

Mohammad-Amir Khani

Amirkabir University of Technology, Tehran, Iran

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RESEARCH INTERESTS

- Systems and Computational Neuroscience
- Neural Coding
- Digital Signal Processing and Machine Learning
- Electrophysiology
- Artificial Intelligence
- Learning and Memory

EDUCATION

Bachelor of Computer Science August 2021 - September 2024 (expected)
Amirkabir University of Technology

- Overall GPA: 3.93/4 (18.15 via 108 units)

Bachelor of Science in Biomedical Engineering September 2019 - June 2021 (Not Completed)
Amirkabir University of Technology

RESEARCH EXPERIENCES

Research Intern (Remote) Ongoing
Donders Institute for Brain, Cognition and Behaviour Nijmegen

- Assisted with research under the guidance of Dr. Abdelrahman Rayan, with Dr. Lisa Genzel as the Principal Investigator.
- Investigated the changes in the aperiodic part of the signal to determine if it reflects sleep cycles in rodents, similar to those observed in humans.
- Conducted Time-Frequency and Topological Data Analysis on LFP data from rodents and EEG signals from humans.

Undergraduate Research Assistant Ongoing
Department of Psychology, Tehran University Tehran

- Under the supervision of Dr. Ehsan Rezaayat.
- Analyzed electrophysiological recordings from multiple sessions targeting IT and FEF in monkeys, alongside eye tracking data, to study reward-based emotional responses.
- Analyzing correlations between pupil dilation (indicative of reward receipt) and specific brain activity patterns.

Research Intern July 2023 - November 2023
Institute for Research in Fundamental Sciences (IPM) Tehran

- Under the supervision of Dr. Ehsan Rezaayat in Brain Computing Lab.
- Analyzing neural data including EEG recordings, spike activity, and local field potentials using techniques such as Time-Frequency Analysis, coherence measures, spike sorting, information theory analysis and Granger causality.
- Designed and implemented psychophysics experiments utilizing Psychtoolbox, PsychoPy and JsPsych to measure visual response times and perceptual decision making.

Research Intern July 2022 - September 2022
Institute for Research in Fundamental Sciences (IPM) Tehran

- Specialized in Spiking Neural Networks as a research intern in the summer of 2022.
- Explored various encodings, including rate, temporal, and floating point.
- Studied advanced models such as Spiking HMAX, Temporal Error, and Hybrid Neural Network frameworks.
- Gained proficiency in tools like spikeTorch and snnTorch.

HONORS & REWARDS

- Ranked in the **top 15%** at the computer science department at Amirkabir University of Technology.
- Ranked in the **top 10%** at the Biomedical Engineering at Amirkabir University of Technology.
- Ranked in the **top 1%** in the Iranian University Entrance Exam, also known as Konkour.

RELEVANT PROJECTS

Pupillary Responses Relationship and Cross-Region Insights **July 2023**

Neuromatch Academy Final Project

- Analyzed the Steinmetz dataset with Neuropixel electrode recordings from mouse brains to explore neural phenomena.
- Utilized SVM to accurately predict monitor contrast based on visual cortex activity and LSTMs to forecast pupillary area from midbrain and visual cortex neural data.
- Discovered significant interactions between the visual cortex and midbrain through conditional mutual information analysis, suggesting a role of the visual cortex in iris muscle regulation.

Neural Activity Prediction using RNN **July 2022**

Neuromatch Academy Final Project

- Utilized the Steinmetz dataset, featuring Neuropixel electrode recordings implanted in mice brains, to capture neural activity patterns.
- Applied Recurrent Neural Networks (RNNs) to predict neural responses across brain regions, focusing on midbrain to visual cortex connections.
- Successfully forecasted neural activity shifts within the visual cortex and achieved 96.6% accuracy in predicting wheel-turning behavior by harnessing RNN-derived latent variables in conjunction with SVM.

Online Psychophysics Task Development **August 2023**

Internship Project

- Designed and implemented psychophysics tasks using jsPsych, enhancing online experiment accessibility and flexibility.

TEACHING EXPERIENCES

Undergraduate Teaching Assistant **September 2023 - Present**

Amirkabir University of Technology

- Computer Vision | Instructor: Dr. Mostafa Shamsi.

Undergraduate Teaching Assistant **September 2023 - Present**

Amirkabir University of Technology

- Basic Programming | Instructor: Dr. Zahra Ghorbanali.

Undergraduate Teaching Assistant **February 2023 - July 2023**

Amirkabir University of Technology

- Operating Systems | Instructor: Dr. Mohammad Mahdi Bejani.

COURSES ATTENDED

Deep Learning Course

July 2022

Neuromatch Academy

- Learning implementation of Deep Neural Networks using PyTorch
- Learning about CNNs, RNNs, Natural Language Processing, and Data Mining skills.
- In the Final project we predict the neural activity of mice from the Steinmetz dataset using RNNs and we predict the behaviors of the mice using SVM.

Computational Neuroscience Course

July 2023

Neuromatch Academy

- Learning Model Fitting, how to use Dimensionality Reduction
- Learning all about dynamical systems and how to apply them to build more biologically plausible models of neurons and networks of neurons.
- Learning Bayesian Decisions, Hidden Dynamics, Optimal Control and Reinforcement Learning and Network Causality

Selected University Courses

- Statistics & Probability | 20/20 - 4/4
- Foundation of Matrix & Linear Algebra | 20/20 - 4/4
- Computer Vision | 20/20 - 4/4
- Anatomy | 19.5/20 - 4/4
- Artificial Intelligence | 20/20 - 4/4
- Data Mining | 19.25/20 - 4/4
- Research Methodology | 20/20 - 4/4
- Physiology | 20/20 - 4/4

SKILLS

Programming

Python, Rust, C, C++, MATLAB, HTML, CSS, JavaScript

Python Libraries

Numpy, Pandas, Matplotlib, SciPy, TensorFlow, PyTorch, SnnTorch, Scikit-learn, Keras, PsychoPy

Language

- Farsi (Native)
- English (Professional)
- Kurdish (Native)
- My Overall TOEFL score: 99

Other

Git, Github, Microsoft Office, L^AT_EX, AFNi, FSL, Django, Docker, Qt, Qt Creator, Psychtoolbox, Psychopy

REFERENCES

Dr. Abdelraham Rayan

Donders Institute for Brain, Cognition and Behavior - Radboud University

- Email: abdelrahman.rayan@donders.ru.nl
- Relationship: Supervisor

Dr. Mostafa Shamsi

Amirkabir University of Technology

- Email: m_shamsi@aut.ac.ir
- Relationship: Mentor