Postdoctoral Fellow in Advanced Machine Learning Techniques in Neuroscience

Hurvitz Brain Sciences Program and Physical Sciences at the Sunnybrook Research Institute
Departments of Medicine and Medical Biophysics
Temerty Faculty of Medicine, University of Toronto

PIs:  
Maged Goubran, PhD  
Assistant Professor, Scientist  
Medical Biophysics  
University of Toronto

Sandra Black, MD, FRCP  
Professor, Director Brain Sciences  
Neurology  
University of Toronto

Description of the Position: We are seeking a postdoctoral fellow to lead development of novel, machine learning algorithms for the analysis of MRI and 3D (light-sheet) microscopy/tissue cleared data. Our work combines technical and translational research, focusing on the development of novel AI and computational tools to probe, predict and understand neuronal and vascular circuit alterations, and model brain pathology in neurological disorders, including Alzheimer’s disease, stroke, and traumatic brain injury. This position is in support of a new CIHR-funded project to study early structural and functional network dysfunction in Alzheimer’s disease, building on our established pipelines for novel tissue clearing techniques and imaging technology. There will also be opportunities to develop AI algorithms using large multi-site imaging studies and trials (with hundreds or thousands of subjects each), including the Ontario Neurodegenerative Disease Research Initiative (ONDRI), Canadian Consortium on Neurodegeneration in Aging (CCNA), Canadian Alliance for Healthy Hearts and Minds (CAHHM), Toronto Dementia Research Alliance (TDRA), Brain-Eye Amyloid Memory Study (BEAM), and Medical Imaging Trials Network of Canada-C6 (MITNEC-C6).

The position requires working closely with the PIs Dr. Goubran (expertise in computational neuroscience, machine learning, neuroimaging), Dr. Black (neurology, small vessel disease, cognition) and with graduate students, imaging analysts and software developers in the lab to develop, improve and apply novel computational approaches to challenging image analyses and patient outcome prediction problems (ex: https://miracl.readthedocs.io/; https://hippmapp3r.readthedocs.io/). This will be performed in collaboration with our internal and external international collaborators (in USA, Switzerland, and Germany), including neurologists, radiologists, surgeons, psychologists, physicists, and computer scientists. This dynamic and collegial research environment provides opportunities to participate in pioneering techniques that will be used to understand and treat neurodegenerative and neurovascular disease. Our team also leads the computational and neuroimaging analyses for several cutting-edge trials at the Harquail centre for Neuromodulation at Sunnybrook, including those focused on Alzheimer’s disease, Parkinson’s disease and refractory obsessive-compulsive and major depressive disorders. There will be opportunities for multiple publications and conference presentations focused on novel computational tools for dementia, stroke, and neuroscience research.

Existing imaging infrastructure within SRI includes three research-dedicated 3T MRI scanners (GE, Philips, Siemens), a Bruker 7T horizontal bore small animal MRI scanner, and a Bruker 7T vertical bore NMR system. A 7T human scanner will be installed in 2023. The centre also houses a 3T MR/PET system (Siemens Biograph MMR) as well as an MR-Linac system (Elekta Inc) for MR guided radiation therapy. The centre also houses a comprehensive infrastructure for studying animal models and histological analyses, with numerous microscopes including a twin two-photon laser scanning microscope from Olympus (MPERS), a microPET/CT system from Bruker, a 32-channel electrophysiological recording amplifier (AM Systems 3600), and dedicated operating theatres and behavioural testing suites.

This is a funded position. Stipend levels are in line with experience and CIHR stipend levels. A 2-year commitment is required. Contract is renewable contingent on performance.
**Required Qualifications:**

- PhD received within the last 3 years or graduating PhD candidate (within the next three months) in computer science, biomedical engineering, neuroscience, biological science, or related discipline
- Experience with machine and deep learning libraries Scikit-learn, Tensorflow, Keras or Pytorch
- Strong research record
- Excellent verbal and written communication skills
- Proficiency with programming languages (Python/MATLAB, C/C++, etc.)
- Intermediate knowledge of Linux and scripting
- Ability and willingness to work in a dynamic interdisciplinary team environment

**Preferred Experience and Skills:**

- Advanced knowledge of machine learning models for image processing, segmentation, or registration
- Advanced knowledge of computer vision
- Experience with designing data analysis workflows and incorporating existing tools
- Working knowledge of neuroimaging software: FSL, FreeSurfer, SPM, ITK or microscopy software: Fiji/ImageJ, Ilastik
- Python software packaging, virtual environments, Anaconda/Conda, Jupyter/IPython
- Experience with statistical analyses and relevant software: example R or SPSS
- Experience with version control systems (Git) and software testing
- Demonstrated ability to learn quickly and problem-solve

All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority.

The Sunnybrook Research Institute, fully affiliated with the University of Toronto, is a dynamic and collegial research environment that provides opportunities to participate in pioneering research.

Applications are encouraged from qualified women and men, members of visible minorities, aboriginal peoples and persons with disabilities. In accordance with Canadian immigration requirements, this advertisement is directed initially to Canadian citizens and permanent residents. We thank you in advance for your interest. Only those candidates selected for an interview will be contacted. No phone calls please. Application screening will continue until a suitable candidate is identified.

**Application**

To apply for this position, please:

Send: 1) cover letter, 2) Curriculum Vitae, 3) a writing sample (e.g., manuscript), and 4) the names and contact information for three potential references to:

Mr. Christopher Scott  
Brain Imaging Analysis Lab Manager  
L.C. Campbell Cognitive Neurology Research Unit Sunnybrook Health Sciences Centre  
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**Links**

- Sunnybrook Research Institute: [www.sunnybrook.ca/research](http://www.sunnybrook.ca/research)
- University of Toronto: [www.utoronto.ca](http://www.utoronto.ca)
- Medical Biophysics: [https://medbio.utoronto.ca/faculty/goubran](https://medbio.utoronto.ca/faculty/goubran)
● The Dr. Sandra Black Centre for Brain Resilience & Recovery: https://sunnybrook.ca/foundation/content/?page=brain-sciences-sandra-black
● Harquail Centre for Neuromodulation: https://sunnybrook.ca/research/content/?page=sri-centre-harquail
● LC Campbell Cognitive Neurology Research Unit: www.sunnybrook.ca/research/?page=cognitiveneurologyhome imaging.brainlab.ca
● Heart and Stroke Foundation Canadian Partnership for Stroke Recovery: www.sunnybrook.ca/research/?page=csrhome