

# Elham Karimigharighi

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## Summary

Ph.D. student and research assistant bridging MRI/fMRI methodology and cerebrovascular physiology, with an emphasis on practical cerebrovascular reactivity (CVR) biomarkers, reproducible analysis pipelines, and translational reporting. Prior industry experience in embedded systems and hardware/product development (ARM/AVR/STM32), instrumentation, and measurement workflows.

## Education

<b>Ph.D., Electrical &amp; Electronics Engineering</b>	<i>Jan 2023 – May 2028 (expected)</i>
University of Maryland, Baltimore County (UMBC)	Baltimore, MD
<b>M.S. (en route), Electrical &amp; Electronics Engineering</b>	<i>May 2027 (expected)</i>
University of Maryland, Baltimore County (UMBC)	Baltimore, MD
<b>M.Sc., Electrical &amp; Electronics Engineering</b>	<i>2012 – 2014</i>
Sharif University of Technology	Tehran, Iran
<b>B.Sc., Electrical &amp; Electronics Engineering</b>	<i>2004 – 2008</i>
Shahid Rajaei Teacher Training University	Tehran, Iran

## Experience

<b>Research Assistant</b>	<i>Jan 2023 – Present</i>
University of Maryland, Baltimore (UMB) & University of Maryland, Baltimore County (UMBC) United States	
<ul style="list-style-type: none"><li>▷ Conduct research on MRI/fMRI biomarkers with emphasis on cerebrovascular reactivity (CVR), analysis workflows, and reporting.</li><li>▷ Support study execution and data processing; generate publication-quality figures and summaries for manuscripts/abstracts.</li><li>▷ Collaborate with multidisciplinary teams across engineering, radiology, and clinical research.</li></ul>	
<b>R&amp;D Engineer (Embedded Systems) &amp; Product Designer</b>	<i>Jan 2018 – Jun 2022</i>
FANPAYA Company (Knowledge-Based Enterprise)	Tehran, Iran
<ul style="list-style-type: none"><li>▷ Designed and implemented environmental measuring systems using electrochemical and NDIR gas sensors on STM32 (STM32CubeMX).</li><li>▷ Led hardware architecture, board-level design (ARM/PIC/AVR-based), and MATLAB simulations for design verification.</li><li>▷ Developed embedded firmware (C/C++) and performed bring-up, testing, and debugging using Keil/IAR; AVR development using CodeVision.</li><li>▷ Integrated peripherals and interfaces: USB, SD card, GLCD, keypad, motor drivers, relays, flash memories, and calibration/self-test routines.</li><li>▷ <i>Selected projects:</i></li></ul>	

- ARM-based exhaust emission analyzer with 5 gas sensors (electrochemical + NDIR), GLCD display, USB/SD storage, pump-cycle control, and self-cleaning process.
- ARM-based stack flow gas analyzer with 7 gas sensors (electrochemical + NDIR), GLCD display, USB/SD storage, pump-cycle control, and self-cleaning process.

**Electrical Engineer & R&D Engineer (Lighting Products)**

Jan 2015 – Jan 2018

Khazarsheed Lighting Manufacture Company

Tehran, Iran

- ▷ Characterized electrical and photometric properties of LED and fluorescent products using professional measurement systems.
- ▷ Performed goniophotometer testing (glare, light distribution, DIALux plugin outputs) and integrating sphere measurements (spectral distribution, efficiency).
- ▷ Evaluated LED drivers and electronic ballasts to diagnose production/return issues; produced technical reports for supply and quality decisions.
- ▷ Supported product compliance documentation (e.g., standards/CE) and created user manuals for process control staff.

**Graduate Research Assistant & Teaching Assistant**

Sep 2012 – Jan 2015

Sharif University of Technology

Tehran, Iran

- ▷ M.Sc. thesis: designed a 25 MHz acquisition and processing workflow to measure random pulse heights and compute 1024-bin histograms.
- ▷ Simulated the full pipeline using ADS, MATLAB, and MultiSim; implemented FPGA programming (Xilinx) for data capture and processing.

**R&D Electronics Engineer**

Oct 2009 – Sep 2013

Ariana Modern Epoch Innovators Engineering Company

Tehran, Iran

- ▷ Designed electronic/mechatronic/industrial systems: circuit design and PCB layout (Altium), AVR firmware (CodeVision), and MATLAB toolchains.
- ▷ Implemented control and signal processing workflows (Simulink, GUI development, LabVIEW-based control with hardware actuators).
- ▷ Prototyped image and speech processing solutions in MATLAB and integrated them with embedded hardware.

**PHP Web Developer**

Sep 2008 – Sep 2009

GHASEDAK SAMANEH (IT & Telecom)

Tehran, Iran

- ▷ Developed websites using PHP, MySQL, HTML/CSS/JavaScript; created graphics/assets using Adobe Photoshop.

