

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 expressive power and learning biases of language models. To accomplish this I use a mix of methods from formal language theory and modern interpretability research.

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, Satwik Bhattamishra, Neil Rathi, Guillaume Rabusseau, and Michael Hahn. Benefits and limitations of communication in multi-agent reasoning. In *First Workshop on Foundations of Reasoning in Language Models*, 2025
2. Michael Rizvi-Martel, Satwik Bhattamishra, Guillaume Rabusseau, and Michael Hahn. From expressivity to sample complexity: Narrow teachers for transformers via c-RASP. In *What Can('t) Transformers Do? @ NeurIPS 2025*, 2025
3. Michael Rizvi-Martel, Maude Lizare, Clara Lacroce, and Guillaume Rabusseau. Simulating weighted automata over sequences and trees with transformers. In *AISTATS*, 2024
4. 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

Theory of Multi-Agent Systems May 2024 - Present
Supervisor: Michael Hahn University of Saarland

- In-person internship for the summer of 2025.
- Formalization of multi-agent LLM systems from a communication complexity and multi-threaded computation perspective.
- Responsible for all theoretical aspects such as writing definitions, theorems and proofs.

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

Supervisor: Sébastien Lachapelle

February 2024 - Present
Samsung Advanced Institute of Technology (SAIT)

- Application of sparse dictionary 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

Supervisor: prof. Rabusseau

February 2024 - May 2025
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.
- wrote the Pytorch implementation of GFN training and coded part of task environment.
- Submitted to NeurIPS 2025

Simulating Weighted Automata with Transformers, MSc Thesis Project

Supervisor: Prof. Rabusseau

September 2022 - January 2024
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

Supervisor: Prof. Rabusseau

September 2022 - May 2024
Mila, Université de Montréal

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

TEACHING EXPERIENCE

Teaching Assistant, IFT 1065 - Discrete Mathematics

Université de Montréal

Sep. 2025 - Present
Montréal, QC

- Prepared and taught the recitations.
- Corrected assignments.

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.

AWARDS & HONORS

- **University of Montréal AI scholarship (MSc):** 5000\$
- **University of Montréal AI scholarship (PhD):** 10000\$
- **NSERC Postgraduate Scholarships-Doctoral (PGS D) Award:** 120 000\$

SERVICE

- **Reviewer for TMLR.**
- **Reviewer for ICLR 2026.**

- **Evaluator - Mila Supervision Committee:** I evaluated applications of potential candidates to the professional MSc program for the 2025 academic year.
- **Reviewer 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. (2023–2024)
- **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 held office hours where undergraduate students could 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