

Hessam Alizadeh

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SUMMARY: Senior Data Scientist with **5+ years of experience** developing **end-to-end ML solutions** from research through **production deployment**. Expert in **Python, AWS infrastructure, and SQL** with proven track record building **anomaly detection systems** directly transferable to **fraud detection** and **financial risk modeling**. Strong background in **feature engineering, model lifecycle management, statistical modeling**, and writing **production-ready code** for real-time decision-making. Experienced in **cross-functional collaboration** with business stakeholders, translating complex problems into high-impact ML solutions. Demonstrated ability to develop **deep domain expertise** through research, deliver measurable business results, and thrive in fast-paced environments solving varied, open-ended problems.

EDUCATION

PhD in Computer Engineering Purdue University - Main Campus

Dec 2024

MSc in Computer Engineering Amirkabir University

Feb 2011

BS in Computer Engineering Azad University

Jul 2008

TECHNICAL SKILLS

Proficient: Python, C, C++

Programming & Databases: C#, Java, JavaScript, Rust, TypeScript, SQL, Gremlin

Tools & Paradigms: OOP, Functional, Concurrent & Parallel Programming, Embedded, Linux Programming, Bash, Shell, Make, WAF, Gradle, Spring Boot

AI/ML: PyTorch, TensorFlow, CUDA, NumPy, Pandas, SciPy, Scikit-Learn, MLFlow, Experiment tracking, Node2Vec, NodeForce, Transformers, CNN, RNN, CRNN, GNN, GCN

NLP/LLM: Fine-Tuning, PEFT, RAG, LangChain, LangGraph, Prompt Engineering, Context Engineering

Statistical Analysis: Design of Experiments, Time series analysis, Entropy analysis, Statistical modeling

Infrastructure and DevOps: Computer architecture, Distributed systems architecture, SLURM, CI/CD, Git, AWS, Neptune, GCP, OCI, RESTful APIs, SQL, Docker, Podman, Kubernetes, MQTT

WORK EXPERIENCE

Graph Systems Architect || Inertia Systems

Apr 2025 - Sep 2025

- Developed **end-to-end ML system** for conflict detection achieving **95%+ accuracy**, demonstrating full-stack capabilities from data acquisition through **production deployment** and monitoring.
- Architected solution using **AWS Neptune, SQL-like Gremlin queries, and RESTful APIs**, writing **production-ready code** for real-time decision-making with high reliability.
- Applied **feature engineering** and **statistical modeling** to optimize detection performance, iterating through research and experimentation to achieve business goals.
- Collaborated with cross-functional teams** (engineering, product, marketing) to deliver high-impact solution that drove **\$3M investment**, demonstrating strong communication with senior stakeholders.

Postdoctoral Researcher || Indiana University

Jan 2025 - Present

- Developed **anomaly detection models** using **graph diffusion** and **statistical methods** for identifying unusual patterns, directly applicable to **fraud detection** in financial systems.
- Conducted **deep research** into complex detection problems with high visibility, developing domain expertise through iterative experimentation and critical thinking.
- Employed **Python, PyTorch**, and **statistical modeling** for model development, training, and evaluation with rigorous success metrics.

AI/ML Intern || Eli Lilly

May 2024 - Aug 2024

- Built **end-to-end ML system** from data acquisition through **production deployment** on **AWS infrastructure**, handling **large-scale data (1M+ nodes)** with **SQL queries** and **feature engineering**.
- Developed **supervised and semi-supervised models** achieving **96%+ recall**, demonstrating strong practical ML knowledge and ability to optimize business-critical metrics.
- Wrote **production-ready Python code** with **CI/CD pipelines** and testing, ensuring reliability for real-time operations and data quality maintenance.
- Collaborated with cross-functional teams** across chemistry, finance, and marketing, presenting analyses and outcomes to senior management to inform product development and strategy.
- Designed and performed **analyses** that drove data acquisition decisions, product priorities, and business strategy with measurable impact.

Data Science Researcher || Purdue University

Dec 2019 - Apr 2022

- Developed **real-time anomaly detection models** using **time series analysis, entropy analysis, and neural networks (RNN, CRNN)**, directly transferable to **fraud detection** use cases requiring pattern recognition in sequential data.
- Architected **end-to-end production system** on **AWS** using **MQTT, PostgreSQL**, and distributed architecture, writing **production code** for real-time classification with fault tolerance.
- Applied **inventive feature engineering** and **statistical modeling** techniques, achieving success through iteration and integration of new data sources.
- Implemented **model monitoring** and data quality checks, ensuring reliable real-time decision-making across multiple concurrent streams.
- Demonstrated **deep domain understanding** of time series patterns and anomaly signatures through extensive research and experimentation.

RESEARCH EXPERIENCE

Graph Embedding and Graph ML

Purdue University | PhD Thesis

My PhD thesis at Purdue University. Researched graph embedding methods. Invented a graph embedding methodology using force-directed approach and provided a mathematical proof-of-convergence using Brouwer's fixed point theorem. Optimized complexity of the method from $O(n^2)$ to $O(n \log n)$. This method can be employed in supervised or unsupervised learning schemes. Made extensive use of PyTorch framework, CUDA library, GPU unit and memory optimization methods. Implemented parallelized algorithms for multi-GPU execution using SLURM. Improved graph task metrics (link prediction, node classification, etc.) by over 6% compared to state-of-the-art methods. Developed a library to optimize the memory utilization by searching for an optimum batch count during run time. Used "wrapper" design pattern to implement a Python decorator for the batch-count optimizer during run-time. Implemented an experiment tracking system using MLFlow.

Technical Environment: Deployed models on multi-GPU clusters using SLURM for resource management

Applied Methods: Force-Directed approach | PyTorch | CUDA | Memory optimization | Multi-GPU scaling | SLURM job orchestration | Experiment tracking

Large-Scale Knowledge Graph Processing

Eli Lilly and Company | Internship Project

An internship project at Eli Lilly and Company. Researched optimized methods for extracting subgraphs from large-scale knowledge graph and visualizing it. The objective was to provide a KG tool with search and visual exploration features, helping the user better explore the KG. The users of this tool were scientists and domain experts from various departments (chemistry/pharma, finance, marketing, etc.). In addition, for enhancing user experience, a smooth transition between various levels of visualization granularities was implemented.

Applied Methods: Force-Directed | ForceAtlas | Community detection | Clustering | GraphViz

DDoS attack detection and mitigation in SDN

Purdue University | Research Project

A research project at Purdue University. Researching on DDoS attacks and development of methods for their detection and mitigation. In this research the network traffic flows were collected in set intervals. Then they were compiled into time series data for processing using entropy analysis and neural network models for classification and prediction. Proposed the idea of partitioning incoming traffic based on various parameters. Then, each partition was effectively a separate time series data.

Applied Methods: Entropy analysis | Group testing | RNN and CRNN

Quantum Computer Scheduler

Amirkabir University (QDA group) | Master's Thesis

A master's thesis at Amirkabir University. Designed and implemented a method and algorithm for scheduling ion-trap quantum computers with the goal of reducing execution latency of quantum program. Reduced the scheduling latency by 50% average compared to the state-of-the-art methods.

Applied Methods: OOP in C++ | Lee's maze routing

CERTIFICATES

Machine learning specialization

Stanford University. Verification: <https://coursera.org/verify/specialization/HMWE8SJ5U82M>

MLOps

Duke University. Verification: <https://coursera.org/verify/specialization/ENSE7V7CKMU7>

Deep learning specialization

Stanford University.

PUBLICATIONS

Under the name "Hamidreza Lotfalizadeh"

[Google Scholar Profile](#)