NIKA EMAMI

New York University, Department of Electrical & Computer Engineering

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EDUCATION

New York University   **Sep 2023 – present**
Ph.D. in Electrical Engineering   *New York City, USA*
- GPA: 4/4

University of Tehran   **Sep 2019 – Jun 2023**
B.Sc in Electrical Engineering   *Tehran, Iran*
- GPA: 18.78/20 (3.89/4)

RESEARCH INTERESTS

- Deep Learning
- Computer Vision
- Speech Decoding
- Brain-Computer Interface
- Natural Language Processing

WORK EXPERIENCE

NYU Video Lab   **Sep 2023 – present**
Graduate Research Assistant, Advisor: Prof. Yao Wang   *New York City, USA*

- Implemented a **vector quantization module** for integration into an existing speech decoder framework, which maps input spectrograms to speech parameters including Pitch Frequency, Formant Filter Center Frequencies, and Broadband Unvoiced Filter Frequency. I focused on implementing VQ-VAE models to optimize performance with our dataset.

- Developed a **phoneme classifier** using spectrograms as input data to integrate phoneme classification loss into an existing speech generator model. Evaluated several models, including MLP, vanilla RNN, GRU, and LSTM, to accurately classify phonemes from the spectrogram features.

- Developed a **brain decoding** method using visual features from deep neural networks and the Natural Scenes Dataset. Features were extracted with **ResNet-50** and **DINOv2**, and dimensionality was reduced using **PCA** and **UMAP**. Nilearn's SpaceNet Decoder with Graph-Net regularization was employed to generate classification and regression weight maps from fMRI data.

Avir Company   **Jul 2022 – Sep 2022**
Summer Intern   *Tehran, Iran*

- Generated a dataset of handwritten Persian words by applying Generative Adversarial Networks **(GANs)** to a dataset of typed Persian words, initially extracted by using a **YOLOv5** model on typed documents.

PUBLICATIONS

- Le, C., **Emami, N.**, Liu, X. C., Chen, X., & Wang, Y. *Visual Feature-Based Brain Decoding Yields Weight Maps Better Aligned with Scene Understanding than Classification*. Presented at Cognitive Computational Neuroscience (CCN) 2024.

SKILLS

Programming Languages & Frameworks: PyTorch, TensorFlow, Python, C/C++, MATLAB, Verilog

Hardware & System Design: Simulink, STM32Cube, ModelSim, Intel Quartus Prime, NI Multisim

RELEVANT COURSES

- Deep Learning
- Stochastic Processes
- Data Structures & Algorithms
- Machine Learning
- Probability & Statistics
- Linear Algebra
- Image and Video Processing
- Intelligent Systems
- Digital Signal Processing

RELATED COURSE PROJECTS

Deep Learning:
- Implemented **Transformer** models, including **BERT** for sentiment analysis of IMDB movie reviews and **Vision Transformer(ViT)** for FashionMNIST image classification.
- Created an emotion-driven **Music Generation** pipeline with **EfficientNet** for emotion classification and **MIDINet** for melody generation.
- Trained a **DCGAN** to generate images of realistic clothing items from the FashionMNIST dataset.
- Implemented **Binary Segmentation** of pedestrian images in PyTorch, using the **U-Net** architecture.
- Performed **Object Detection** and **Recognition** in a video footage using **YOLOv3**.
- Implemented the EfficientNet model using **Transfer Learning** for image classification tasks.
- Developed a classifier for the CIFAR-10 dataset using **CNN** architectures.
- Implemented **Neural Style Transfer** with the pre-trained **VGG19** model in TensorFlow.
- Modified pre-trained word embedding models like **GloVe** and **Word2Vec** to perform word analogies.

Machine Learning:
- **Speech Emotion Recognition** with supervised (SVM, KNN, MLP) and unsupervised (DBSCAN, K-Means, GMM) learning models.
- **EEG Signal Processing** with feature extraction and supervised machine learning techniques to identify neural activation time steps.
- Developed different supervised machine learning models like **SVM, KNN, Parzen Window, Decision Tree, Random Forest, MLP, Logistic Regression, Polynomial Regression, Ensemble Learning,** and **Optimal & Naive Bayes Classifiers** in Python.
- Developed different unsupervised machine learning models like **GMM, SFS, SBE, JTA**, and **PCA** models in Python.
- Investigating the impact of Metric-Based Learning methods, **LMNN** and **LFDA**, on k-Nearest Neighbors classifier performance.
- Explored the application of **Genetic Algorithms** for local minima optimization.

