Alireza Heidari

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EDUCATION

Sharif University of Technology Tehran, Iran
*B.Sc in **Computer Engineering** with specialization in Machine Learning; GPA: 17.62/20 (3.52/4)* *2019 – present*

Young Scholars Club (Pre-University) Tehran, Iran
Prepared for the 13th International Astronomy Olympiad as a member of the Iranian national team. *2018 – 2019*

RESEARCH INTERESTS

- **Multimodal Learning**
- **Generative Modeling**
- **Machine Learning Theory**
- **Self-Supervised Learning**
- **Representation Learning**
- **Graph Neural Networks**

PUBLICATIONS

Unlabeled Out-of-Domain Data Improves Generalization

- A. Saberi, A. Najafi, **A. Heidari**, M.H. Movasaghinia, A. Motahari, B. Khalaj
- *International Conference on Learning Representations (ICLR)*, 2024. [Spotlight Presentation]

RESEARCH EXPERIENCE

Research Assistant In Multimodal Learning Sharif University of Technology
Supervised by Prof. Mahdieh Soleymani Baghshah *July 2023 - Aug. 2024*

Enhancing Vision-Language Model Performance with Hierarchical Semantic Labels

Vision-Language Models (VLMs) like CLIP demonstrate inconsistencies in their ability to process concepts at varying levels of label abstraction. To mitigate this distribution gap, we propose incorporating semantic hierarchical label knowledge to enforce the separation of embedding features for different categories across multiple granularity levels.

Research Assistant In Machine Learning Theory Sharif University of Technology
Supervised by Prof. Abolfazl Motahari, Prof. Amir Najafi *Jan. 2023 - Sep. 2023*

Out-Of-Domain Unlabeled Data Improves Generalization

Our work focuses on demonstrating the effectiveness of incorporating out-of-domain unlabeled samples. We proposed a polynomial-time algorithm that combines self-supervised learning (SSL) and Distributionally Robust Learning (DRL), with theoretically guaranteed improved generalization bounds over existing ERM methods.

TEACHING EXPERIENCE

(Grad. Course) Deep Generative Models Sharif University of Technology
Teacher Assistant - Lectured by Prof. Beigy *2024*

(Grad. Course) Intelligent Analysis of Biomedical Images Sharif University of Technology
Teacher Assistant - Lectured by Prof. Rohban *2023*

(Grad. Course) Deep Learning (×2) Sharif University of Technology
Teacher Assistant - Lectured by Prof. Beigy & Prof. Soleymani *2024 & 2023*

(Grad. Course) Machine Learning (×2) Sharif University of Technology
Teacher Assistant - Lectured by Prof. Sharifi Zarchi & Prof. Motahari *2022 & 2023*

Artificial Intelligence Sharif University of Technology
Teacher Assistant - Lectured by Prof. Soleymani Baghshah & Prof. Rohban *2023*

Advanced Information Retrieval Sharif University of Technology
Teacher Assistant - Lectured by Prof. Beigy *2023*

Scientific Committee Member Young Scholars Club (YSC)
Lecturer and Examiner - IOAA & INOAA Team Selection *2019 - 2021*

AWARDS

- *2019* **Silver Medal** International Olympiad on Astronomy and Astrophysics (IOAA), Hungary.
- *2018* **Gold Medal (Rank 1)** Iranian National Olympiad on Astronomy and Astrophysics, Iran.
- *2019* **Best Astronomical Observer** Messier Marathon & StarCup competitions, Iran.
- *2018 - Present* **Nationally Recognized Elite** Iran's National Elites Foundation, Iran.

WORK EXPERIENCE

During the Sharif University of Technology's **Co-op program**, I worked at **Tapsi**, Iran's Uber counterpart, operating in 30 cities and serving over 25 million users. My contributions resulted in a significant increase of ~**3%** in the company's revenue.

Data Scientist   Tapsi Co.

Artificial Intelligence & Data Science Team   *Jan. 2022 - Jan. 2023*

I contributed to the improvement of our in-house **Estimated Time of Arrival (ETA)** service.

- **GNNs for ETA Prediction**: Enhanced the spatial understanding of our deep traffic forecaster by integrating Spatial-Temporal Graph Neural Networks, primarily inspired by Google's ETA Prediction with GNNs.
- **Seasonality-Aware Pre-processing**: Eliminated the influence of seasonality-trend patterns in traffic data by implementing a seasonal decomposer module, resulting in a notable 0.5% increase in our model's performance metric.
- **Location Matching Enhancement**: I enhanced OSRM's performance in location trace matching by analyzing its HMM algorithm. This led to the development of a data filtering strategy, coupled with a linear regression approach to augment the input trace, resulting in a significant increase of 1% in the company's revenue.

