Samira Malek

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Education

Pennsylvania State University	**Pennsylvania, USA**
Ph.D. in Computer Science & Engineering	*2023–present*
Pennsylvania State University	**Pennsylvania, USA**
M.S. in Computer Science & Engineering	*2023–2025*
Sharif University of Technology	**Tehran, Iran**
M.S. in Electrical Engineering	*2018–2020*
Sharif University of Technology	**Tehran, Iran**
B.S. in Electrical Engineering	*2013–2018*

Research Interests

- Natural Language Processing
- Computer Vision
- Optimization
- Computational Imaging
- Learning Theory
- Explainable Deep Learning
- Communication
- Information Theory
- Signal Processing

Honors and Awards

- Awarded the College of Engineering Dean's Office scholarship at **Pennsylvania State University**. — *2022*
- **Ranked 29th** in the Iran Nation-wide University Entrance Exam (Konkoor) for M.S degree, among **+40,000** test-takers. — *2018*
- **Ranked 40th** in the Iran Nation-wide University Entrance Exam (Konkoor) for B.S degree, among **+84,000** test-takers. — *2013*
- **Silver Medalist** of 30th Iran National Mathematical Olympiad. — *2012*
- Admission to high school in **National Organization for Development of Exceptional Talents (NODET)** (success rate $< $ **0.3%**). — *2009*

Research Experience

Pennsylvania State University — **Pennsylvania, USA**
Ph.D. Thesis — *2023–present*
- Designing generalizable and explainable deep neural networks for image restoration tasks such as denoising and deblurring.
- Establishing theoretical guarantees of convergence for both the full network and its component blocks.

Sharif University of Technology — **Tehran, Iran**
M.S. Thesis — *2018–2021*
- Designed novel neural network decoders (MVN, MatNet) inspired by belief propagation.
- Improved decoding accuracy (lower BER) on BCH, LDPC, and Polar codes.
- Reduced computational complexity by up to 98% compared to prior state-of-the-art methods.

Sharif University of Technology — **Tehran, Iran**
B.S. Thesis — *2016–2017*
- Analyzed recorded MicroElectroRetinoGram (MERG) signals from mice to study neural retina responses.
- Developed denoising and classification methods to differentiate healthy and unhealthy retinas.

Work Experience

Applied Research Laboratory, Pennsylvania State University — **Pennsylvania, USA**
Research Assistant — *2024–2025*
- Developed a methodology powered by Large Language Models (LLMs) to detect health-related misinformation (both human-created and AI-generated) on social media.
- Designed a hierarchical topic modeling framework to analyze misinformation and generate sentence-level topic descriptions.
- Built a refutation generation module to explain inaccuracies and provide corrective responses with actionable guidance.
- Applied the framework to datasets of COVID-19 and HPV vaccine misinformation, producing interpretable analyses.

SNOWA — **Tehran, Iran**
Data Scientist — *2022*

Contributed as a Data Scientist in the Customer Relationship Management (CRM) department of SNOWA, a leading home appliance manufacturer in Iran. Key projects included:
- Developed customer segmentation using unsupervised learning (e.g., K-means) to support targeted marketing.
- Applied graph-based algorithms in SQL to identify and analyze customer relationship networks.
- Designed and developed a scalable Data Warehouse to support business intelligence and analytics.

Grants & Funding
- Financial assistance award from the Economic Development Administration Build Back Better Regional Challenge, Farms Food Future (F3) Innovation.
- Partial support from NSF and AgAID Institute (Agricultural AI for Transforming Workforce and Decision Support) under the USDA-NIFA award No. 2021-67021-35344.
- Research grant from the Investigator Initiated Studies Program of Merck Sharp & Dohme Corp (MISP #102050).

