Seyedeh Somayyeh Mousavi

Extended Curriculum Vitae

Ph.D. Candidate in Computer Science and Informatics
Department of Biomedical Informatics
School of Medicine, Emory University
Atlanta, GA, United States

Email: seyedeh.somayyeh.mousavi@emory.edu
Cell: +1-404-360-0543
Linkedin
Google Scholar, ResearchGate, GitHub

Education

- **Department of Biomedical Informatics, School of Medicine, Emory University** *Atlanta, Georgia, USA*
  Ph.D. in Computer Science and Bioinformatics *Aug 2022 – Present*
  Supervisor: Dr. Reza Sameni
  Thesis Title: Demographic-Aware Artificial Intelligence Models for Cardiovascular Risk Prediction: Longitudinal and Cross-Sectional Analysis
- **Department of Biomedical Informatics, School of Medicine, Emory University** *Atlanta, Georgia, USA*
  M.Sc. in Computer Science and Informatics *Aug 2022 – May 2025*
- **Department of Electrical Engineering, University of Zanjan** *Zanjan, Iran*
  M.Sc. in Biomedical Engineering (Bioelectric) *Aug 2015 – Aug 2018*
  Supervisors: Dr. Mostafa Charmi and Dr. Mohammad Firouzmand
  Thesis Title: Developing a Mobile-based Ambulatory Monitoring of Blood Pressure Using Electrocardiogram and Photoplethysmography Signals
- **Department of Electrical Engineering, University of Zanjan** *Zanjan, Iran*
  B.Sc. in Electrical Engineering (Electronics) *Aug 2010 – Aug 2014*
  Supervisor: Dr. Mostafa Taheri
  Thesis Title: Designing, Simulating, and Developing a Mobile-Based Incubation System with Control Capabilities

Research Experience

- **The Alphanumerics Lab, Emory University** *Atlanta, Georgia, USA*
  Research Assistant *Aug 2022 – Present*
  - **Machine/Deep Learning-Based Analysis of Longitudinal Changes in Electrocardiograms of Congenital Heart Disease (CHD) Patients**
    1. Developing an open-source ECG feature extraction toolset that incorporates an extensive list of clinically relevant characteristics from the literature and is applicable to signals of different lengths, arbitrary leads, and various sampling frequencies.
    2. Identifying ECG features in a CHD population that change over time and can serve as biomarkers for studying the progression of CHD-related complications.
    3. Developing machine learning models for age and age-gap estimation.
    4. Developing machine learning and deep learning models to classify the anatomic side of CHD in patients and predict early outcomes in the CHD population, including cardiac hospitalization or cardiac interventions.
    5. Developing deep learning models that use ECG variations to predict the need for cardiac intervention, unplanned cardiac hospitalization, or death within 1 and 2 years after the ECG.
    6. Zero-Shot implementation of pre-trained Large Language Model (LLM) for predicting ECG phenotypes from ECG statement codes.
    7. Evaluating CHD models using a reduced number of ECG leads for ambulatory applications.
  - **Revolutionizing Blood Pressure Monitoring Devices: Developing a New Generation of Cuff-Based Blood Pressure (BP) Measurement Devices to Remove Biases and Provide Cardiovascular Risk Factors**
    1. Identification of considerable potential sources of biases in cuff-based BP measurements arising from factors like measurement and device errors, demographics, and body habitus.
    2. Investigation of demography-specific patterns across 75 million patient encounters using two decades of blood pressure data from Emory Healthcare, GA, USA.
    3. Utilization of artificial intelligence to develop an advanced generation of cuff-based BP devices, drawing from clinical literature and electronic health records enriched with NLP tools.
    4. Deployment of machine learning techniques, including deep learning and Bayesian inference, to mitigate BP measurement biases and offer individualized cardiovascular risk assessments.

