Hessam Alizadeh

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SUMMARY: ML researcher and engineer with expertise in **graph neural networks**, **distributed systems**, and **GenAI/RAG** implementations. Proven track record of delivering scalable ML solutions: achieved **80% reduction** in conflict detection time, **>80% accuracy** in pharmaceutical knowledge discovery, and **$3M investment** through product demonstrations. Strong foundation in systems programming and cross-functional collaboration.

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

Core Languages: Python, C, C++, Rust, Java, JavaScript, TypeScript, C#
ML/AI Frameworks: PyTorch, TensorFlow, CUDA, Numpy, Pandas, SciPy, Scikit-Learn, MLFlow, Transformers, Node2Vec, NodeForce
Deep Learning & NLP: CNN, RNN, CRNN, GNN, GCN, GAT, Fine-Tuning, PEFT, RAG, LangChain, LangGraph, Prompt Engineering
Data & Analytics: Time series analysis, Entropy analysis, Statistical modeling, Design of Experiments, Real-time data streaming (MQTT)
Infrastructure & Databases: AWS, Neptune, GCP, OCI, Docker, Kubernetes, SLURM, Spark, SQL, Gremlin, Graph databases
Software Engineering: OOP, Functional Programming, Concurrent & Parallel Programming, Multi-threaded Applications, CI/CD, Git, RESTful APIs, Distributed Systems Architecture

WORK EXPERIENCE

Graph Networks Specialist || Inertia Systems — Jul 2024 - present

- **Architected graph-based system** for construction tech, achieving over **90% reduction** in conflict detection and resolution time for building plans
- **Designed and deployed Neptune graph database solution** with optimized Gremlin queries for real-time conflict detection across complex building structures
- **Built an interactive graph visualization UI and querying system** and enabled stakeholders for efficient and timely conflict detection.
- **Delivered critical features** that secured **$3 million investment** through compelling product demonstrations to investors
- **Lead GenAI integration initiative** to incorporate LLM and RAG capabilities for advanced document ingestion

Postdoctoral Researcher || Indiana University — Apr 2024 - Jul 2024

- **Researched and developed diffusion models** on dynamic graphs for simulating structural changes in complex networks
- **Created novel models** for detecting source of rumore using graph diffusion techniques
- **Applied graph diffusion algorithms** to solve alignment tasks with results pending publication

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

- **Developed scalable ML methods** for analyzing large-scale knowledge graphs with **over 1 million nodes** using Python, JavaScript, and TypeScript
- **Achieved 96% precision** with semi-supervised learning methods for pharmaceutical knowledge discovery
- **Built RAG-powered exploration tool** integrating graph traversal algorithms for intelligent subgraph extraction and query-based analysis
- **Collaborated with cross-functional teams** across chemistry/pharma, finance, and marketing to align ML solutions with business objectives
- **Designed and deployed web interface** with interactive visualization features, improving decision-making processes for domain experts

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

- **Architected scalable real-time streaming pipeline** using MQTT to process IoT sensor data for early incident detection
- **Built fault-tolerant distributed system** for multivariate time series analytics and prediction models
- **Implemented concurrent multi-threaded operations** enabling real-time classification across multiple data streams
- **Developed time series prediction models** improving incident detection accuracy and reducing false positives

Software Developer || Purdue University — May 2018 - Aug 2020

- **Developed distributed systems** using Python socket programming for robust client-server connections
- **Built web server implementation with Django** for scalable data processing and RESTful API development

RESEARCH EXPERIENCE

Graph Embedding and Graph ML

Purdue University | PhD Thesis

Invented novel graph embedding methodology using force-directed approach with mathematical proof-of-convergence via Brouwer's fixed point theorem. **Optimized algorithm complexity from $O(n^2)$ to $O(n \log n)$**, enabling scalability to million-node graphs. **Achieved 6% improvement** over state-of-the-art methods in graph tasks (link prediction, node classification). **Developed memory optimization library** using wrapper design pattern for dynamic batch-count optimization. **Implemented parallelized algorithms** for multi-GPU execution using SLURM and CUDA. Built comprehensive experiment tracking system using MLFlow.

Applied Methods: Force-Directed approach, PyTorch, CUDA, Memory optimization, Multi-GPU scaling, SLURM orchestration, MLFlow

Large-Scale Knowledge Graph Processing

Eli Lilly and Company | Internship Project

Designed optimized methods for extracting and visualizing subgraphs from large-scale pharmaceutical knowledge graphs. **Developed KG exploration tool** with advanced search and visual features for scientists and domain experts across departments. **Implemented smooth multi-granularity visualization** transitions enhancing user experience and decision-making efficiency.

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

DDoS Attack Detection and Mitigation in SDN

Purdue University | Research Project

Developed innovative DDoS detection methods using network traffic flow analysis and time series processing. **Proposed novel traffic partitioning approach** creating separate time series for enhanced analysis. **Implemented entropy analysis and neural network models** (RNN, CRNN) for real-time attack classification and prediction.

Applied Methods: Entropy analysis, Group testing, RNN, CRNN, Time series analysis

Quantum Computer Scheduler

Amirkabir University (QDA group) | Master's Thesis

Designed and implemented scheduling algorithm for ion-trap quantum computers targeting execution latency reduction. **Achieved 50% average latency reduction** compared to state-of-the-art scheduling methods. Developed efficient C++ implementation using object-oriented design principles.

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

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 Verification: In Progress

PUBLICATIONS

Published under the name **Hamidreza Lotfalizadeh**

Google Scholar Profile