Email: faraz.khoshbakhtian@mail.utoronto.ca
Cell: 647-702-0238
Toronto, Ontario
linkedin.com/in/faraz-khoshbakhtian
farazkhoshbakhtian.ca

Faraz Khoshbakhtian

EDUCATION

Ph.D., Industrial engineering, University of Toronto, Expected defense in 2025 (Current GPA: 4.0)
Thesis: Network representation learning and reinforcement learning for generalized critical node detection on large sparse graphs, with applications to pandemic vaccination strategies
Supervisor: Dionne M. Aleman, Ph.D.
H.B.Sc., University of Toronto, 2020 (Cumulative GPA 3.7)
Concentrations: Philosophy, Computer Science, and Statistics

Professional experience

- **Applied science intern, Amazon, Summer 2024**
  Network representation learning R&D for optimizing Amazon Air's transportation networks.
- **Applied science intern, Mastercard, 2023-2024**
  A Mitacs Accelerate project, developing state-of-the-art network representation learning algorithms for universal node embeddings. Project focused on development of novel self-supervised and reinforcement learning algorithms for generalized learning on graphs.
- **Data scientist and software developer, Ctrl Designer, 2017-2019**
  Applied machine learning techniques such as reinforcement learning in software development to optimize and automate industrial processes.
- **Data scientist, RBC, Summer 2021**
  Designed, implemented, and validated climate analytics tools using interpretable machine learning and statistics. Extensively used Hadoop and Spark to handle big data, train models, and interpret them.
- **Developer and curriculum writer, Code at the Edge, 2018-2019**
- **Department assistant, Department of Philosophy, University of Toronto, Summer 2018**
- **Research assistant, Scholars in Residence, University of Toronto, Summer 2017**

Areas of expertise and technical skills

- Agentstack, AWS, Bedrock, C++, CI/CD, CrewAI, Django, Gurobi, Hadoop and Spark, Java, Julia, LangChain, LangGraph, MLflow, Mojo, PyG and DGL, Pydantic and PydanticAI, PyTorch, Python, SageMaker, Weights & Biases, analysis and interpretability for machine learning, cloud computing, combinatorial optimization, computer science and machine learning theory, database management systems, deep neural networks and training dynamics, distributed computing, graph neural networks, large-scale agent-based simulation modelling, operations research, recommendation engines, reinforcement learning, self-supervised learning, Transformer architecture.

Notable projects

- **Q-learning CNDP** (work in progress, code to be released publicly soon)
  State of the art design and experimentation suite for generalized critical node detection problem (CNDP) with support for diverse training strategies, learning algorithms, pre-training modules, model architectures, interpretability features, and CNDP variants.

Notable projects (cont.)

- **PanSim** (pansim.vercel.app)
  Full-stack development for pandemic simulation modelling. Leading an initiative at the Department of Mechanical and Industrial Engineering at the University of Toronto. Industry standard technologies such as Django, React, and AWS are used to create a state-of-the-art pandemic monitoring and mitigation platform.
- **TuneCabinet** (tunecabinet.farazkhoshbakhtian.ca)
  Generating musical ideas and full pieces using off the shelf LLMs (e.g., Sonnet). Function calling is leveraged in LLM usage so that the structured text outputs can be turned into musical ideas in format of drum loops, melodies, and chord progressions in MIDI format. Project is deployed using AWS, Replit and is publicly available for free use.
- **DailyZaphyr** (github.com/faraz2023/daily_zephyr)
  Leveraging agentic AI for automatic newspaper generation, focusing on geopolitical and market trends. The project utilizes LLM engineering technologies such as CrewAI, AgentStack, LangGraph, and API services like PerplexityAI.

Publications

Published

[1] Khoshbakhtian, F., Validi, H., Ventresca, M., Aleman, D. M. Distance-based critical node detection for effective vaccine policies. *Operations Research Letters.* 2024.
[2] Khoshbakhtian, F., Gaurav, O., Aleman, A., and Asthana, S. MEGA: Multi-Encoder GNN Architecture for stronger task collaboration and generalization. *Lecture Notes in Computer Science Series (LNCS)*. 2024.
[3] Khan, S. S., Khoshbakhtian, F., and Ashraf, A. B. Anomaly detection approach to identify early cases in a pandemic using chest X-rays. *Proceedings of the Canadian Conference on Artificial Intelligence*. 2021. doi: 10.21428/594757db.fab

Submitted

[4] Khoshbakhtian, F., Ventresca, M., and Aleman, D. "MUSE-CN: MUlti-encoder Self-supervised Expert for learning to identify Critical Nodes in large graphs". submitted for publication in *KDD 2025* proceedings.

In-progress

[5] Khoshbakhtian, F., Ventresca, M., Aleman, D. M. Q-learning for critical node detection: a comprehensive and modular learning suite for generalized CNDP. *targeted for INFORMS Journal on Computing.*
[6] Khoshbakhtian, F., Ahamd, A., Cohen, A., and Aleman, D. M. Sequential critical node detection with beam search: a heuristic-agnostic approach*. targeted for INFORMS Journal on Computing.*

Leadership and service

- **Co-Founder, Executive Member,** University of Toronto Students for a Free Iran, 2022-2024
- **Co-Director, Marketing Team**, ILead:Grad, University of Toronto Faculty of Applied Science & Engineering, 2020-2021
- **Co-Lead, Design Team**, Cyrus International Film Festival of Toronto, 2016-2018

Leadership and service (cont.)