## Publications

**Journal Articles**

- ▷ Badrzadeh, F., **Karimigharighi, E.**, Liang, H., Chan, A., Chang, L., & Liu, P. (2025). *Association between gas-free cerebrovascular reactivity (CVR) and cognitive function in older adults with a high risk for vascular dementia. Journal of Magnetic Resonance Imaging.* doi:10.1002/jmri.70212.
- ▷ Rajavand, H., Zalouli, V., Nematollahi, Z., Fathy Karkaragh, F., **Karimigharighi, E.**, Jafarizadeh, F., & Rabiei Rads, A. (2025). *The cooperation of neurogranin with calmodulin promotes the treatment of aging-related diseases via regular exercise. Molecular Neurobiology.* doi:10.1007/s12035-025-04959-6.

- ▷ Greenberg, S. M., Albert, M. S., An, H., *et al.*, & MarkVCID2 Consortium. (2025). *MarkVCID2 Consortium for Clinical Validation of Biomarkers of Cerebral Small Vessel Disease: Validation Framework and Baseline Characteristics*. *Annals of Neurology*.

### Conference Abstracts / Presentations

- ▷ **Karimigharighi, E.**, Badrzadeh, F., Lu, H., & Liu, P. (2025). *Normalized cerebrovascular reactivity mapping using hypercapnia and hyperoxia challenges*. ISMRM 2025, Abstract #5195.
- ▷ Liu, P., Badrzadeh, F., Chan, A., Liang, H., Mayeli, M., **Karimigharighi, E.**, Walter, J., Koko, C., Ernst, T., & Chang, L. (2025). *Impaired cerebrovascular reactivity in aging people living with HIV: compared with normal aging and vascular cognitive impairment*. ISMRM 2025 (accepted abstract).
- ▷ Walters, J., Liu, P., Liang, H., Badrzadeh, F., **Karimigharighi, E.**, Chan, A., Koko, C., Ernst, T., & Chang, L. (2025). *Lower cerebrovascular reactivity in older people with HIV is associated with cognitive impairment*. *Annals of Neurology* **98**(Suppl S34), S246. Conference abstract (Abstract M195).

### Conference Proceedings

- ▷ **Karimigharighi, E.**, Shojaee, F., & Shams Esfand Abadi, M. (2008). *Removal of ocular artifacts from electro-encephalogram by affine projection adaptive algorithm*. 11th Iranian Student Conference on Electrical Engineering.

## Certifications & Training

- ▷ Good Clinical Practice (GCP) – Social and Behavioral Research Best Practices for Clinical Research
- ▷ Good Clinical Practice and ICH (Biomedical Research Investigators and Key Personnel, Group 1)
- ▷ Biomedical Responsible Conduct of Research
- ▷ Circuit Design and Construction Workshop with FPGA

## Technical Skills

<b>Programming</b>	Python, MATLAB, C/C++, Embedded C
<b>Neuroimaging</b>	fMRI/BOLD analysis, CVR workflows, research reporting
<b>Embedded Systems</b>	STM32, ARM/AVR development; Keil, IAR, STM32CubeMX, CodeVision; USB/SD/GLCD interfacing
<b>Hardware/EDA</b>	Circuit/PCB design (Altium Designer); testing, debugging, instrumentation
<b>Web (earlier)</b>	PHP, MySQL, HTML/CSS/JavaScript
<b>Productivity</b>	Microsoft Office (Word/Excel), Git, L <sup>A</sup> T <sub>E</sub> X

## Projects

- ▷ **Medical Image Segmentation Pipeline (Image Processing Course)** *Fall 2025*  
UMBC — ENEE 612 Image Processing
  - Implemented and compared classical segmentation approaches including edge-based methods (e.g., Sobel) combined with watershed, and morphology-based segmentation for boundary preservation and region separation.
  - Evaluated qualitative trade-offs (boundary sharpness vs. over/under-segmentation) and se-