Image and Video Processing:
- Developed a **block-based hybrid video coder** for P-frame coding with intra- and inter-prediction using integer accuracy EBMA.
- Constructed **Gaussian and Laplacian pyramids** for image decomposition and reconstruction.
- Implemented **Harris corner detection** and **SIFT descriptors** to extract features for Harris corner points.
- Implemented **panorama stitching** with L2 norm feature matching and RANSAC for homography estimation.
- Compared **image denoising** methods by evaluating Gaussian and average filters using PSNR for different noise levels and filter sizes.
- Image Enhancement and Color Analysis: Enhanced image contrast using **histogram equalization**, analyzed color components in **RGB** and **HSV** color spaces, and applied 2D convolution with **lowpass, highpass**, and **high emphasis** filters on images.

Optimization & Reinforcement Learning:
- Implemented a model-free RL solution for a taxi game environment, applying **Q-Learning**.
- Developed a model-based RL approach using **Value Iteration** to determine the optimal strategy in a betting scenario.
- Implemented applications of **Linear** and **Non-Linear Programming** using Pyomo and IPOPT in Python.
- Developed different applications of **Dynamic Programming** in Python, including string similarity and matching.

Data Structures & Data Analysis:
- Implemented different graph theory problems like **DFS** , and **BFS.**
- Implemented different recursive algorithms with **stacks, queues, linked lists, trees**, and **heaps** in Python.
- Qualitative analysis of an automobile dataset on Kaggle, using **R** language.
- Implementation of the **SEIRS model** to study the spread of infectious diseases.
- Investigation of different probability and statistics concepts including **Monte Carlo methods** with Python.
- Investigated the **Central Limit Theorem (CLT)** through statistical analysis.

CERTIFICATIONS & ONLINE COURSES

- Neural Networks & Deep Learning - Coursera
- Deep Neural Networks with PyTorch - IBM
- Convolutional Neural Networks - Coursera
- Deep Learning Specialization - DeepLearning.AI
- Build Better GANs - Coursera
- Structuring Machine Learning Projects - Coursera

TEACHING EXPERIENCE

Teaching Assistant at the University of Tehran:

- Machine Learning (Fall 2022)
- Probability & Statistics (Spring 2021 & Spring 2022)
- Signals & Systems (Spring 2022 & Fall 2022)
- Linear Control Systems (Fall 2022)
- Electrical Circuits (Fall 2021)
- Engineering Mathematics (Spring 2021 & Fall 2021)
- Electrical Machinery (Fall 2021 & Spring 2022)
- Instrumentations (Spring 2023)

HONORS AND AWARDS

- Received the Ernst Weber **PhD Fellowship** at NYU for the 2024/2025 academic year.
- Received the School of Engineering (SoE) **PhD Fellowship** at NYU for the 2023/2024 academic year.
- Ranked **1st** in the Control Engineering specialization, Class of 2023, Department of Electrical and Computer Engineering at the University of Tehran.
- Achieved **3rd** place among 120 Electrical Engineering B.Sc. students, Class of 2023, University of Tehran.
- Represented Iran as one of five national team members at IYPT 2017 **(The Physics World Cup)**, held at the National University of Singapore.
- **Awarded first** in Iran Physics Cup tournaments, April 2017.
- **Awarded first** in Persian Young Physicists' Tournaments (PYPT), February 2017.

POSTER PRESENTATIONS

- "Visual Feature-Based Brain Decoding Yields Weight Maps Better Aligned with Scene Understanding than Classification", **Cognitive Computational Neuroscience Conference (CCN)**, Boston, August 2024.
- "Neural Speech Decoding Leveraging Deep Learning for Future Brain-Computer Interface", **Tandon Research Excellence Exhibit**, New York, April 2024.

Professional Service and Volunteering

- **Reviewer:** conference on Cognitive Computational Neuroscience (CCN) 2024
- **Vice Chair** of the IEEE student branch at the University of Tehran for the academic year 2021/2022.
- **Web designer and maintainer** of the NYU Video Lab offical webpage.

LANGUAGES

- **English:** Advanced Proficiency
- **French:** Elementary Proficiency (A2)
- **Persian:** Native