PROGRAMME DOCTORAL ROMAND EN PSYCHOLOGIE

DOCTORAL PROGRAM IN PSYCHOLOGY | WESTERN SWITZERLAND

LE PROGRAMME EST OUVERT AUX DOCTORANTS EN PSYCHOLOGIE ET OFFRE LA POSSIBILITÉ DE:

- Développer des savoir-faire méthodologiques
- Acquérir des compétences dans le domaine de la recherche qui soient transférables sur le marché du travail non-académique
- Favoriser le réseautage scientifique

THE PROGRAM WELCOMES ALL PHD STUDENTS IN PSYCHOLOGY AND GIVES THE OPPORTUNITY:

- To develop methodological skills
- To acquire research expertise that is transferable to the non-academic job market
- To favor scientific networking

Programme Doctoral Romand Psychologie
Doctoral Program in Psychology | Western Switzerland

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EEG METHODS: Focus on functional connectivity (EEG II)

6th - 8th November 2023, Géopolis, UNIL

Around 25hrs of education (1 ECTS)

Organisers

Paolo Ruggeri, Senior scientist, UNIL; Jérôme Barral, Senior Lecturer; Alexandre Cretton, UNIL.

Invited speakers

Mahmoud Hassan, Adjunct professor, Reykjavik University; David Pascucci, PhD, EPFL; Dr. Marzia De Lucia, PhD, UNIL; Ruxandra Tivadar, PhD, UNIBE; Michael De Pretto, PhD, UNIL; Nicolas Roheri, PhD, UNIGE; Isotta Rigoni, PhD, UNIGE.

UNI FR Université de Fribourg Universität Freiburg · Université de Genève · Unil Université de Lausanne · unine Université de Neuchâtel · The Graduate Institute Geneva

General information

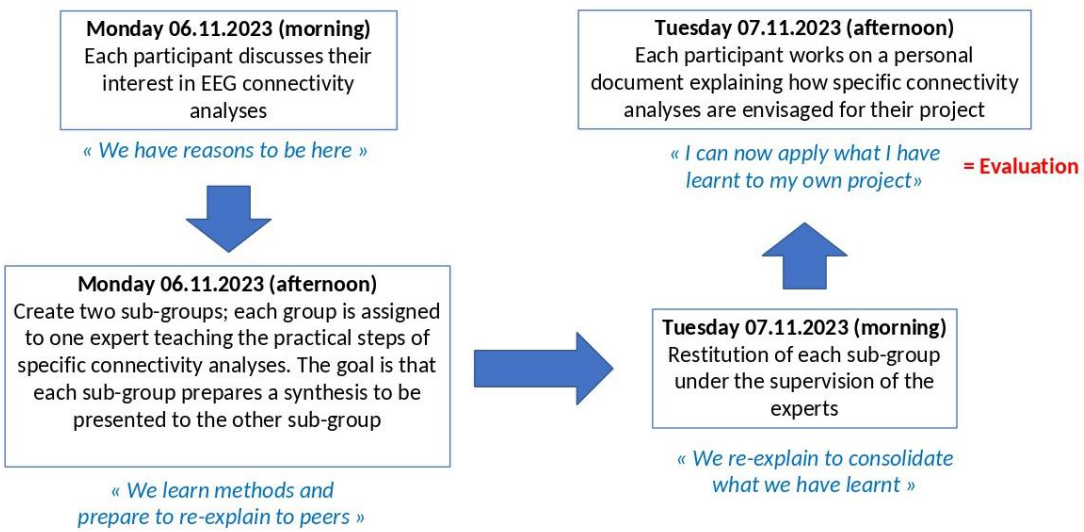
This course is for PhD students who have or want to plan an EEG data collection with the aim of analysing the collected data using functional connectivity methods. The first two days, devoted exclusively to functional connectivity activities, are complemented by a day with short talks on EEG methodologies used in different clinical contexts.

Requirements for participation

The course has a primary objective of promoting the consolidation of knowledge related to functional connectivity analysis procedures applied to the EEG signal. To achieve this goal, the course follows a bottom-up structure, aiming to address the specific research needs of the participants. Through engaging with experts during the various activities provided, participants gain valuable insights for designing an appropriate data analysis tailored to their own ongoing or future projects.

