Alireza Hashemi

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I am a 2nd-year PhD student in Physics with experience in data science and machine learning. My academic background is complemented by over two years of hands-on experience as a data scientist, gaining experience with Python, C++, and data engineering tools. My PhD research focuses on leveraging the power of graph neural networks and graph symmetries to tackle complex biological problems, specifically focusing on protein structures. My MSc thesis, which was on the numerical simulation of chaos in systems of many-body topological defects, has made me somewhat proficient in programming and numerical methods (and life I guess). This multidisciplinary background and interests equip me with the problem-driven approach to bridge the gap between theory and real-world applications to use different mathematical and computational tool to tackle different problems, from fraud detection in banking to protein structure analysis.

EDUCATION

The City University of New York

PhD in Physics — Sep 2022 – Fall 2026

Master of Science in Physics — Sep 2022 – Sep 2024

- Applied graph theory and graph machine learning on biological data. Application of symmetries and fibrations in studying graph-based problems. (Python, PyTorch)

Supervisor: Hernán Makse

Sharif University of Technology

Master of Science in Physics — Sep 2019 – Jan 2022

- Numerical simulation of chaos in systems of many topological defects *(i.e. life is unpredictable)*. (Python)
- Simulation of social distancing in pedestrian dynamics *(mathematically proving it helps stop diseases!)*. (Python)

Supervisor: Mohammad-Reza Ejtehadi

University of Zanjan

Bachelor of Science in Physics — Sep 2015 – Jun 2019

- Radiative heat transfer in many-body fractal nano-structures *(basically computational linear algebra)*. (C++, OpenMP, CUDA)
- Ground-state energy eigenvalues for fractal quantum potentials *(solving Schrödinger's equation for cute fractals because why not?)*. (C++, MATLAB)

Supervisor: Amirhossein Darooneh, Moladad Nikbakht

WORK EXPERIENCE

blubank, Iran

Data Scientist — May 2020 – Aug 2022

- Fraud detection on user transactional data using isolation forests, autoencoders, and other anomaly detection methods.
- Fine-tuning and training of several CNNs for face vs. ID card verification and liveness detection.
- Development of a Neo4j graph database and graph machine learning solutions on various internal data sources to identify money-laundry networks, community detection, fraud detection, and recommender system in a user transaction database with >2 million users.
- Data engineering pipelines & automations with Apache Airflow and ETL with Python on different databases (SQL, NoSQL).
- High-level presentations of results and solutions to business and marketing teams.

Rahnema College, Iran

Machine Learning Course Mentor (Volunteer work) — Mar 2021 – Jun 2021

- Mentored a group of interns to work on machine learning projects in anomaly detection on website traffic data.

Rahnema College, Iran

Machine Learning Intern — Jan 2020 – Mar 2020

- Three-month internship on theory and applications of machine learning, gained experience with big data tools such as Spark & Hadoop. Worked on a music recommender system project for a music streaming website (beeptunes).

PUBLICATIONS

Visiting distant neighbors in graph convolutional networks
Alireza Hashemi, Hernán A. Makse - *arxiv preprint* (2023)

Social distancing in pedestrian dynamics and its effect of disease spreading
Alireza Hashemi, Sina Sajjadi and Fakhteh Ghanbarnejad - *Physical Review E* (2021)

Chaotic dynamics of active topological defects
Alireza Hashemi, Mohammad Reza Ejtehadi - *Soft Materials* (2021)

Analysis of the ground-state energy eigenvalues of fractal quantum potentials
Alireza Hashemi, Amirhossein Darooneh - *Physica Scripta* (2019)

Many-body effects on the radiative heat transfer in fractal nanostructures
Moladad Nikbakht, Serviyeh Ahmadian, **Alireza Hashemi** - *IJAA* (2017)

CONFERENCE PRESENTATIONS

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)

RELEVANT SKILLS

Programming Languages: Python, C++, MATLAB, R, **Standard Machine Learning Libraries, Network Science Libraries:** NetworkX, graph-tool, **Deep Learning:** Keras, TensorFlow, PyTorch (and PyTorch geometric), **Parallel Computation**: LAPACK, OpenMP, CUDA, **SQL & NoSQL Databases**: PostgreSQL, MongoDB, Neo4j, **Timeseries:** Causal impact analysis, timeseries prediction, anomaly & fraud detection, **Data Reporting:** Metabase, Superset, **Data Engineering & ML Automation Tools:** Apache Airflow, Python ETL

OTHER

NTD Hackathon runner-up team (report on NPR.org), 23rd & 24th school on physics at IASBS, Tehran School on Complex Networks (TACN2018) participant, Teaching experience as an adjunct lecturer at CCNY, Translation of the book "Dark Matter & Dark Energy" by Brian Clegg to Farsi (2020). Student representative in Doctoral & Graduate Student Council at CUNY. Dynamical Biological Systems 2020 award for best visualization.

RELATED COURSEWORK

Deep Learning *(with Y. LeCun)*, Stochastic Optimization, Numerical Methods in Physics, Advanced Programming *(for physicists)*, Statistical Machine Learning

LINKS

Google Scholar Researchgate Linkedin Github