# Alireza Hashemi

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## EDUCATION

**The City University of New York -** PhD in Physics — Aug 2022 – Present
- Applied graph machine learning and graph neural networks on social & biological data. Application of symmetries and graph fibrations in biological neural networks of C. Elegans, machine learning on protein structure. (Python: Github)
- Application of open-source LLMs in social media sentiment classification. Inference & finetuning (unsloth, PyTorch)

**Sharif University of Technology** - Master of Science in Physics — Sep 2019 – Jan 2022
- Numerical simulation of chaos in many-body systems of topological defects in active nematic matter. (Python: Github)
- Simulation of social distancing in pedestrian dynamics, analysis of COVID-19 spread patterns. (Python: Github)

**University of Zanjan** - Bachelor of Science in Physics — Sep 2015 – Jun 2019
- Radiative heat transfer in many-body fractal nano-structures, using computational linear algebra for numerical solution of fluctuational electrodynamics in fractal patterns. (C++, OpenMP, LAPACK)
- Ground-state energy eigenvalues for fractal quantum potentials. (C++: Github)

## WORK EXPERIENCE

**The New York Times,** New York, USA
Data Science Intern — Jun 2025 – Aug 2025

**Memorial Sloan Kettering Cancer Center,** New York, USA
Research Assistant — Jul 2024 – Present
- Studying the brain functional and physical networks using graph theory & machine learning on fMRI data. (AFNI, Python)

**City College of New York,** New York, USA
Adjunct Lecturer – Physics — Sep 2023 – Present

**blubank** (1st Iranian Neobank)**,** Tehran, Iran
Data Scientist (Founding Member of the Data Science Team) — May 2020 – Aug 2022
- Implementation and design of fraud detection system on large-scale user transactional data using user-specific isolation forests, designing a pioneering platform for money-laundry detection in Iranian banking system.
- End-to-end development of a KYC system featuring liveness detection and on-device OCR, reducing the sign-up process time by 90% and enhancing the overall customer onboarding experience.
- Development and design of a Neo4j graph database and graph machine learning solutions to identify money-laundry networks, community detection, and recommender system in a user transaction database with >2 million users.
- Development of an effective credit scoring platform with <0.5% annual default rate, optimizing the risk in loans product.
- Data engineering pipelines & automations with Apache Airflow and ETL with Python on different databases (SQL, NoSQL).
- In-app user experience A/B testing and drill-down analysis using Elasticsearch to identify bottlenecks and patterns.
- Strategic insights as on-demand dashboards and in-depth analytics on customer acquisition and business growth.

**Rahnema Co.,** Tehran, Iran
Machine Learning Intern — Jan 2020 – Mar 2020
- Worked on a team to design a recommendation system for beeptunes, an Iranian music streaming platform.

## PUBLICATIONS & CONFERENCES

Brains vs. Bytes: Evaluating LLM Proficiency in Olympiad Mathematics – *COLM (2025)*
Symmetries and synchronization in C. elegans connectome: Integration of functional and structural networks – *PNAS (2025)*
Protein Secondary Structure Prediction with GNNs and a Large-Scale Novel Graph Dataset – *under review*
Visiting distant neighbors in graph convolutional networks - *ICTIS* (2024)
Social distancing in pedestrian dynamics and its effect of disease spreading - *Physical Review E* (2021)
Chaotic dynamics of active topological defects - *Soft Materials* (2021)
Social distancing in pedestrian dynamics - *Dynamical Biological Systems* (2020)
COVID-19 in Iran - *NetSci* (2020)
Effectiveness of social distancing through the lens of Agent-Based Modelling - *Complex Systems Society* (2020)
Analysis of the ground-state energy eigenvalues of fractal quantum potentials - *Physica Scripta* (2019)
Many-body effects on the radiative heat transfer in fractal nanostructures - *IJAA* (2017)

## RELEVANT SKILLS

**Programming Languages:** Python, C++, MATLAB, R, SQL, **Tools & Libraries:** GBM (xgboost), sklearn, NetworkX, TensorFlow, PyTorch, PyTorch Geometric, Unsloth, Ollama, Metabase, Elasticsearch, Superset, Apache Airflow, Python ETL, Spark, AWS, MLFlow, Python ETL (with PostgreSQL, MongoDB, Neo4j, MySQL), git, bash.

## RELEVANT COURSEWORK

Deep Learning (with Prof. Yann LeCun, NYU), Stochastic Optimization, Numerical Methods in Physics, Statistical Machine Learning, Algorithms & Data Structures, Linear Algebra, Probability Theory, Complex Networks Analysis

## SERVICE

- Teaching assistant for Physics I & II, University of Zanjan, Fall 2017-2018
- Teaching assistant for Analytical Dynamics, University of Zanjan, Fall 2018
- Teaching assistant for Nonlinear Dynamics & Chaos, Sharif University of Technology, Fall 2020
- Lab assistant for Physics I, II, City College of New York, Fall 2023-2024
- Reviewer for Journal of Physics A: Mathematical and Theoretical (2024)
- Reviewer for IEEE Transactions on Neural Networks and Learning Systems (2023-2024)

## OTHER

- NTD Hackathon runner-up team (NPR.org) for designing an graph-theoretical approach for contaminated water management for neglected tropical diseases.
- Dynamical Biological Systems award for best visualization, 2020.
- Translation of the book “Dark Matter & Dark Energy” by Brian Clegg to Farsi, Chatrang Pub, 2020