MICHAEL RIZVI-MARTEL

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PROFILE

PhD student in Computer Science at Université de Montréal and Mila. My main research focus is better understanding the intersection between learning and "reasoning" tasks through the lens of formal languages and theoretical CS. I am also interested in applications of DL to the physical sciences.

EDUCATION

PhD Computer Science, Université de Montréal/Mila   Expected 2027
Fast tracked from the MSc.program

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
2. Maude Lizare, Michael Rizvi-Martel, Marawan Gamal, and Guillaume Rabusseau. A tensor decomposition perspective on second-order rnns. In *ICML*, 2024 (Spotlight paper)

Non Peer-reviewed Communications

1. *Simulating Weighted Automata over Sequences and Trees with Transformers* − FLaNN Seminar Series, May 2024.
2. *LLMs and How to Use Them* − Seminar at the Center for Advanced Research in Sleep Medicine, February 2024.

RESEARCH EXPERIENCE

Towards an AI Mathematician   May 2024 - Present
Supervisor: Kolya Malkin   University of Edinburgh

- Design of a theorem proving agent using the Peano Language. Agent is trained by intrinsic motivation and learns to propose problems as well as to solve them.
- Collaboration with researchers from Oxford, Edinburgh and prof. Bengio's group.

Disentangled Representations in CLIP models   February 2024 - Present
Supervisor: Sébastien Lachapelle   Samsung Advanced Institute of Technology (SAIT)

- Application of sparse dictionnary learning to the representations of CLIP models. This method provably improves generalization by learning disentangled features.
- Collaboration with SAIT and Samuel Lavoie (senior PhD at Mila) in which I am lead.
- I am main contributor to the codebase and manage all the experiments.

GFlowNets for Quantum Circuit Design   February 2024 - Present
Supervisor: prof. Rabusseau   Mila, Université de Montréal

- Application of GFlowNets (GFNs) to generate circuit structure (or ansatz) for ground state search and max cut problem.
- Collaboration with Jun Dai, postdoctoral researcher with prof. Rabusseau.
- Developed the Python code for GFN training and environment.
- Submitted to ICLR 2024

Simulating Weighted Automata with Transformers, MSc Thesis Project September 2022 - January 2024
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 - May 2024
Supervisor: Prof. Rabusseau Mila, Université de Montréal

- Helped design and conducted experiments.
- Assisted in writing and reviewing the submission.
- Paper accepted as spotlight for ICML 2024.

Honors Research Project January 2022 - May 2022
Supervisor: prof. Rabusseau Mila, Université de Montréal

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

Research Intern October 2021 - March 2022
Supervisor: Julien Cohen-Adad 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 May 2020 - August 2020
Supervisor: Max Hofheinz Quantum Institute, Sherbrooke University

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

TEACHING EXPERIENCE

Teaching Assistant, IFT 3395 - Fundamentals of Machine Learning Sep. 2023 - Dec. 2023
Université de Montréal *Montréal, QC*

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

Teaching Assistant, IFT 1227 - Computer Architecture Sep. 2021 - Dec. 2021
Université de Montréal *Montréal, QC*

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

PROFESSIONAL EXPERIENCE

Hardware and Test Specialist October 2020 - July 2021
Aeponyx *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.

AWARDS & HONORS

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

SERVICE

- **Evaluator - Mila Supervision Comittee**: I evaluated applications of potential candidates to the professional MSc program for the 2025 academic year.
- **Reviewer ICLR 2025**: I participated in the review process for ICLR 2025.
- **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. (2023−present)
- **Mentor - Directed Readings in Mathematics program**: I acted as a mentor in a directed readings program aimed to introduce undergrads to research in applied mathematics. (2022−2023)
- **Departmental tutor in Computer Science:** I worked 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. (2021−2023)

SKILLS

Fluent Languages: English, French, Spanish
Operating Systems: Linux, Windows, Mac
Programming Languages: advanced knowlege: Python, MATLAB, LaTeX, C/C++; familiar with: Rust, Java, JavaScript SQL Bash
Machine Learning Libraries: Pytorch, JAX, Numpy, Scikit-Learn
Machine Learning Accelerators: advanced knowledge in GPU CPU and SLURM protocol