- **Investigating the Relationship Between Electrocardiograms and Blood Pressure Using Multimodal Data**
  1. Developing regression and classification machine-learning (ML) models to explore the feasibility of estimating BP and predicting BP categories (normal vs. hypertensive) using only ECG records
  2. Rejecting the hypothesis of estimating blood pressure and classifying blood pressure categories using ECG records.
- **Developing Generic Data Structure for AI-ML-Ready Feature Tables**
  1. Creation of a lightweight and generic data structure known for ensuring reproducibility in AI and ML applications by linking code, data, and exact parameters used for feature extraction and model training.
  2. Implementation of a structure known for tracking codebase hashes data record hashes, and parameter settings, ensuring reliable and reproducible outcomes in model evaluation.
  3. Application of a structure known for its versatility across various AI-ML use cases, including the extraction of features from physiological time-series data.
- **Developing a Zero-Shot Model Based On Voting Algorithms to Classify ECG Signals**
  1. This project is dedicated to creating a robust zero-shot learning AI tool for ECG signal classification.
  2. The project incorporates a novel fusion technique called the voting algorithm, which combines the outputs of well-established ECG classifiers.
  3. The development is based on the PhysioNet Challenge 2021 team codes and a synthetic dataset.
  4. Case study: Classification of atrial fibrillation versus normal using synthetic data generated to train the model with algorithms developed by Dr. Sornmons and his colleagues.
- **Presenting a Dynamic Model for the Synthetic Generation of Abnormal ECG Signals**
  1. Introduction of an innovative algorithm for stochastically generating abnormal ECG signals based on the McSharry-Clifford model.
  2. Focus on the investigation of Atrial Fibrillation (AF) ECG signals, emphasizing key features such as the absence of P waves, the presence of fluctuating waveforms (f-waves), and irregularities in heart rate (HR).
  3. Evaluation of the proposed synthetic AF ECG generation algorithm's effectiveness using a machine learning (ML) approach, comparing it to a real dataset that includes both AF and Normal ECG records.

- **Katebi's Lab, Emory University** *Atlanta, Georgia, USA*

  Research Assistant *Jan 2024 – Nov 2024*
  - **Prediction of Preeclampsia and Gestational Hypertension Using Medical Health Records and Early Pregnancy Blood Pressure Patterns**
    1. Identification of the blood pressure trajectory during the pregnancy
    2. Deployment of an ML model to predict hypertensive disorders of pregnancy just based on blood pressure trajectory and body mass index and focus on longitudinal concepts
    3. Investigation demographic feature including age, race and ethnicity on developing hypertensive disorders of pregnancy

- **Biomedical Signal and Image Processing Laboratory (BiSIPL), University of Zanjan** *Zanjan, Iran*

  Research Assistant *Aug 2015 – Dec 2020*
  - **Introducing a New Method for Extracting iPPG Signals from Video Images of the Facial Region**
  - **Non-Contact Blood Pressure Estimation Algorithm Using Only iPPG Signals**
  - **Cuff-less Blood Pressure Estimation Algorithm Using Bio Signals**
    1. Deployment of a cuff-less blood pressure estimation algorithm using ECG and PPG signals to address the limitations of traditional methods, with a focus on non-invasive, continuous monitoring and without calibration.
    2. Introducing a new algorithm for extracting feature vectors called "Whole-based" from only ECG signals, only PPG signals, and both of them.

- **Biomedical Instrumentation Research Lab**, *Tehran, Iran*

  Iranian Research Organization for Science and Technology

  Visiting Researcher *Feb 2016 – Dec 2018*
  - **Designing and Developing an Innovative Cuff-less Ambulatory Monitoring of Blood Pressure Using bio Signals**

Publications

- **Journal Papers**

1. **Seyedeh Somayyeh Mousavi**, Sajjad Karimi, Mohammad Sina Hassannia, Zuzana Koscova, Ali Bahrami Rad, David Albert, Gari D. Clifford, Reza Sameni, "Estimating Blood Pressure from the Electrocardiogram: Findings of a Large-Scale Negative Results Study", Physiological Measurement, Vol 46(11), PP. 115005, Nov 2025.
2. Yuting Guo, **Seyedeh Somayyeh Mousavi**, Yao Ge, Madhumita Baskaran, Reza Sameni, Abeed Sarker, "Leveraging Few-Shot Learning and Large Language Models for Analyzing Blood Pressure Variations Across Biological Sex from Scientific Literature", Elsevier Computers in Biology and Medicine Journal, Vol 198, PP.111128, Nov 2025.
3. **Seyedeh Somayyeh Mousavi**, Matthew A. Reyna, Gari D. Clifford, and Reza Sameni, "A Survey on Blood Pressure Measurement Technologies: Addressing Potential Sources of Bias", MDPI Sensor journal, Vol 24(6), PP.1730, March 2024.
4. **Seyedeh Somayyeh Mousavi**, Mohammad Firouzmand, Mostafa Charmi, Mohammad Hemmati, Maryam Moghadam, and Yadollah Ghorbani,"Blood Pressure Estimation from Appropriate and Inappropriate PPG Signals Using the Whole-Based Method", Elsevier Biomedical Signal Processing and Control (BSPC), Vol 47, PP.196-206, Jan 2019.

