MASOUD NATEGHI

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EDUCATION

- **B.Sc. in Electrical Engineering** *Sep 2017 - Sep 2022*
  Sharif University of Technology, Tehran
  GPA: 17.18/20.00
- **M.Sc. in Computer Science and Informatics** *Aug 2023 - Nov 2025*
  Emory University, Atlanta, GA
  GPA: 4.00/4.00
- **Ph.D. in Computer Science and Informatics** *Aug 2023 - May 2028*
  Supervisor: Dr. Reza Sameni
  Emory University, Atlanta, GA
  GPA: 4.00/4.00

RESEARCH INTERESTS

- Biomedical Signal/Image Processing
- Statistical Signal Processing
- AI for Healthcare

RESEARCH EXPERIENCE

The Alphanumerics Lab, Emory University *Aug 2023 – Present*
Research Assistant *Advisor: Dr. Reza Sameni*

- **Physiological Biomarker Discovery for Major Depressive Disorder (MDD)**
  — Head of Biomedical Data Collection Team, Emory University
  - Led multimodal biomedical data collection team at the Emory site, ensuring high-quality EEG, ECG, PPG, eye-tracking, electrodermal activity, respiration, and continuous BP recordings from over 30 participants in a psycholinguistic DARPA-funded project called *Preconscious Signal Compilation for Robust and Individualized Belief Evaluation (PRESCRIBE)*.
  - Ensured precise synchronization between PsychoPy stimulus presentation and physiological recording systems across all modalities.
  - Processed wearable ECG/PPG signals, extracted cardiovascular biomarkers, and developed machine learning pipelines (SVM, XGBoost, RF, LR) for depression risk prediction, achieving AUROC up to 0.83 for BDI-II classification.
  - Extracted ERP-derived neural features (LFP, N400, LPP) to classify MDD vs. healthy controls (∼80% accuracy) and predict depression severity from EEG responses.
- **EEG-based Sleep Staging**
  - Developed a feature extraction pipeline based on time varying auto regressive (TVAR) models, using Kalman filtering to track model coefficients for instantaneous frequency estimation and Hilbert transform to compute instantaneous envelope features using two EEG and one EMG channels.
  - Built supervised machine learning models for automated sleep stage classification and achieved 77% accuracy using a LightGBM classifier.
  - Performed post-hoc model explainability using SHAP to identify physiologically meaningful frequency-domain biomarkers driving sleep stages discrimination.
- **Oscillometric Blood Pressure (BP) Bias Correction**
  - Simulated oscillometric BP measurement using intra-arterial waveforms from the MIMIC database to model the interaction between linearly deflating cuff pressure and arterial pulse dynamics, revealing systematic underestimation of systolic BP ($\sim$ 9 mmHg) and overestimation of diastolic BP ($\sim$ 6 mmHg) inherent to cuff-based devices.

- Developed an estimation-theoretic framework employing least squares, maximum likelihood, and Bayesian estimators to correct oscillometric biases.
- Demonstrated that using statistical priors and averaging across measurements substantially reduced mean absolute error and variance of both SBP and DBP estimates.

- **Fetal ECG Representation Learning** — *Ongoing Research Direction*
  - Curated the first and largest noninvasive fetal ECG dataset with clinically annotated pregnancy outcomes using the FDA-approved MERIDIAN fetal monitor from multiple international sites.
  - Implementing a Kalman filter–based pipeline to characterize instantaneous maternal–fetal heart rate coupling dynamics; preliminary results indicate that these coupling biomarkers can predict C-section versus vaginal delivery up to 1 hour before birth with ∼74% accuracy.
  - Developing a foundation model tailored to fetal ECG capable of downstream tasks including fetal ECG extraction, fetal R-peak detection, and latent representation–based phenotyping of adverse pregnancy outcomes using WaveNet, U-Net, and transformer-based architectures.
  - Awarded the CAIRE Fellowship at Emory University to support the development of fetal ECG foundation models; also applied for the American Heart Association (AHA) Predoctoral Fellowship (decision pending).

Human Machine Interfaces Lab (HMIL), Sharif University of Technology *Sep 2021 – Jul 2022*
Research Assistant *Advisor: Dr. Sepideh Hajipour Sardouie*

- **Seizure Prediction Using Functional and Causal Connectivity**
  - Modeled EEG functional networks using directed (Granger causality) and undirected (correlation, PLV) connectivity measures.
  - Extracted graph biomarkers, including functional integration/segregation metrics and centrality measures.
  - Classified EEG segments into pre-ictal vs. inter-ictal intervals using LASSO regression.
  - Compared performance across weighted vs. unweighted and directed vs. undirected graph representations.

