Mohammadamir Khani

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Research Interests

- Systems Neuroscience
- Computational Neuroscience
- Cognitive Neuroscinece
- Artificial Intelligence
- Digital Signal Processing and Machine Learning
- Spiking Neural Networks

Education

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

- GPA: 3.95/4
- Score: 18.14 via 108 units

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

Research Experiences

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

- Analyzed neural data including EEG recordings, spike activity, and local field potentials using techniques such as Time-Frequency Analysis, coherence measures, spike sorting, population coding, information theory analysis, Granger causality, and Phase locking. 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*

- As an undergraduate research assistant in the summer of 2022, I specialized in Spiking Neural Networks.
  - I explored encodings such as rate, temporal, and floating point encoding.
  - Learned spike timing dependent plasticity (STDP) and reward-modulated STDP (R-STDP).
  - Studied models including Spiking HMAX, Temporal Error, and Hybrid Neural Network frameworks.
  - Gained proficiency in tools like spikeTorch and snnTorch.

Honors & Rewards

- Ranked in the **top 10%** 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 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 advanced 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

- Artificial Intelligence | Instructor: Prof. Mahdi Ghatei.

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

fMRI Workshop - Principles and Practices **February 2023**
Sharif Neuroscience Symposium *Tehran*

- Acquired valuable skills in fMRI data analysis using AFNI and FSL.

Selected University Courses

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

Skills

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

Python Libraries Numpy, Pandas, Matplotlib, SciPy, TensorFlow, PyTorch, SnnTorch, Scikit-learn, Keras, JsPsych

Language

- Farsi (Native)
- Kurdish (Native)
- English (Professional)

Other Git, Github, Microsoft Office, AFNi, FSL, Django, Docker, Qt, Qt Creator, Psychtoolbox, Psychopy