- lected a final method per case to balance accuracy and interpretability for reporting.
- Produced publication-quality figures and an experiment-driven report summarizing observations across cases and methods.
- ▷ **Voxel-wise Classification for Brain Imaging Data (Pattern Recognition Course)** *Fall 2025*  
UMBC — ENEE 712 Pattern Recognition
  - Built an end-to-end supervised learning pipeline to classify voxels within an SPM12-based brain mask using a fixed train/test split for fair method comparison.
  - Trained and compared models (e.g., Random Forests and neural networks) with feature standardization based on training statistics to prevent data leakage.
  - Reported performance using accuracy and class-aware metrics (precision, recall, F1-score) with confusion-matrix-based analysis to interpret error modes.
- ▷ **The Urban Air Quality Puzzle: Traffic Congestion & Air Pollution (ML Course Project)** *Spring 2025*  
UMBC — CMSC 678 Machine Learning
  - Integrated multi-source urban datasets (air pollutants, weather, and traffic flow) and performed cleaning, time synchronization, and missing-data handling.
  - Built interactive visualizations (time-series, heatmaps, and geospatial overlays) to identify peak congestion periods, pollution hotspots, and weekday/weekend patterns.
  - Developed predictive models to estimate pollutant levels (e.g., NO<sub>2</sub>, CO, O<sub>3</sub>, PM<sub>2.5</sub>) from traffic and meteorological features; evaluated model performance with appropriate regression metrics.
- ▷ **Generating Correlated Gaussian Random Variables: Direct vs. Eigenvalue Method (ENEE 620)** *Fall 2024*  
UMBC — ENEE 620 Probability and Random Processes
  - Implemented two methods to generate 2D correlated Gaussian samples for varying correlation ( $\rho$ ), and compared stability/accuracy across trials.
  - Evaluated results using scatter plots, kernel density estimation, and MSE-based error analysis; found eigenvalue-based construction more stable at high correlation.
- ▷ **Monte Carlo Validation of the Central Limit Theorem for Binary Random Variables (ENEE 620)** *Fall 2024*  
UMBC — ENEE 620 Probability and Random Processes
  - Validated CLT behavior using Monte Carlo simulations of Bernoulli variables with varying sample sizes and realizations.
  - Compared empirical distributions to the Gaussian target using histograms and variability analysis (e.g., boxplots), showing improved convergence as sample size increases.
- ▷ **Combustion Exhaust Analyzer for Automobiles (Electrochemical + NDIR Sensors)** *Jan 2018 – Sep 2019*  
FANPAYA Company (Knowledge-Based Enterprise) | University of Tehran, Dept. of Mechanical Engineering
  - Designed and built an exhaust gas analyzer using electrochemical sensors and NDIR sensing modules.
  - Developed embedded acquisition/processing and calibration workflows for field measurements.
- ▷ **Beehive Data Logger (AVR + Altium Designer)** *Jun 2017 – Dec 2017*  
Ariana Modern Epoch Innovators Engineering Company | Khuzestan Agricultural Sciences & Natural Resources University

- Designed hardware and firmware for multi-sensor logging and long-term deployment.
- Implemented PCB design in Altium and AVR-based embedded data capture.
- ▷ **Cupcake Baker System using Image Processing (AVR + Altium + MATLAB)** *Jan 2017 – Jun 2017*  
Ariana Modern Epoch Innovators Engineering Company | Khuzestan Agricultural Sciences & Natural Resources University
  - Built an automated system with MATLAB image processing for inspection/decision logic.
  - Implemented embedded control and I/O integration on AVR; designed supporting electronics in Altium.
- ▷ **Fruit Sorting System for Manufacturing (MATLAB + AVR + Altium)** *Jan 2017 – Jun 2017*  
Ariana Modern Epoch Innovators Engineering Company | Khuzestan Agricultural Sciences & Natural Resources University
  - Developed MATLAB-based sorting criteria and embedded control for actuation and timing.
  - Produced a PCB + firmware stack suitable for prototype-to-deployment iteration.
- ▷ **Pulse Height Analyzer (FPGA, 25 MHz)** *Sep 2013 – Dec 2014*  
Sharif University of Technology
  - Designed a high-rate data acquisition pipeline for pulse-height detection and histogram analysis.
  - Implemented FPGA-based capture/processing and validated with simulation and bench testing.
- ▷ **Particle Energy Deposition Computation (Modeling & Optimization)** *Feb 2013 – May 2013*  
Sharif University of Technology
  - Implemented and optimized computational workflows for energy deposition estimation in matter.
- ▷ **Automated Cow Feeding System (AVR + RF/IR + UI Electronics)** *Jan 2010 – Dec 2011*  
Ariana Modern Epoch Innovators Engineering Company | Private Engineering Company
  - Built embedded control and communication using AVR with RF/IR modules.
  - Designed detailed user-interface hardware and system electronics for operational reliability.
- ▷ **Truck Terminal Weighing Data Logger (AVR + Altium)** *Jan 2009 – Dec 2009*  
Ariana Modern Epoch Innovators Engineering Company
  - Developed an AVR-based logging system and PCB design for industrial weighing terminals.
- ▷ **Speech Recognition Door Authorization (MATLAB + AVR + Altium)** *Mar 2009 – May 2009*  
Ariana Modern Epoch Innovators Engineering Company
  - Prototyped a MATLAB-based recognition workflow integrated with AVR embedded control for access authorization.
- ▷ **ECG Noise Cancellation via Adaptive Filters** *Dec 2007 – Sep 2008*  
Shahid Rajaei Teacher Training University, Dept. of Electrical Engineering
  - Applied adaptive filtering techniques to reduce noise artifacts in ECG signals.

## Service & Leadership

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- ▷ Abstract Reviewer, ISMRM & ISMRT Annual Meeting (Cape Town 2026): 20 abstracts assigned (Review period: Nov 9–Dec 3, 2025).
  - ▷ Lab support: coordinated study logistics (participant scheduling support, data organization, documentation) and maintained reproducible analysis notes.
  - ▷ Research communication: prepared figures, posters/abstract materials, and internal technical summaries for team review.
  - ▷ Collaboration: contributed to cross-institution teamwork between UMB and UMBC and supported onboarding of new lab members when needed.