Hessam Alizadeh

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SUMMARY: ML engineer and researcher with **5+ years of production experience** building **AI-enabled applications** and deploying **ML systems at scale**. Expert in **Python** and modern **AI/ML tools**, with deep experience integrating **LLMs**, **RAG systems**, and **cloud platforms (AWS, Neptune, GCP)** into production environments. Proven ability to **solve complex problems**, **collaborate with cross-functional teams**, and deliver **production-ready software** with measurable business impact. Passionate about leveraging **emerging AI technologies** to build intelligent applications that drive real-world value.

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 Networks Specialist || Inertia Systems — Apr 2025 - Sep 2025

- Developed **production-ready graph-based application** for construction tech to manage and resolve conflicts in building plans. Achieved over **95% time efficiency** in conflicts detection and resolution.
- Integrated **AWS Neptune graph database** with **SQL-like Gremlin queries** and **RESTful APIs** for conflict detection and resolution in **cloud-deployed system**.
- Built **full-stack application** with **graph querying system** and **interactive visualization UI** for enhanced operability and stakeholder insights.
- **Collaborated with cross-functional teams** (engineering, product, marketing) to translate business requirements into technical solutions, helping secure **$3 million investment**.

Postdoctoral Researcher || Indiana University — Jan 2025 - Present

- Researched and prototyped **diffusion models** on dynamic graphs to simulate structural changes, exploring novel **AI/ML approaches** for complex systems.
- Developed **production-ready models** for rumor source detection using **graph diffusion algorithms**.
- Applied **graph ML techniques** to solve **alignment tasks** with results pending publication, demonstrating adaptability to unfamiliar problem domains.

AI/ML Intern || Eli Lilly — May 2024 - Aug 2024

- Built **production AI application** integrating **GraphRAG**, **LLM APIs**, and **graph traversal algorithms** for intelligent knowledge discovery, handling **large-scale graphs (1M+ nodes)**.
- Led research and development of **ML methods** deployed on **cloud infrastructure (AWS)** for **large-scale graph analysis** and knowledge extraction.
- Implemented **supervised and semi-supervised ML systems** achieving **96+ recall**, delivering measurable business impact for decision-making processes.
- **Collaborated with cross-functional and international teams** across chemistry/pharma, finance, and marketing, translating diverse business needs into **production-ready technical solutions**.
- Developed **user-friendly web interface** with **interactive features** and **RESTful APIs**, enabling field experts to leverage AI tools effectively.

Data Science Researcher || Purdue University — Dec 2019 - Apr 2022

- Architected and deployed **production-scale real-time streaming data pipeline** using **MQTT** and **distributed systems architecture** to process IoT sensor data.
- Built **fault-tolerant ML system** with **concurrent multi-threaded operations** for real-time classification and prediction, demonstrating strong **system design** and **software engineering** skills.
- Developed **time series analysis and anomaly detection models** using **PyTorch** and **modern ML frameworks**, solving complex problems in early detection systems.
- Implemented **production-ready code** following best practices for scalability, maintainability, and performance optimization.

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