Ebrahim **Pichka**

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EDUCATION

Georgia Institute of Technology 2025 – 2026 (Exp.)
M.Sc. • Computer Science • Machine Learning Specialization
- **CGPA:** 4.0/4.0

University of Windsor 2023 – 2024
M.A.Sc. • Industrial Engineering
- **CGPA:** 4.0/4.0
- **Supervisor:** Dr. Guoqing Zhang

Amirkabir University of Technology (Tehran Polytechnic) 2017 – 2022
B.Sc. • Industrial Engineering
- **CGPA:** 3.18/4.0 (**3.58**/4 for the last 2 years)
- **Thesis:** Algorithmic Trading in Financial Markets using Deep Reinforcement Learning Algorithms.
- **Supervisor:** Dr. Masoud Mahootchi

EXPERIENCE

Graduate Research Assistant • University of Windsor Jan. 2023 – Dec. 2024
- Conducted academic research on the intersection of combinatorial optimization and machine learning, developing models to learn to generate reliable solutions for optimization problems using Graph Representation Learning & Reinforcement Learning.
- Studied hybrid approaches that enhanced traditional optimization solvers' performance on benchmark problems.
- Applied Policy Gradient Optimization reinforcement learning to solve the dynamic financial portfolio construction and allocation, leading to better investment decisions under changing market conditions.
- Technologies used: Python, PyTorch, TorchRL, Gurobi, OR-tools, Git

Machine Learning Intern • Astyage Apr. 2021 – Sep. 2021
- Architected and deployed a production-grade conversational AI chatbot that reduced customer support response time by 60% and handled 1000+ daily customer inquiries for insurance services.
- Built and deployed a transformer-based language model that accurately identified customer needs with more than 90% accuracy, the model served as the chatbot's NLU engine.
- Managed data collection and created data pipelines that were used in periodic model training and deployment enabling continuous model improvements with a team of software and operations engineers.
- Technologies used: Python, TensorFlow, Keras, transformers, SQL, PostgreSQL, Linux, Git

Data Science Intern • Dayche Data Mining Group Jan. 2021 – Apr. 2021
- Created a customer segmentation system using clustering techniques analyzing hundreds of transactions, identifying 5 key customer groups that was estimated to increase marketing campaign effectiveness by 30%.
- Built automated data processing workflows in Python that reduced analysis time from days to hours.
- Technologies used: Python, scikit-learn, pandas, NumPy, Linux, Git

RESEARCH INTERESTS

- Machine learning for Optimization (Learning-to-Optimize) & Decision-focused Learning.
- Deep Reinforcement Learning & Sequential Decision-making.
- Graph Representation Learning & Deep Learning on Graphs.
- Combinatorial Optimization & Operations Research.

SKILLS

Programming	Python, Julia, C++
ML	PyTorch, JAX, TensorFlow, Keras, PyG, TorchRL, Scikit-learn, XGBoost
Optimization & OR	CVXPy, Pyomo, JuMP, Gurobi, Google OR-tools
Statistics & Data Sci.	Statsmodels, Pandas, NumPy, SciPy, Polars, Matplotlib, Plotly, Seaborn
Dev Tools/Software	Linux, Git, Docker, MongoDB, SQL

SELECTED PROJECTS

Option Pricing with Machine Learning • [GitHub] Mar **2023**
- Developed, trained, and benchmarked three ML models i.e. MLP Neural Networks, LightGBM, and Support Vector Regression against the Black-Scholes model for option pricing using underlying asset price, volatility, and time-to-expiration as features.
- Achieved 57.9% improvement in RMSE with Neural Networks (325.04 vs 771.98) using a dataset of 98 option contracts.

Bayesian Portfolio Optimization • [GitHub] Dec **2024**
- Implemented a Bayesian portfolio optimization method using PyMC incorporating Markov Chain Monte-Carlo (MCMC) sampling to model uncertainty in asset returns and correlations
- Achieved Sharpe ratio of 1.002 (vs 0.602) against Classical Markowitz, and Black-Litterman models on a portfolio of 10 stocks from Technology and Finance sectors.

