NIKA EMAMI

New York University, Department of Electrical & Computer Engineering

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EDUCATION

New York University   **Sep 2023 – May 2028**
Ph.D. in Electrical Engineering   *New York City, USA*
- GPA: 3.972/4

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

RESEARCH INTERESTS

- Deep Learning
- Computer Vision
- Speech Decoding
- Machine Learning
- Natural Language Processing
- Large Language Models

WORK EXPERIENCE

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

- Designed a **machine learning pipeline** to predict speech-critical cortical regions from ECoG recordings by integrating **neural activity**, **anatomical labels**, and **graph-based connectivity metrics**. Evaluated multiple classifiers and used a **histogram-based score aggregation** method to improve model performance across different subjects.

- 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.

- 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.

- 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.

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 the Cognitive Computational Neuroscience (CCN) 2024 conference.

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
- Intelligent Systems
- Data Structures & Algorithms
- Machine Learning
- Stochastic Processes
- Linear Algebra
- Computer Vision
- Probability & Statistics
- Game Theory
- Image and Video Processing
- Machine Listening
- Digital Signal Processing

RELATED COURSE PROJECTS

Image and Video Processing:
- Developed a **neural image colorization** model using ResNet-18 with perceptual and pixel-wise loss for grayscale-to-RGB translation.
- Implemented **adaptive image segmentation** using histogram clustering and region growing.
- Compared **Mean Shift** and **Graph Cut** segmentation methods across diverse image types.
- Applied classical CV techniques: **template matching**, **thresholding** (Otsu, Niblack), and **histogram equalization**.
- Built feature alignment pipelines with **Harris corner detection**, **SIFT descriptors**, and **panorama stitching** using RANSAC.
- Evaluated **image denoising** methods (Gaussian and average filters) using PSNR under varied noise levels.
- Constructed **Gaussian and Laplacian pyramids** for multi-scale image decomposition and reconstruction.
- Explored color and spatial processing by analyzing **RGB/HSV color channels** and applying **2D convolutions** with various filters.
- Developed a **block-based hybrid video coder** using integer-accuracy EBMA for P-frame compression with intra/inter prediction.

Audio & Speech Processing:
- Developed a **sound event classification** pipeline using log-Mel spectrograms from the ESC-50 dataset. Compared traditional models (SVM, Random Forest) and neural networks (MLP, Conv1D), and evaluated performance using temporal pooling strategies.
- Developed a **voice activity detection** system using neural networks and log-Mel spectrogram features to identify speech segments in noisy audio.
- Built a multimodal **audio captioning** pipeline by extracting mel-spectrogram and wavelet-based features, and generating descriptive captions using a pre-trained **Vicuna LLM**.
- Explored **fundamental audio features** such as envelope, energy, spectral centroid, pitch, and STFT. Built modular visualizations to demonstrate temporal and spectral characteristics of speech signals.

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.

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

- "VideoLab Research Highlights", **NYC Computer Vision Day**, New York, February 2025.
- "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.

LANGUAGES

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