Dominic Boutet

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OBJECTIVE

Developing a framework for the use of whole-brain dynamical models calibrated to multimodal neuroimaging data in the study of the neurophysiological processes underlying individual brain activity in health and diseases.

EDUCATION

Bachelor of Science, Interdisciplinary Science
McGill University, Qc, CA, expected May 2023
Concentration: Neuroscience (Major) & Computer Science (Minor)
Current cGPA: 3.97

RESEARCH EXPERIENCE

Research internship May 2021-Now
The Neuro at NeuroSPEED-BailletLab, Qc, CA

Summer research project (2021):

- ➢ Learning to use whole-brain dynamical models in combination with magnetoencephalography (MEG) data.
- Literature review of current modelling approaches at the levels of single and coupled neural masses with a focus on The Virtual Brain (TVB).
- Implementation of a parallel processing workflow for mass simulations of a TVB model.
- Literature review of model calibration approaches for dynamical models.

COMP 396 - Undergraduate Research Project class (Fall 2021):

- ➢ Investigating the potential of a novel parameter space reduction metaheuristic that guides search-based optimization algorithms in high-dimensional space.
- Implementation of the general idea behind the metaheuristic.
- Implementation of a simple testing framework based on the calibration of a TVB model to MEG data.
- Writing of a report and preparation of a presentation for course evaluation.

NSERC USRA summer project (2022):

- ➢ Developing a formal mathematical expression of the parameter space reduction metaheuristic designed in the previous project, implementing a flexible toolkit for its use, and thoroughly testing its efficacy against other algorithms.
- Writing of the API for initialization and training of neural networks used in the metaheuristic along with an approach to sampling from the parameter subspace.
- Implementation of accelerated simulator models of neurons and neural masses along with various search algorithms for testing.
- Design and implementation of thorough testing on performance and convergence of the metaheuristic against baseline algorithms.
- Writing a manuscript reporting the metaheuristic and its performance.

Undergraduate thesis (Fall 2022 - Winter 2023):

- ➢ Investigating the effect of varying the number of free parameters in whole-brain dynamical models when used in a neural fingerprinting identification task where individuals in a cohort are identified based on their brain activity.

- Modification of the simulation workflow of TVB models from previous projects to facilitate model calibration at varying number of free parameters.
- Implementation of a model calibration framework for the simulation workflow based on the parameter space reduction metaheuristic designed in previous project.
- Design and implementation of hypothesis-driven tests on specific combinations of free parameter and the resulting identification accuracy.
- Analysis of the results from the tests. (*Pending*)
- Writing of an undergraduate thesis for the project. (*Pending*)

COMMUNITY ENGAGEMENT

Undergraduate Research Lead January 2022-May 2022
Youreka Canada, CA

Acting as Principal Investigator to:

- Design a complete research project based on the topic provided by Youreka.
- Mentor and lead a team of high school students through the whole research process, such as defining a research question, implementing a methodology, interpreting results, etc.
- Write a manuscript reporting our findings and prepare a presentation for the Youreka Symposium (Regional and National).
- ✧ Details: We established a proof of concept for COVID-19 cases forecasting from vaccination data using time series linear regression models on US daily updates datasets.
- ★ Note: We won the Youreka Montreal Regional Finalists Award.

Vice-President of the Machine Learning Committee August 2022-Now
PharmaHacks, Qc, CA

Acting as leader within the organization to:

- Help with the general operations of the organization.
- Help define the role for the new Machine learning committee in the organization and lead the team.
- Evaluate the Hackathon challenges provided by our sponsors.
- Work with our sponsors in the development of new challenges.
- Design custom "PharmaHacks challenges".

AWARDS & DISTINCTIONS

Academic Awards:

- Dean's Honour List (2021)
- Faculty Of Science Scholarships Award (2021)
- NSERC Undergraduate Summer Research Award (2022)