming skills in MATLAB, Python or C/C++ are required. Knowledge on machine learning or deep learning is a plus.
- Fluency in French is a plus.

Supervisors:

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- Dr. Antonia Kaiser, CIBM MRI EPFL-AIT https://people.epfl.ch/antonia.kaiser

How to apply:

if you are interested to learn more about the projects, please contact: antonia.kaiser@epfl.ch

About CIBM

The CIBM Center for Biomedical Imaging was founded in 2004 and is the result of a major research and teaching initiative of the partners in the Science-Vie-Société (SVS) project between the Ecole Polytechnique Fédérale de Lausanne (EPFL), the Université de Lausanne (UNIL), Université de Genève (UNIGE), the Hôpitaux Universitaires de Genève (HUG) and the Centre Hospitalier Universitaire Vaudois (CHUV), with the generous support from the Fondation Leenaards and Fondation Louis-Jeantet.

CIBM brings together highly qualified, diverse, complementary and multidisciplinary groups of people with common interest in biomedical imaging.

We welcome you in joining the CIBM Community.

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