- **Preprint**

1. **Seyedeh Somayyeh Mousavi**, Cheryl L. Raskind-Hood, Alexandra Haffner, Chad Robichaux, Lindsey C. Ivey, Wendy M Book, Reza Sameni, "Electrocardiogram-Based Machine Learning Models for Predicting Adverse Cardiac Outcomes in Adults Congenital Heart Disease", Feb 2026 (Under review: Computers in Biology and Medicine).
2. **Seyedeh Somayyeh Mousavi**, Cheryl L. Raskind-Hood, Alexandra Haffner, Chad Robichaux, Lindsey C. Ivey, Reza Sameni, Wendy M Book, "Electrocardiogram Characteristics and Outcomes in an Adult Congenital Heart Disease Population", Jan 2025 (Under review: Journal of Electrocardiology).
3. **Seyedeh Somayyeh Mousavi**, Kim Tierney, Chad Robichaux, Sheree Boulet, Cheryl Franklin, Suchitra Chandrasekaran, Reza Sameni, Gari D. Clifford, and Nasim Katebi, "Early Prediction of Hypertensive Disorders of Pregnancy Using Machine Learning and Medical Health Records from the First and Second Trimesters", MEDrXiv:10.1101/2024.11.21.24317720, Nov 2024 (Under review: IOP machine learning).
4. Yuting Guo, **Seyedeh Somayyeh Mousavi**, Abeed Sarker, Reza Sameni, "Leveraging Large Language Models for Analyzing Blood Pressure Variations Across Biological Sex from Scientific Literature", arXiv:2402.01826, Feb 2024.
5. **Seyedeh Somayyeh Mousavi**, Mostafa Charmi, Mohammad Firouzmand, Mohammad Hemmati, Maryam Moghadam, and Yadollah Ghorbani, "ECG-Based Blood Pressure Estimation Using Mechano-Electric Coupling Concept", arXiv:2008.10099v1, August 2020.

- **Conference Papers**

1. Yash Vijay, Dennis Bergau, **Seyedeh Somayyeh Mousavi**, C. Richard Chen, Ishita Chen, Ajay Singh Bhawariya, Avinash Sharma, Thanujaa Subramaniam, "Inpatient Mortality Prediction Model in Critically Ill Intracerebral Hemorrhage Patients", Critical Care Congress, Orlando, Florida, USA, Feb 2025.
2. **Seyedeh Somayyeh Mousavi**, Yuting Guo, Abeed Sarker, Reza Sameni, "Learning from Two Decades of Blood Pressure Data: Demography-Specific Patterns Across 75 Million Patient Encounters" (Indexed in IEEE-Xplore), The 46th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2024), Orlando, Florida, USA, July 2024. [Presentation Slide] and [Poster]
3. Reza Heydari Goudarzi, **Seyedeh Somayyeh Mousavi**, and Mostafa Charmi, "Introducing a New Feature Extraction Method for Non-Contact Blood Pressure Estimating Through iPPG Signals Extracted Using the G-R Method from Video Images of Different Facial Regions" (Indexed in IEEE-Xplore), The 5th International Conference on Pattern Recognition and Image Analysis (IPRIA 2021), Iranian Society of Machine Vision and Image Processing, University of Kashan, Kashan-Iran, April 2021.
4. Reza Heydari Goudarzi, **Seyedeh Somayyeh Mousavi**, and Mostafa Charmi,Using imaging Photoplethysmography (iPPG) Signal for Blood Pressure Estimation (Indexed in IEEE-Xplore), The 11th Iranian and the 1st International Conference on Machine Vision and Image Processing (MVIP 2020), Iranian Society of Machine Vision and Image Processing, University of Tehran, Qom-Iran, Feb 2020.
5. **Seyedeh Somayyeh Mousavi**, Mostafa Charmi, Mohammad Firouzmand, Mohammad Hemmati, and Maryam Moghadam, "A New Approach Based on the Dynamical Model of The ECG Signal to Blood Pressure Estimation"(Indexed in IEEE-Xplore), The 4th International Conference on Pattern Recognition and Image Processing (IPRIA 2019), Iranian Society of Machine Vision and Image Processing, Sharif University of Technology, Tehran-Iran, March 2019.