Reinforcement Learning for Financial Trading • [GitHub] Sept **2022**
- Implemented and compared two deep reinforcement learning algorithms (PPO and DQN) for automated single-asset stock trading, with a custom-developed Gym-interface environment for simulating market conditions given daily price data.
- Evaluated Sharpe and Sortino ratio, max drawdown, and value-at-risk (VaR) to validate strategy robustness. Achieved a significantly higher Sharpe ratio (2.04) compared to buy-and-hold baseline (0.92) on daily data of "GOOG" stocks.

Monte Carlo Option Pricing • [GitHub] Dec **2024**
- Implemented Monte Carlo option pricing based on Geometric Brownian Motion process for European call options in Python.

TECHNICAL WRITING

Authored in-depth technical articles on machine learning and optimization concepts**:**
- ***"Portfolio Optimization with Python: using SciPy Optimize & Monte Carlo Method"*** [Medium] **:** Step-by-step explanation and implementation of modern (mean-variance) portfolio optimization using Monte Carlo simulation and sequential least squares programming (Scipy) in Python.
- *"**What is Query, Key, and Value in the Transformer Architecture**"* [Blog Post] [Medium]: Detailed explanation of attention mechanism and the intuition behind the notion of Key, Query, and Value in Transformer architecture and why is it used.
- *"**Graph Attention Networks Paper Explained**"* [Blog Post] [Medium]: A detailed and illustrated walkthrough of the "Graph Attention Networks paper by Veličković et al. with the PyTorch implementation.
- *"**Policy Gradient Algorithms Mathematics Explained**"* [Blog Post] [Medium]: Step-by-step derivation of the policy gradient theory along with python implementation of vanilla policy gradient and the REINFORCE algorithm.
- *"**Automatic Differentiation: A Brief Introduction**"* [Blog Post] [Medium]: An introduction to the mechanics of AutoDiff, exploring its mathematical principles, implementation strategies, and applications in currently most-used frameworks.

TEACHING EXPERIENCE

Teaching Assistant

- Engineering Economics	University of Windsor	Fall 2024
- Treatment of Experimental Data	University of Windsor	Winter 2024
- Operations Research I	University of Windsor	Fall 2023
- Production Analysis	University of Windsor	Summer 2023
- Numerical Analysis	University of Windsor	Winter 2023
- Fuzzy Intelligent Systems	University of Tehran	Fall 2021
- Statistical Quality Control	Amirkabir University of Technology	Fall 2021
- Corporate Finance	Amirkabir University of Technology	Spring 2020

TEST SCORES

GRE (Graduate Record Examinations) General: Oct. 2021
- Quant: **169**/170
- Verbal: **153**/170
- Analytical Writing: **3.5**/6

CERTIFICATES

- Machine Learning Engineer Nanodegree — Udacity (AWS)
- Computer Science Fundamentals — Coursera (University of Illinois at Urbana-champaign)
- Deep Learning Specialization — Coursera (DeepLearning.ai)
- Reinforcement Learning Specialization — Coursera (University of Alberta/AMII)
- TensorFlow Developer — Coursera (DeepLearning.ai)
- Machine Learning — Coursera (Stanford Online)

SELECTED COURSEWORK

- Computational Intelligence	(A)	- Artificial Intelligence	(A+)
- Data & Information Analysis	(A+)	- Optimization I (Operations Research)	(A+)
- Principles of Simulation	(A+)	- Optimization II	(A)
- Production & Inventory Control Systems	(A+)	- Supply Chain Management & Logistics	(A)

AWARDS & HONORS

- **AWS Scholarship** recipient for the Machine Learning Engineer Nanodegree tuition exemption from Udacity.
- **Ranked top 1%** in Iran's National University Entrance Exam among more than 600,000 students.

OTHER

- **Open Source:** Contributed to development of open-source projects such as Pytorch, Pytorch-geometric, etc.
- **Voluntary Activities:** Served as the committee member of the Students' Scientific Association of the Industrial Engineering Department at Amirkabir University of Technology, responsible for organizing the industry-university collaboration division.