*Considering the context, it is crucial for prospective participants of this course to possess the ability to articulate research hypotheses concerning the EEG data they currently possess or the research project they intend to establish. To ensure adherence to this prerequisite, we kindly request individuals interested in enrolling to complete the following questionnaire (https://sphinx2.unil.ch/index.php/431239?lang=en) and submit it by the **30/09/2023**. The information provided through this form will serve two purposes: firstly, to guarantee that all participants come with their own research objectives, and secondly, to tailor the proposed activities on Monday 6.11 and Tuesday 7.11 accordingly. This will enable us to align the course content with the specific needs and interests of each attendee.*

Pedagogic design



Evaluation

Writing report: Develop a concluding document that addresses the research question and hypotheses posed by developing the details of the methodology chosen for the analysis of the data of your ongoing or future projects.

Registration

https://psychologie.cuso.ch/les-cours/

Programme

	TIME	AGENDA ITEM	INTERVENER
Monday 06.11.2023	Morning	**Géopolis, room 2218**	
	8:30 - 9:10 AM	Introduction and Explanation of Course Objectives & Overview of Connectivity Expertise	Jérôme Barral, Paolo Ruggeri
	9:10 - 12:20 PM	Open Discussion with Connectivity Experts (with 30 minutes break)	Mahmoud Hassan, David Pascucci, Jérôme Barral, Paolo Ruggeri
	12:20 - 12:30 PM	Summary and Next Steps	Jérôme Barral, Paolo Ruggeri
	Afternoon	**Géopolis, room 2218/2208**	
	1:30 - 1:40 PM	Recap of Morning Session (room 2218)	Jérôme Barral, Paolo Ruggeri
	1:40 - 3:40 PM	Group Work with Connectivity Experts (2 groups of 8 max; rooms 2218 & 2208)	Mahmoud Hassan, David Pascucci
	3:40 - 4:00 PM	Break	-
	4:00 - 5:00 PM	Group Preparation for Tuesday Session (room 2218)	Mahmoud Hassan, David Pascucci, Jérôme Barral, Paolo Ruggeri
Tuesday 07.11.2023	Morning	**Géopolis, room 2218**	
	8:30 - 8:40 AM	Recap of Previous Day's Afternoon Session	Jérôme Barral, Paolo Ruggeri
	8:40 - 9:40 AM	Group Work to Complete Previous Day's Tasks	Mahmoud Hassan, David Pascucci, Jérôme Barral, Paolo Ruggeri
	9:40 - 10:00 AM	Break	-
	10:00 - 12:00 AM	Group Presentations and Knowledge Consolidation	Mahmoud Hassan, David Pascucci, Jérôme Barral, Paolo Ruggeri
	Afternoon	**Géopolis, room 2218**	
	1:00 - 5:00 PM	Initial Project Work Session	Mahmoud Hassan, David Pascucci, Jérôme Barral, Paolo Ruggeri
Wednesday 08.11.2023	Morning	**Géopolis, room 2879**	
	9:00 - 10:00 AM	Signal Processing Approaches In Invasive And Non-Invasive EEG For Epilepsy Research	Nicolas Roehri
	10:00 - 11:00 AM	Recent advancements in EEG clinical applications and graph signal processing	Isotta Rigoni
	11:00 - 11:20 AM	Break	-
	11:20 - 12:20 PM	Investigating brain dynamics and cognitive functions using intracranial recordings	Ruxandra Tivadar
	Afternoon	**Géopolis, room 2208**	
	2:00 - 3:00 PM	Multivariate EEG decoding and prediction of comatose patients' outcome	Marzia de Lucia
	3:00 - 4:00 PM	Electrical neuroimaging of proactive inhibition in Parkinson's disease: assessing effects of deep brain stimulation	Michael De Pretto
	4:00 - 4:30 PM	Wrap up and closing information	Jérôme Barral, Paolo Ruggeri

Abstract talks

Signal Processing Approaches In Invasive And Non-Invasive EEG For Epilepsy Research