6. **Seyedeh Somayyeh Mousavi**, Mostafa Charmi, Mohammad Firouzmand, Mohammad Hemmati, Maryam Moghadam, and Yadollah Ghorbani, Cuff-Less Blood Pressure Estimation Using Only the Photoplethysmography Signal by A Frequency Whole-based Method, The 4th Iranian Conference on Signal Processing and Intelligent Systems (ICSPIS 2018), Amirkabir University of Technology, Tehran-Iran, Dec 2018.
7. **Seyedeh Somayyeh Mousavi**, Mohammad Hemmati, Mostafa Charmi, Maryam Moghadam, Mohammad Firouzmand, and Yadollah Ghorbani, Cuff-Less Blood Pressure Estimation Using Only the ECG Signal in Frequency Domain(Indexed in IEEE-Xplore), The 8th International Conference on Computer and Knowledge Engineering (ICCKE 2018), Ferdowsi University of Mashhad, Mashhad-Iran, Oct 2018.

Honors and Awards

- **Society of Critical Care Medicine's (SCCM) Travel Award** *June 2025*

  for participating in the Datathon 2025 as a data scientist, due to my experience in Bioinformatics, Chicago, Illinois, USA, July 2025
- **Iranian American Academics and Professionals (IAAP) Organization Scholarship** *June 2025*

  Based on academic achievements and services to Iranian American communities, Vienna, VA, USA
- **Society of Critical Care Medicine's (SCCM) Travel Award** *May 2024*

  for participating in the Datathon 2024 as a data scientist, due to my experience in Bioinformatics, Chicago, Illinois, USA, July 2024
- **IEEE EMBC NextGen Scholar Award** *April 2024*

  for participating in the EMBC 2024 conference and presenting my research paper, Orlando, Florida, USA, July 2024
- **Emory University PhD Scholarship** *April 2021*
- **Best Thesis Award** *Nov 2020*

  for my master's thesis, the 18th Thesis of the Year National Festival, Iranian Student Book Agency, Tehran, Iran
- **Best Young Award** *June 2019*

  for my research contributions in the field of science and technology, Zanjan, Iran
- **Ranked First in the 3 Minute Thesis Competition** *Feb 2019*

  for presenting my M.Sc. thesis, Zanjan, Iran
- **Best Paper Award** *Dec 2018*

  for the paper "Cuff-Less Blood Pressure Estimation Using Only the Photoplethysmography Signal by A Frequency Whole-Based Method", the 4th Iranian Conference on Signal Processing and Intelligent Systems (ICSPIS2018), Amirkabir University of Technology, Tehran, Iran
- **Best Thesis Award** *Nov 2018*

  for my M.Sc. thesis, the 25th National and 3rd International Iranian Conference on Biomedical Engineering (ICBME2018), Iranian Society of Biomedical Engineering, Amirkabir University of Technology, Shahabdanesh University, Qom, Iran
- **Ranked First in M.Sc** *Sep 2018*

  University of Zanjan, Zanjan, Iran
- **Ranked Third in the Idea Competition** *Apr 2017*

  for presenting my M.Sc. thesis, at the Third Biomedical Engineering Idea Competition, Amirkabir University of Technology (Tehran-Polytechnic), Tehran, Iran
- **Ranked First in the Mechatronics and Robotics Symposium** *Nov 2016*

  for my B.Sc. thesis, University of Zanjan, Zanjan, Iran

Teaching Experiences

- **Workshop Instructor**

1. **Digital Image Processing (MATLAB)**, Held by Scientific Association of Robotic, University of Zanjan, Fall 2017

- **Teaching Assistants**

  My roles included attending main classes with professors to assist students with coding and problem-solving. I also collaborated with professors on diverse tasks like assignment design, correction, and grading. Furthermore, I conducted separate classes to teach specific parts of the courses, provide comprehensive instruction, and support the students.

