November 24, 2020

Neurofeedback for Memory

Brief Project Description

Learning and memory are some of the most critical and fundamental functions of the human brain. Traditionally, human memory has been dichotomized into two systems: declarative memory (i.e. explicit memory, such as remembering places, faces, names, events, etc) which has the hippocampus at its core, and non-declarative memory (i.e. implicit memory, such as procedural skills like riding a bike, etc) which has the striatum at its core. Recent evidence suggests that these two systems do not work in isolation, and instead interact with the goal of optimizing behaviour based on current context and previous experience. In our laboratory, we have recently developed a neurofeedback task in which humans (and animals) can be trained to control the activity of individual neurons in the hippocampus and other memory-related structures. Fascinatingly, this type of learning appears to directly involve the ventral striatum. Hence, this task facilitates and fosters an experimentally-controlled interactions between the striatum and the hippocampus. We are now interested in determining how such interaction affects mnemonic (i.e. memory related) processes in the human brain. This project will involve modifying the existing behavioural paradigms, collecting data with human subjects (i.e. patients on the epilepsy monitoring unit), analyzing data and disseminating knowledge through conference abstracts and journal publications.

Level of Study

Masters and/or PhD

Project Specific Technical Skill Requirements

- Extensive experience with MATLAB is a must.
- Prior programming experience with a variety of programming languages (Python, C, Java, etc.) will be a strong asset
- Strong bio-signal processing experience. Ability to decontaminate noisy biopotential data with a variety of signal processing methodologies.
- Experience with neural data (EEG/iEEG) collection and/or processing will be a strong asset.
- Strong understanding of frequency domain analysis of time-series data.
- Prior experience with implementing machine learning algorithms will be an asset (not mandatory)
- General understanding of the brain and central nervous system will be an asset.

General Skill Requirements

- Strong written and oral communication skills. Experience with writing journal papers and/or presenting conference abstracts will be a strong asset.
- Experience with reading and critiquing literature.

Krembil Relentless.

Required Soft Skills

- Ability to take initiative, be self-motivated and work with minimal supervision
- Ability to work under pressure
- Creativity
- Problem Solving and critical thinking
- Team player
- Integrity

How to Apply

To apply for this position, please email Kramay Patel (kramay.patel@mail.utoronto.ca) and Anett Schumacher (anett.schumacher@uhnresearch.ca) with the subject line "*PROSPECTIVE STUDENT: Neurofeedback for Memory*". Please include your up-to-date CV/resumé, your academic transcript, along with a description of why you would be a good fit for this position. Please note that all prospective graduate students must simultaneously and independently apply through the School of Graduate Studies (SGS) at the University of Toronto. Dr. Taufik Valiante holds a cross-appointment at the Institute of Biomedical Engineering and Electrical and Computer Engineering. Prospective graduate students interested in joining the Neuron To Brain Lab may choose to apply to either of these departments.