Nicolas Roehri, PhD, UNIGE

One percent of the world's population suffers from epilepsy, with a third of patients experiencing a drug resistant form. Epilepsy surgery, which consists in resecting the part of the brain involved in generating seizures (i.e., the epileptogenic zone, EZ), is the most effective treatment option to achieve seizure freedom in these patients. About thirty percent of patients undergoing epilepsy surgery are, however, not seizure free. This high rate of surgical failure has motivated the search of electrophysiological biomarkers to better localise the EZ or predict success of surgery. The presurgical evaluation typically involves non-invasive electroencephalogram (EEG) monitoring and, in complex cases, invasive intracranial EEG (iEEG) recordings. While iEEG provides a gold standard for studying brain activity, it has limited spatial coverage. Conversely, EEG/magnetoencephalography (MEG) offers whole-brain imaging but suffers from low spatial resolution. In this talk, we explore the potential of signal processing techniques to aid in EZ localization, epilepsy diagnosis, and surgical outcome prediction. Specifically, we will focus on employing time-frequency analysis to detect and characterise epileptic activities in iEEG recordings, validating source reconstruction of EEG/MEG using simultaneous iEEG and EEG/MEG recordings, and diagnosing epilepsy through non-invasive connectivity analysis. By leveraging these two types of recordings, we aim to enhance our understanding of epilepsy and improve surgical outcomes.

Investigating brain dynamics and cognitive functions using intracranial recordings

Ruxandra-Iolanda Tivadar, PhD, UNIBE

This presentation will touch upon practical matters involved in intracranial recordings and will demonstrate a few examples of data analysis depending on different questions and research interests. At first, the methodological steps and requirements needed to record data will be discussed. This will include discussing patient handling ethics and rights, such as privacy, confidentiality, and informed consent. Then, the discussion will move onto data preprocessing. Finally, two analysis plans will be illustrated: one using statistical modelling at single patient and group levels, and another one based on decoding.

Electrical neuroimaging of proactive inhibition in Parkinson's disease: assessing effects of deep brain stimulation

Michael de Pretto, PhD, UNIL

Inhibitory control refers to the process of interrupting ongoing actions. In predictable contexts, motor inhibitory control can be deployed before the actual need for response suppression. Current evidence suggest that such proactive inhibitory control involves a brain network partly overlapping with reactive control, namely the pre-supplementary motor area, the right inferior frontal gyrus, as well as the subthalamic nucleus (STN). In Parkinson's disease, deep brain stimulation of the STN improves motor symptoms, interfering with dysfunctional oscillations within basal ganglia circuitry. Here, I will show how EEG can help understand the brain functional underpinnings of proactive inhibition and notably the effects of deep brain stimulation in patients with Parkinson's disease.

Multivariate EEG decoding and prediction of comatose patients' outcome

Marzia De Lucia, PhD, UNIL

I will describe the main steps of a "single-trial topographic analysis tool", a multivariate EEG decoding analysis, and its application for predicting comatose patients' outcome. This method takes advantage of the overall distribution of voltage measurements across electrode montage at the single-trial level and offers a general framework for detailing activity reflecting different configurations of intracranial sources between experimental conditions. The application of this multivariate decoding analysis to EEG data collected in comatose patients during the first two days of coma revealed that basic auditory processing is usually preserved during acute coma irrespective of the patient's outcome. By contrast, the progression of these neural functions over the course of days is highly informative about patients' chance of survival.

Recent advancements in EEG clinical applications and graph signal processing

Isotta Rigoni, PhD, UNIGE

Electroencephalography (EEG) is widely utilized in clinical settings due to its cost-effectiveness, portability, and non-invasive nature, making it one of the primary methods for directly measuring neuronal activity. It plays a crucial role in diagnosing various conditions ranging from epilepsy to cardiac arrest, as well as in providing prognostic assessments and follow-up examinations. In the first part of this presentation, we will cover recent research findings in the EEG field that hold promise for various clinical applications, emphasizing the state-of-the-art analyses employed.

The second part of the talk will focus on a novel approach called graph signal processing (GSP), which integrates electrophysiology with information on brain structure extracted from diffusion imaging. Initially developed to combine functional and structural MRI data, GSP has shown promising results when applied to EEG analysis. Notably, it has successfully revealed mechanisms underlying brain integration and segregation, while also serving as a valuable tool for signal compression. We will begin by outlining the methodological steps involved in GSP and subsequently explore its applications in cognitive and clinical settings.