

# REZA ARABPOUR

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## Highlight

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- Quantitative Machine Learning Engineer in **BMO's AI Research (ARC) team**, following a **six-month research internship at BMO Capital Markets**.
- Research in **geometric deep learning and computational finance**, with an ICML 2025 ES-FoMo workshop paper and an article accepted in Analysis and Applications.
- **Bronze medal, ACM ICPC 2018 West Asia regional contest**, and three Excellent Term Awards during undergraduate studies.
- **M.Sc.** in Computational Science and Engineering with a **3.9/4.0 GPA and full scholarship**.

## Publications

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- **Reza Arabpour**, Mojtaba Valipour (Waterloo), Mozhgan Saeidi (Stanford University), Anastasis Kratsios, “***FinAttn: Interpretable Financial Attention with Closed-Form Risk-Neutral Pricing Heads***,” November 2026, Paper is in the polishing phase and will be submitted to **SIAM Journal on Financial Mathematics**
- **Reza Arabpour**, Haitz Sáez de Ocáriz Borde (University of Oxford), Anastasis Kratsios, “***LoRA Fine-Tuning Without GPUs: A CPU-Efficient Meta-Generation Framework for LLMs***,” July 2025, **ICML 2025 Workshop on Efficient Systems for Foundation Models (ES-FoMo)**, arXiv: 2507.01806.
- Luca Galimberti (King's College London), **Reza Arabpour**, John Armstrong (King's College London), Anastasis Kratsios, Giulia Livieri (LSE), “***Low-dimensional approximations of the conditional law of Volterra processes: a non-positive curvature approach***,” **Analysis and Applications**, accepted/in press, 2026; preprint: arXiv:2405.20094.

## Work and Research Experience

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### - Quantitative Machine Learning Engineer

Nov. 2025 – Present

*BMO – AI Research (ARC); Permanent Full-Time*

Work in the **AI Research (ARC) team** on production ML, stress testing, financial forecasting, and generative AI.

- **Led economic-intelligence stress testing systems** and RAG-based agents for **scenario analysis**, using multi-agent systems, RAG, knowledge distillation, and Azure.
- **Own in-production time series forecasting** model and execution workflows for mortgage applications, using a mixture of **transformer and statistical models with exogenous features**.
- **Leading BMO's first SLM toolkit** and benchmarking small language models for financial workflows, including **fine-tuning, monitoring, and observability**.
- Contributed to large-scale customer attrition modeling with classical ML, AWS, Dask, and SQL for memory-efficient processing; the production model has **estimated annual savings of US\$2 million**.
- Contribute to **BMO's first MCP server** for Wealth Management using FastMCP and AWS; production deployment is in progress.
- **Led and built** the first version of a multi-agent security analysis and code auditing, attack scenario design, and defense solutions, using a **hierarchical multi-agent architecture** and efficient **memory and context management**.

### - Machine Learning Quantitative Researcher

May 2025 – Nov. 2025

*BMO Capital Markets – Mitacs – McMaster University; Internship*

Adapted advanced deep learning models to financial time series for forecasting and feature extraction.

- Built a **synthetic data generation module** using a **regime-switching rough Bergomi stochastic-volatility model with Hawkes jumps** to support financial time-series research.
- Designed and benchmarked transformer-based forecasting architectures incorporating known mathematical models of financial dynamics. Developed a new model, **FinAtten**, that forecasts return distributions across **interpretable stochastic regimes** and provides a separate closed-form **risk-neutral adapter for derivatives pricing**.

- Research Assistant

Sep. 2023 – Dec. 2025

Vector Institute and McMaster University

Researched **geometric deep learning and computational finance** under Dr. Anastasis Kratsios.

  - Developed a **CPU-only LoRA adapter generation** framework for LLMs using a set of pretrained adapters. Benchmarked a 7-billion-parameter model across 502 datasets, achieving **mean ROUGE-L of 0.520 versus 0.192 for the base model**.
  - Built and optimized **hypernetworks for conditional laws of Volterra processes**; parallelized computation across multiple GPU nodes using **PyTorch and TensorFlow** on Vector Institute compute clusters, **achieving 60x speedup**.
- Teaching Assistant

Sep. 2023 – Dec. 2025

McMaster University

Supported teaching, grading, and project supervision in graduate finance courses.

  - MFM 713, Computational Finance II**, Dr. Anastasis Kratsios  
Supported instruction in numerical methods for PDEs and SDEs, exotic and path-dependent options, and free-boundary methods for American options.
  - MFM 714, Topics in Risk Management**, Dr. David Lozinski  
Tutored students and graded Python implementations of credit-risk measurement for debt portfolios.
  - Finance MFIN 704, Numerical Methods in Finance**, Dr. Michael Milewski  
Supported instruction in sourcing and processing financial data, including Yahoo Finance and Bloomberg, for analysis and forecasting.
- Quantitative Researcher and Co-Founder

Jan. 2021 – Sep. 2022

Independent Trading Research Venture – Self-Employed

Co-founded a start-up researching statistical arbitrage in foreign exchange and gold markets.

  - Developed strategy baskets combining **24 trading agents** using genetic algorithms and fuzzy logic. Evaluated strategies and Monte Carlo simulations across **500 augmented datasets** representing different market regimes and time frames.

## Technical Skills

**Generative AI Technologies:** Multi-Agent Systems, RAG, Graph-RAG, MCP, FastMCP, SLMs, Knowledge Distillation, Fine-Tuning, Monitoring, Observability, LLM Benchmarking, Guardrails

**Languages and Applications:** C, C++, Python, R, MATLAB, Bash, SQL, MS Excel

**Machine Learning and Data Libraries:** Hugging Face, PyTorch, TensorFlow, Keras, Scikit-Learn, Statsmodels, Dask

**Development Tools:** Git, Linux Servers, AWS, Azure, Dataiku, Scrum

## Education

- Master of Science, Computational Science and Engineering

Sep. 2023 – Aug. 2025

McMaster University

Thesis: *Geometric Deep Learning for Financial Data & Efficient Fine-Tuning of Foundation Models*
- Bachelor's, Mathematics and Applications

Sep. 2018 – Mar. 2023

University of Tehran

Final Project: *Text-Based Emotion Detection Using Deep Learning and Transformers*

## Seminars and Internship

- Eastern Conference on Mathematical Finance | *Fields Institute*

September 2024

Presented research on forecasting stochastic processes at the 8th Eastern Conference on Mathematical Finance, hosted by the Fields Institute in Toronto.
- DLRL Summer School | *CIFAR and Vector Institute*

Summer 2024

Attended the 20th Deep Learning and Reinforcement Learning Summer School, organized by CIFAR and hosted by the Vector Institute in Toronto.
- AWS Machine Learning Foundations | *Amazon / Udacity*

October 2022

## Relevant Coursework

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|-------------------|---------------------------|------------------------|---------------------------|
| • Probability     | • Mathematical Analysis   | • Optimization         | • Game Theory             |
| • Data Mining     | • Artificial Intelligence | • Statistical Learning | • Advanced Linear Algebra |
| • Data Structures | • Algorithm Design        | • Graph Theory         | • Object-Oriented C++     |