  1. **Artificial Intelligence**
     B.Sc. and M.Sc. course, Emory University, Supervisor: Dr. Amin Pouriyeh, Fall 2024
  2. **Machine Learning**
     M.Sc. and Ph.D. course, Emory University, Supervisor: Dr. Hyeok Kwon, Spr 2024
  3. **High Performance Computing**
     M.Sc. and Ph.D. course, Emory University, Supervisor: Dr. Tony Pan, Fall 2023
  4. **Digital Image Processing** (Head TA)
     M.Sc. and Ph.D. course, University of Zanjan, Supervisor: Dr. Mostafa Charmi, (Fall 2019, Fall 2018, Fall 2017, and Fall 2016)
  5. **Medical Imaging Systems**
     M.Sc. and Ph.D. course, University of Zanjan, Supervisor: Dr. Mostafa Charmi, Spr 2018
  6. **Signals and Systems**
     B.Sc. Course, University of Zanjan, Supervisor: Dr. Mostafa Charmi, (Spr 2019, Spr and Fall 2018, Fall 2017, Spr 2016)
  7. **Introduction to Biomedical Engineering**
     B.Sc. Course, University of Zanjan, Supervisor: Dr. Mostafa Charmi, Spr 2018
  8. **Electrical Circuits**
     B.Sc. Course, University of Zanjan, Supervisor: Dr. Abolfazl Jalilvand, Spr 2016
  9. **Statistics and Probability**
     B.Sc. Course, University of Zanjan, Supervisor: Dr. Mehdi Ghamari Adian, Fall 2016

Professional Experience

Biomedical Engineer *Sep 2019 – May 2022*
Zanjan University of Medical Sciences, Ayatollah Mousavi Educational and Treatment Center, Zanjan, Iran

I was responsible for a wide range of critical tasks and played a pivotal role in ensuring the smooth operation of medical equipment within the healthcare facility. My key responsibilities included:

1. Providing Expert Consultation
2. Performance Testing and Maintenance
3. Preventative Maintenance
4. Equipment Repair and Documentation
5. Calibration Expertise
6. Troubleshooting Mastery
7. Quality Assurance
8. Training and Education
9. Vendor Relations

Professional Skills

- **Programming Languages:** Python, MATLAB, C++ —— **Libraries:** PyTorch, TensorFlow, Numpy
- **Technologies:** Pycharm, Anaconda, Jupyter Notebook, Spyder, MATLAB, Simulink, Microsoft Visual Studio
- **Circuit Design and Simulation:** Proteus, Pspice, Altium Designer
- **Microcontroller Tools:** AVR
- **Typesetting:** Microsoft Office, LaTeX

Technical Manuscript Reviewer

- Journal of Physical and Engineering Sciences in Medicine
- Journal of Medical Internet Research
- Journal of Healthcare Engineering, Hindawi
- The Third International Conference on Biological Information and Biomedical Engineering (BIBE 2019), China

Gratudate Course

- Ph.D.
  1. Natural Language Processing (NLP)
  2. Model-based Machine Learning
  3. Biostatistics for Machine Learning
  4. Machine Learning
  5. Introduction to Biomedical Informatics
- M.Sc.
  1. Digital Image Processing (DIP)
  2. Digital Signal Processing (DSP)
  3. Biomedical Signal Processing (BSP)
  4. Biological Systems Modeling
  5. Stochastic Processes
  6. Bio Instrumentation

Research Interests

- Utilizing AI in the healthcare field
- Applied Biomedical Natural Language Processing
- Biomedical Signal and Image Processing (BSP and DIP)
- Modeling biosignals
- Biomedical Instrumentation