Amirhossein **Mesbah**

Graduate Student · Research Assistant

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Education

University of Tehran *Tehran, Iran*

M.Sc. in Artificial Intelligence and Robotics *Sep 2020 - Sep 2023*

- Thesis: Subgoal Discovery using Subspaces and a Free Energy Paradigm
  - Designed a fully autonomous sub-goal discovery algorithm for RL agents in Hierarchical and goal-conditioned tasks
- Supervisors: Dr. Nili Ahmadabadi, Dr. Hosseini; Advisor: Dr. Shariatpanahi
- Overall GPA: **19.48/20 (4.00/4.00)**
- Key courses: Distributed Optimization and Learning, Interactive Learning, Deep Learning, Pattern Recognition

University of Tabriz *Tabriz, Iran*

B.S. in Computer Engineering *Sep 2016 - Jul 2020*

- Thesis: news scrapping dashboard using Scrappy and Django frameworks for news clustering
- Overall GPA: 18.23/20 (3.79/4.00)
- Graduated **3rd** out of 70 students in the Computer Engineering program
- Key courses: Computational Intelligence, Computer Vision, Introduction to NLP

Research Interests

Reinforcement Learning Focus on theoretical aspects of Continual RL, Offline RL, and Representation Learning
Deep Learning theory Optimization, Statistical Learning Theory, and Generalization Bounds
Trustworthy ML Safety, Robustness, and Fairness in AI systems

Research Experience

Research Assistant *Tehran, Iran*

Cognitive Systems Lab, University of Tehran *Nov 2020 - present*

- Developed novel subgoal discovery method for Goal-Conditioned and Hierarchical RL, leveraging Free Energy principles and subspace
- Designed and implemented new Social Reinforcement Learning techniques
- Led a systematic review of Social Reinforcement Learning methods (Link)

Publications

Subgoal Discovery Using a Free Energy Paradigm and State Aggregations *Reinforcement Learning*

A.Mesbah, R.Hosseini, P.Shariatpanahi, M.Nili *2023*

- Preparing to submit **(Draft Link)**. Soon to be on Arxiv.

Who to Learn from: A Preference-based Method for Social Reinforcement Learning *Reinforcement Learning*

B.Karimian, *E.Mirzaei, ***A.Mesbah**, R.Hosseini, P.Shariatpanahi, M.Nili (* Equal Contribution) *2022*

- submitted to IEEE Transactions on Cognitive and Developmental Systems (TCDS). **(Link)**

Teaching Experience

Regular Teaching Assistant *Neuromatch Academy*

United States (Virtual - Online) *Summer 2022 & Summer 2024*

- Supervised international students in intensive 3-week courses for Computational Neuroscience (Certificate) and Deep Learning (Certificate)
- Led two research group projects, guiding students through experiment design

Mentor (Github Link) *HooshBaaz Summer School*

University of Tehran, Tehran, Iran *Summer 2022 & Summer 2023*

- Collaborated with 7 other mentors to design and deliver 14 workshops
- Taught fundamental concepts of Data Analytics and Machine Learning to 80 students
- Developed hands-on notebooks to reinforce theoretical and practical concepts of Machine Learning

Volunteer Teaching Assistant for Graduate Courses — *University of Tehran*

School of Electrical and Computer Engineering, Collage of Engineering, University of Tehran, Tehran, Iran — *Sep 2021- Jul 2023*

- Assisted in advanced courses like Advanced Deep Learning, Interactive Learning, Machine Learning and Distributed Optimization and Learning
- Graded assignments and projects for classes of 40+ students

Volunteer Teaching Assistant for Reinforcement Learning course — *Sharif University of Technology*

Computer Engineering Department, Sharif University of Technology, Tehran, Iran — *Spring 2023*

- Conducted hands-on workshop on RL agent coding and environment design for 30+ students
- Collaborated in developing theoretical problems for Hierarchical and Offline RL homework

Projects

Reinforcement Learning (Link)

- Desinging personalized environments and wrappers using different libraries like **Gymnasium, Pybulet, and Panda-Gym**.
- Implementing **Multi-Agent Reinforcement Learning Algorithms** for Grid Environment.
- Training Deep Reinforcement Learning Agents for turning the forest fires off in a cooperative multi-agent setting.
- Finding the best route for packet routing in the network with multi-armed bandit algorithms.

Deep Learning & Machine Learning (Link)

- Utilizing **Federated Learning** methods (**FedAVG, FedADMM**) for image segmentation task locally for each car.
- Training **Distributed Deep Neural Networks** for Fashion MNIST classification using **Gossip Training** method.
- Implementing **Generative Cooperative Network** for generating images with given style and facial expression.
- Setting up a Machine translation system with **transformers** and **Attention** mechanism (English to Persian).
- Implementing an **Image Captioning** Deep Network by combining VGG Network and LSTMs to generate captions for given images.
- Performing **Semantic segmentation** on Camvid Dataset for detecting different objects from the perspective of an autonomous car.
- Detecting Parkinson's disease using signals of speech data with **ensemble learning**.

Neuroscience (Link)

- Implementing multiple Neural Dynamic models of single cell and population models.
- Evaluating Discrete-Time Neural Signals.
- Studying Continuous-Time Neural Signals for different data modalities.
- Analyzing behavioral data of subjects collected by designing a Psychopy task.
- Investigating the Role of Imitation and Emulation in Decision Making.

BigData (Link)

- Launching a real-time **data pipeline** on the Crypto and Stocks market.
- Using Apache Spark for NLP, Social Networks Analysis and dimensionality reduction tasks.

Skills

Theoretical Experience	Statistical Machine learning, Reinforcement Learning, Deep Learning, Design of Algorithms and Databases
Programming & Scripting	Python, SQL, HTML, CSS, JavaScript, Matlab, C, C++ and Java and LaTeX
Libraries and Frameworks	PyTorch, Tensorflow, Jax, Gymnasium, Numpy, Scikit-learn, BeautifulSoup, NLTK, Opencv,Django and Scrapy

Languages

English - TOEFL IBT (overall of 103 - R:30, L:28, S:21, W:24) — *Fluent*

Persian — *Native*

Turkish — *Native*

Academic Engagement and Outreach

Volunteer Organizer — *University of Tehran*

Brain, Technology and Computer Science (BTCS) Virtual Talks — *2022*

- Assisted in organizing a series of interdisciplinary talks on AI and Neuroscience
- Helped coordinate with guest speakers from international institutions including the University of Oxford and Philipps-Universität Marburg
- Supported the organization of virtual talks under the supervision of Dr. Mohammad-Reza A. Dehaqani