

# Faraz Khoshbakhtian

## EDUCATION

### **Ph.D., Industrial engineering, University of Toronto, Expected defense in 2025 (Current GPA: 4.0)**

Thesis: Graph representation learning and reinforcement learning for a generalized and scalable solutions to the critical node detection problem, with applications to pandemic vaccination strategies

*Supervisor: Dionne M. Aleman, Ph.D.*

### **H.B.Sc., University of Toronto, 2020 (Cumulative GPA 3.7)**

Concentrations: Computer Science, Statistics, and Philosophy

## Areas of expertise

Graph neural networks; reinforcement learning; deep neural networks and training dynamics; distributed computing and big data analysis; operations research; combinatorial optimization; analysis and interpretability for machine learning; recommendation engines; test-driven development.

## Professional experience

- **Co-founder, PanSim, 2024-present**

Full-stack development for pandemic simulation modelling. Initiative at the Department of Mechanical and Industrial Engineering at the University of Toronto. Industry standard technologies such as Django, React, and Amazon web services are used to create a state-of-the-art pandemic monitoring and mitigation platform.

- **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**

## Technical skills

Python, , Java, C++, Julia; large-scale agent-based simulation modelling; AWS; SageMaker; PyG and DGL; PyTorch and TensorFlow; GitHub Actions; Weights & Biases; MLflow; LangChain; Graph neural networks; Transformer architecture; Gurobi; database management systems; computer science and machine learning theory; neural network applications and interpretability; statistical learning; cloud computing; distributed computing.

## **Publications**

### **Published (or accepted for publication)**

- [1] Khoshbakhtian, F., Validi, H., Ventresca, M., Aleman, D. M. Distance-based critical node detection for effective vaccine policies. *accepted for publication at 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. *accepted for publication at 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](https://doi.org/10.21428/594757db.fab)

### **In-progress**

- [4] Khoshbakhtian, F., Ahamd, A., Cohen, A., and Aleman, D. M. Enhancing critical node detection with beam search: a heuristic-agnostic approach. *targeted for INFORMS Journal on Computing*.
- [5] 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. *targeted for Canadian Medical Association Journal*.
- [6] Navabzadeh, F., Khoshbakhtian, F., Aleman, D. M., Giffen, R., and Rahman, P. Machine learning to predict clinical outcomes of psoriasis patients. *targeted for Canadian Medical Association Journal*.

### **Pre-prints**

- [1] 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](https://doi.org/10.1101/2021.10.15.21264970v1).

## **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*).
- [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

## **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)
  - Responsibilities: Managing teams of TAs, preparing tutorial material, holding office hours, designing and marking assignments and exams.

## **Leadership and service**

- **Co-Founder, Executive Member**, University of Toronto Students for a Free Iran, 2022-Present
- **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
- **Workshop Facilitator, Research Officer**, InDepth Conference at the Munk School of Global Affairs, 2016-2017

## **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)