Software Engineer   Tapsi Co.

Backend Development Team   *Jan. 2021 - Jan. 2022*

I held ownership of the **Matching Service**, responsible for the drivers-passenger allocation, and dispatching of proposals.

- **Optimized Matching Algorithm**: Designed and implemented an optimized matching algorithm for linking drivers to passengers that significantly increased company revenue by ~2%.
- **Enhancing Software Infrastructure**: I improved multiple micro-services by refactoring the code, migrating databases from PostgreSQL to MongoDB, switching from RabbitMQ to gRPC, and designing dashboards on Grafana and Metabase dashboards to track KPIs and metrics, significantly reducing response time and resource usage.

OPEN-SOURCE CONTRIBUTION

Deep Learning

- **Vision-Language Models Toolbox**: A Python library for fine-tuning and evaluation of vision-language models such as CLIP & BLIP with PyTorch, supporting various datasets and tasks like image classification. [GitHub]
- **MedSegDiff**: Implements the *MedSegDiff: Medical Image Segmentation with Diffusion Probabilistic Model* paper for medical image segmentation, using the LGG Segmentation Dataset to detect tumor and cancer anomalies. [GitHub]
- **BYOL**: A Pytorch implementation of BYOL using a pre-trained ResNet backbone on the STL10 dataset. [GitHub]
- **Generative Models**: Experiments with VAEs, GANs, and DDPMs, on the Fashion MNIST dataset. [GitHub]
- **Object Detection**: Zero-shot object detection with CLIP, utilizing Faster R-CNN for region proposals. [GitHub]
- **Adversarial Robustness**: Evaluating robustness against adversarial attacks such as FGSM and PGD. [GitHub]

Software & Development

- **Full-stack Food Delivery Platform**: A food delivery application built with a Python backend (FastAPI & Docker) and a Vue.js frontend. It presents an event-driven microservices architecture with many modern features! [GitHub]
- **FastAPI JWT Authentication**: A scalable authentication middleware for FastAPI, employing Redis to provide efficient JWT-based authentication and seamless integration with distributed systems. [PyPI] [GitHub]
- **Messaging & DBMS Libraries**: Python libraries for distributed event-driven architectures (rabbitmq-rpc) and streamlined database interactions and connectivity (mongo-motors, asyncpg-client, aredis-client).

RELEVANT COURSES & CERTIFICATES

Deep Learning   Sharif University of Technology
Graduate Course - Grade: 20/20

Machine Learning   Sharif University of Technology
Graduate Course - Grade: 20/20

Artificial Intelligence   Sharif University of Technology
Undergraduate Course - Grade: 20/20

Advanced Information Retrieval   Sharif University of Technology
Undergraduate Course - Grade: 20/20

Advanced Data Science with IBM Specialization   IBM
4 Courses - Grade: 99.0% - [Certificate](#) & [Badge](#)

ML and RL in Finance Specialization   New York University
4 Courses - Grade: 100.0% - [Certificate](#)

Deep Learning for Healthcare Specialization   University of Illinois
3 Courses - Grade: 96.7% - [Certificate](#)

Natural Language Processing Specialization   DeepLearning.AI
4 Courses - Grade: 100.0% - [Certificate](#)

Deep Learning Specialization   DeepLearning.AI
5 Courses - Grade: 96.2% - [Certificate](#)

AI for Medicine Specialization   DeepLearning.AI
3 Courses - Grade: 100.0% - [Certificate](#)

Self-Driving Cars Specialization   University of Toronto
4 Courses - Grade: 99.4% - [Certificate](#)

TECHNICAL SKILLS

Data Science & Machine Learning
- **Workflows & Pipelines**: Luigi, MLflow, Metaflow, Prefect
- **Deep Learning**: PyTorch, Dassl, Hugging Face Transformers, RAPIDS, TensorFlow, Keras, PyTorch Geometric
- **Machine Learning**: Spark MLlib, Scikit-Learn, XGBoost, Catboost, PySpark, Pandas, Numpy, Matplotlib, Seaborn

Programming & Development
- **Programming**: Python, Django, Nodejs, Java, Go, C++, C, R, LaTeX
- **DBMS**: Metabase, Grafana, Tableau, Power BI, MongoDB, PostgreSQL, Redis, Hazelcast, MySQL

Languages
- **English**: IELTS Band Score 7.0 - L: 7.5, R: 8.0, W: 6.0, S: 7.0, **Persian**: Native