Publications
- Hamed Mahdavi, Alireza Hashemi, Majid Daliri, Pegah Mohammadipour, Alireza Farhadi, **Samira Malek**, et al. **"Brains vs. bytes: Evaluating llm proficiency in Olympiad mathematics"**, Conference On Language Modeling, 2025.
- **Samira Malek**, et al. **"A Methodology Framework for Analyzing Health Misinformation to Develop Inoculation Intervention Using Large Language Models: A case study on covid-19"**, submitted to Journal of Medical Internet Research, 2025.
- **Samira Malek**, et al. **"A Large Language Model-Based Analyzing of HPV and COVID-19 Vaccines Misinformation on Social Media"**, submitted to Health Informatics Journal, 2025.
- **Samira Malek**, et al. **"Cascaded, Convergent Unrolled Deep Neural Networks for Blind Image Deconvolution"**, submitted to IEEE Transactions on Computational Imaging, 2025.
- Mohsen Farajijalal, **Samira Malek**, et al., **"Data-Driven Model to Improve Mechanical Harvesters for Nut Trees"**, ASABE Annual International Meeting, 2024.
- **Samira Malek**, et al., **"Multi Variable-layer Neural Networks for Decoding Linear Codes"**, Iran Workshop on Communication and Information Theory (IWCIT), IEEE, 2020.
- **Samira Malek**, et al., **"A Deep Neural Network Architecture for Decoding Linear Codes Based on the Parity Check Matrix"**, (it's available [here]).

Teaching Experience
- **TA for Discrete Mathematics** in Pennsylvania State University.   *Spring & Fall 2023, Spring 2024*
- **TA for Signal & System** in Sharif University of Technology.   *Fall 2019*
- **TA for Stochastic Random Process** in Sharif University of Technology.   *Spring 2019*
- **TA & MATLAB Teaching for Engineering Mathematics** in Sharif University of Technology.   *Spring 2019*
- **Design Mock Test** of the Iran Nation-wide University Entrance Exam (Konkoor) for B.S degree in [Kanoon Institution], which has the most participants in Iran (more than +20,000 students every year).   *2017–2018*
- **Teaching Mathematics** Farzanegan High school (NODET), Preparing students for Iran National Mathematical Olympiad.   *2014–2015*

Selected Courses

Deep Learning for NLP	Large Scale Machine Learning	Machine Learning Algs & Tools
Convex Optimization	Non-convex Optimization	Distributed Optimization
Pattern Recognition & ML	Secure & Robust ML	AI and Biological Computation
Probability and Statistics	Stochastic Random Process	Speech Processing
Communication Systems	Digital Signal Processing	Image Processing

Selected Academic Projects

Deep Learning

Fallacy Science Question Answering with LLMs   *Fall 2024*
- *Built dataset of fallacy-based science questions; evaluated Llama, Gemini, and ChatGPT, improving model accuracy on reasoning by 60% through optimized prompts.*

Identifying the Source Model of Generated Text   *Fall 2024*
- *Generated datasets using five large language models and trained BERT classifiers to distinguish text by source model.*

Multi-hop Question Answering with GPT   *Spring 2023*

Trained GPT models via prompting for multi-hop reasoning on the HotPotQA benchmark.

Pitch Tracking in Noisy Speech *Spring 2019*
Implemented feedforward and recurrent neural networks for pitch estimation in noisy conditions.

EEG-based Typing Classification *Spring 2016*
Designed a neural network to classify right- vs. left-handed typing using EEG signals.

Backdoor Attack and Detection on CIFAR-10 *Spring 2024*
Designed and evaluated additive backdoor attacks and implemented detection methods for image classifiers.

Optimization

MinMax Optimization Algorithms *Spring 2023*
Implemented Stochastic Gradient Descent Ascent (SGDA) and Stochastic Compositional Gradient (SCSC) for min-max optimization problems.

Classical Optimization Methods *Fall 2018*
Implemented BFGS, Steepest Descent, and Newton's method with line-search for nonlinear optimization.

Signal Processing & Communications

Viterbi Algorithm and Sequence Detection *Spring 2020*
Implemented the Viterbi algorithm and developed a reduced-complexity sequence detector for communication systems.

Pitch Contour Extraction *Spring 2019*
Extracted pitch contours from speech signals using SIFT, HPS, and AMDF algorithms.

Image Recovery via Sparse Methods *Fall 2018*
Applied IMAT and OMP algorithms for image recovery from incomplete data.

Signal Reconstruction Techniques *Fall 2018*
Reconstructed 1-D and 2-D signals using SDFT and RS methods.

Computer Skills

Programming Languages: Python, MATLAB, SQL, C/C++, LaTeX, html
Software: VScode, Anaconda, Microsoft Power BI, Microsoft SQL Server Management Studio

Languages

○ English   ○ Persian   ○ Azerbaijani