

MICHAEL RIZVI-MARTEL

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PROFILE

Master's student in Computer Science at Université de Montréal and Mila. I am interested in leveraging tensor methods and deep learning to help solve complicated problems in physics and engineering.

EDUCATION

PhD Computer Science, Université de Montréal/Mila Expected 2024
Fast tracked from the MSc

Major of Computer Science, Université de Montréal 2022
Relevant Coursework: Fundamentals of Machine Learning, Data Science, Quantum Computing

B. Eng. Electrical Engineering, Polytechnique Montréal 2020
Specialization in applied mathematics

PUBLICATIONS

Articles in Peer-reviewed Conferences

1. Michael Rizvi-Martel, Maude Lizare, Clara Lacroce, and Guillaume Rabusseau. Simulating weighted automata over sequences and trees with transformers. In *AISTATS, 2024* (to appear)
2. Maude Lizare, Michael Rizvi-Martel, Marawan Gamal, and Guillaume Rabusseau. A tensor decomposition perspective on second-order rnns. In *ICML, 2024* (In Review)

RESEARCH EXPERIENCE

Simulating Weighted Automata with Transformers, MSc Thesis Project September 2022 - Present
Supervisor: Prof. Rabusseau Mila, Université de Montréal

- Wrote the proofs of two (out of three) of the main theorems.
- Designed and conducted all experiments.
- Collaboration with postdoctoral researcher Clara Lacroce, supervised by prof. Panangaden.
- Paper accepted for a poster session at AISTATS 2024.

Tensor Decomposition Perspective on Second Order RNNs September 2022 - Present
Supervisor: Prof. Rabusseau Mila, Université de Montréal

- Helped design and conducted experiments.
- Helped write and review the submission to AISTATS.
- Project in review for ICML 2024.

GFlowNets for Adaptive Tensor Network Decomposition November 2023 - Present
Supervisor: prof. Rabusseau Mila, Université de Montréal

- Application of GFlowNets (GFNs) to solve complex tensor decomposition problems.
- Collaboration with Nikolay Malkin, postdoctoral researcher with prof. Bengio.
- Development of Python code for GFN training and environment.
- Possible applications: quantum tomography as well as in materials research.

Inferring Neural Dynamics from Activation Changes During Learning

Supervisor: prof. Lajoie

February 2023 - Present
Mila, Université de Montréal

- Project which aims to use deep learning to better infer learning rules used by the brain from changes in activation during learning.
- Collaboration with prof. Lajoie and one of his PhD students.
- Conducted *in silico* experiments using different methods.
- Possible applications: development of adaptive BCIs (Brain Computer Interfaces).

Honors Research Project

Supervisor: prof. Rabusseau

January 2022 - May 2022
Mila, Université de Montréal

- Performed a comparative analysis between two algorithms for a tensor decomposition task (decomposition using tensor ring).
- Implemented a solver (using alternating least squares) for one of the two algorithms. Code is available [here](#).

Probabilistic Graphical Models Course Project

September 2023 - December 2023

- Implemented the model proposed in the paper [A Unified Probabilistic Model for Learning Latent Factors and Their Connectivities from High-Dimensional Data](#) using both score matching and EM (novel contribution). Code is available [here](#)
- Derived the theoretical expressions for both the E step and the M step.

Research Intern

Supervisor: Julien Cohen-Adad

October 2021 - March 2022
NeuroPoly, Polytechnique Montréal

- Collaborated on open source software for the AxonDeepSeg project, a tool using CNNs to segment axon and myelin from microscopy data of nerve fibers.

Research Assistant

Supervisor: Max Hofheinz

May 2020 - August 2020
Quantum Institute, Sherbrooke University

- Developed Python code for data analysis and instrument automation. Conducted cryogenic measurements using a dilution fridge (temperatures under 4K).

Research Assistant

Supervisor: Francois Soumis

Sep. 2019 - May 2020
GERAD, Polytechnique Montréal

- Implemented new features for a public transportation planification solver in C. Resulted in a more accurate model representing the transit of buses.

TEACHING EXPERIENCE

Teaching Assistant, IFT 3395 - Fundamentals of Machine Learning

Université de Montréal

Sep. 2023 - Dec. 2023
Montréal, QC

- Prepared and taught the lab portion of the course.
- Prepared and coordinated assignments
- Corrected assignments

Teaching Assistant, IFT 1227 - Computer Architecture

Université de Montréal

Sep. 2021 - Dec. 2021
Montréal, QC

- Prepared and taught the lab portion of the course.
- Corrected assignments

PROFESSIONAL EXPERIENCE

Hardware and Test Specialist

Aeponyx

October 2020 - July 2021

Montréal, QC

- Built up and coded a Python library to automate measuring instruments. Resulted in massive time gain for data acquisition.
- Developed data pipelines to analyze data from measuring instruments using pandas.
- Designed and debugged PCBs according to requirements

Electronics Engineering Intern

Aeponyx

May 2019 – August 2019

Montréal, QC

- Contributed to development of the alpha version of the product
- Developed embedded C code for PSoC and Teensy microcontrollers
- Tuned and characterized a PID controller for a temperature control system

Electronics Engineering Intern

Motsai

May 2018 – August 2018

Saint-Bruno-de-Montarville, QC

- Developed a power management algorithm for a solar powered cellular module used for real-time measurement of beehive signals
- Developed embedded C code for PSoC microcontrollers
- Developed Python code for testing

AWARDS & HONORS

- **Mention of Excellence (First class honors):** Major and Master's of Computer Science
- **University of Montréal AI scholarship:** 5000\$

SERVICE

- **Coorganizer - Tensor Network Reading Group:** I help organize a reading group on Tensor Networks. We meet weekly, and I help with organizing the list of speakers and hosting the sessions.
- **Mentor - Directed Readings in Mathematics program:** I act as a mentor in a directed readings program aimed to introduce undergrads to research in applied mathematics.
- **Departmental tutor in Computer Science:** I work as a tutor for Université de Montréal CS department. I give office hours where undergraduate students can come ask questions about (basically any) course from the first or second year curriculum.

SKILLS

Fluent Languages: English, French, Spanish

Operating Systems: Linux, Windows, Mac

Programming Languages: advanced knowledge: Python, MATLAB, \LaTeX , C/C++; familiar with: Rust, Java, JavaScript SQL Bash

Machine Learning Libraries: Pytorch, Numpy, Scikit-Learn

Machine Learning Accelerators: advanced knowledge in GPU CPU and SLURM protocol