PUBLICATIONS

Journal Papers

1. **Masoud Nateghi**, Reza Sameni. *A Kalman Filter–Based Framework for Granger Causality Assessment: Application in Tracking Maternal–Fetal Heart Rate Coupling.* IEEE Transactions on Biomedical Engineering (2026). DOI: 10.1109/TBME.2026.3710372
2. Sajjad Karimi, **Masoud Nateghi**, et al. *Prescreening Depression Using Wearable Electrocardiogram and Photoplethysmogram Data from a Psycholinguistic Experiment.* Physiological Measurement (2025). DOI: 10.1088/1361-6579/adf6fe
3. Bradly T. Stone, Phillip C. Desrochers, **Masoud Nateghi**, et al. *Decoding Depression: Event-Related Potential Dynamics and Predictive Neural Signatures of Depression Severity.* Journal of Affective Disorders (2025). DOI: 10.1016/j.jad.2025.119893
4. **Masoud Nateghi**, Mahdi Rahbar Alam, Hossein Amiri, Samaneh Nasiri, Reza Sameni. *Model-Based Electroencephalogram Instantaneous Frequency Tracking: Application in Automated Sleep–Wake Stage Classification.* Sensors (2024). DOI: 10.3390/s24247881

Conference Papers

1. Johann Vargas-Calixto, **Masoud Nateghi**, et al. *Self-Supervised Representation Learning of Fetal Heart Rate Outperforms a Foundation Model in Identifying Fetal Acidosis.* Computing in Cardiology (2026).
2. **Masoud Nateghi**, Reza Sameni. *Estimation-Theoretic Bias Reduction for Oscillometric Blood Pressure Readings.* Proceedings of the AMIA Annual Symposium (Accepted, 2026). Preprint DOI: 10.48550/arXiv.2508.15687
3. Seibi Kobara, Alireza Rafiei, **Masoud Nateghi**, et al. *Social Media as a Sensor: Analyzing Twitter Data for Breast Cancer Medication Effects Using Natural Language Processing.* Artificial Intelligence in Medicine (AIME) (2024). DOI: 10.1007/978-3-031-66538-7_34

Preprints

1. Reza Sameni, Gabriela I. Cestero, **Masoud Nateghi**, et al. *A Psycholinguistics Protocol with Simultaneous Multimodal Physiological Data Collection for Individualized Pre-Screening Depressive Disorders.* protocols.io. DOI: 10.17504/protocols.io.dm6gpme3dgzp/v1

RELEVANT COURSES

- **Introduction to Ethical Data Science and Informatics** *A*
- **Machine Learning** *A*
- **Natural Language Processing** *A*
- **Biostatistics for ML** *A*
- **EEG Signal Processing** *18.5/20.0*
- **Deep Learning** *18.5/20.0*
- **Medical Images Processing** *17.5/20.0*
- **Tensor Decompositions** *17.0/20.0*
- **Computational Intelligence** *19.0/20.0*
- **Engineering Probability & Statistics** *19.0/20.0*
- **Signals & Systems** *19.9/20.0*
- **Digital Signal Processing** *Audited*
- **Linear Algebra** *Audited*

TECHNICAL MANUSCRIPT REVIEWER

- Physiological Measurement
- Discover Medicine
- BMC Psychiatry
- Biomedical Signal Processing and Control
- PLOS One
- Discover Mental Health

TEACHING EXPERIENCE

- **Teaching Assistant, Biostatistics** (BMI 510, Emory University)
- **Teaching Assistant, Introduction to Ethical Data Science** (BMI 500, Emory University)
- **Teaching Assistant, Applications of ML** (CS 323, Emory University)

TECHNICAL SKILLS

Programming:	Python, C/C++, Java, Verilog, Assembly, Arduino
Computing:	HPC Clusters, Linux, SLURM, Bash, SSH
Software & Tools:	MATLAB & Simulink, PyCharm, Proteus, Pspice, ISE Design Suite
Libraries & Toolboxes:	MNE, EEGLAB, TensorFlow, PyTorch, NeuroKit, OSET

HONORS AND AWARDS

- Recipient, CAIRE Fellowship, Emory University, 2025
- Awarded full financial support package for Ph.D. studies at Emory University.
- Received full scholarship from Sharif University of Technology for B.Sc. degree.
- Ranked 167th among 150,000 participants in Iran National University Entrance Exam, 2017.