- **Workshop Facilitator, Research Officer**, InDepth Conference at the Munk School of Global Affairs, 2016-2017

Teaching experience

- **Head teaching assistant, University of Toronto, 2018-present**
  - Courses: Big Data Science (MIE1628); Data Modelling (MIE253); Fundamentals of Object-Oriented Programming (MIE250); Fundamentals of Computer Programming (APS106); Introduction to Philosophy (PHL101)

Awards

- MITACS Accelerate award (toward applied science internship at Mastercard) (17,500) (2024)
- Ontario graduate scholarship (OGS) (15,000) (2023-2024)
- MITACS Accelerate award (toward applied science internship at Mastercard) (15,000) (2023)
- Emerging and Pandemic Infections Consortium (EPIC) doctoral award ($10,000) (2023)
- 6T6 Industrial Engineering 50th Anniversary Award in Healthcare Engineering ($3,000) (2022)
- Faculty of Applied Science & Engineering Graduate Student Endowment Award ($3,000) (2020)
- Woodsworth College Brookfield's Leadership Scholarship ($6,000) (2018)
- Jackman Humanities Scholars in Residence Scholarship ($1,500) (2017)
- Sam & Mary Restivo Family Admission Scholarship ($1,200) (2015)

Mentorship

(Name, project desc., date, current position)

- Ali Ahmad, beam search strategies for enhancing critical node detection in large graphs, 2023-cuerrent, student at UofT
- Issa Al Rawwash, full-stack application development for pandemic modelling and mitigation, 2024-current, student at UofT
- Yousef Al Rawwash, large scale pandemic simulation modelling on distributed systems, 2023, machine learning engineer at AMD
- Solar Rezaei, large scale pandemic simulation modelling on distributed systems, Summer 2022, engineering career center peer coach at UofT
- Ardian Lagman, prediction of severe COVID-19 infection at the time of testing, 2021-22, data scientist at Swiss Re
- Fereshteh Navabzadeh, machine learning to predict clinical outcomes of psoriasis patients, Summer 2020, senior SDE at theScore

Conference and workshop presentations

(**bold** for the presenter)

[1] **Khoshbakhtian, F.**, Ahamd, A., Cohen, A., and Aleman, D. M. Enhancing critical node detection with beam search: a heuristic-agnostic approach. INFORMS Annual Meeting. Seattle, US. October 2024 (*scheduled*).

[2] **Khoshbakhtian, F.**, Gaurav, O., Aleman, A., and Asthana, S. MEGA: Multi-Encoder GNN Architecture for stronger task collaboration and generalization. ECML PKDD. Vilnius Lithuania, September 2024 (*scheduled*).

Conference and workshop presentations (cont.)

[3] **Khoshbakhtian, F.**, Ahamd, A., Cohen, A., and Aleman, D. M. Enhancing critical node detection with beam search: a heuristic-agnostic approach. CORS Annual Meeting. London, Canada. June 2024.
[4] **Khoshbakhtian, F.**, Validi, H., Ventresca, M., Aleman, D. M. Distance-based critical node detection for effective vaccine policies. INFORMS Annual Meeting. Phoenix, US. October 2023 (*scheduled*).
[5] **Khoshbakhtian, F.**, Validi, H., Ventresca, M., Aleman, D. M. Distance-based critical node detection for effective vaccine policies. INFORMS Healthcare. Toronto, Canada. July 2023.
[6] **Khoshbakhtian, F.**, Validi, H., Ventresca, M., Aleman, D. M. Distance-based critical node detection for effective vaccine policies. CORS / Optimization Days. Montreal, Canada. May 2023.
[7] Khoshbakhtian, F., Validi, H., Ventresca, M., **Aleman, D. M.** Distance-based critical node detection for effective vaccine policies. Panoptic: view on global optimization. Florida, US. March 2023.
[8] **Khoshbakhtian, F.**, Lagman, A., Aleman, D. M., Giffen, R., and Rahman, P. Prediction of severe COVID-19 infection at the time of testing: A machine learning approach. *CORS/INFORMS International Conference*. Vancouver, Canada. June 2022.

[9] **Pirmorad, E.**, Khoshbakhtian, F., Mansouri, F., and Farahmand, A. M. Deep reinforcement learning for online control of stochastic partial differential equations. Spotlight presentation at *The Symbiosis of Deep Learning and Differential Equations*. virtual. Dec 2021.

[10] **Khoshbaktian, F.** Machine learning for early detection of severe COVID infection. *University of Toronto Engineering Research Conference (UTERC)*. virtual, Canada. July 2021.

[11] **Navabzadeh, F.**, Khoshbakhtian, F., Aleman, D. M., Giffen, R., and Rahman, P. Machine learning to predict clinical outcomes of psoriasis patients (*invited presentation*). INFORMS Healthcare Conference. virtual, Canada. July 2021

Pre-prints

[12] Khoshbakhtian, F., Lagman, A., Aleman, D. M., Giffen, R., and Rahman, P. (2021). Prediction of severe COVID-19 infection at the time of testing: A machine learning approach. medRxiv. doi: 10.1101/2021.10.15.21264970v1.