Soha Rostaminia

Applied Machine Learning · Physiological Signal Processing · Mobile Health Systems · Wearable and Sensor Computing

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Education

University of Massachusetts Amherst — *MA, USA*

M.S./Ph.D. in Computer Science — *Sep. 2015 - PRESENT*

Received M.S. degree in Feb. 2018 with GPA of 3.85/4

Ph.D. thesis: Enabling Daily Tracking of Individual's Cognitive State with Eyewear — Advisor: Prof. Deepak Ganesan

University of Tehran — *Tehran, Iran*

B.Sc. in Electrical Engineering with Bioelectrical Engineering Concentration — *Sep. 2011 - May 2015*

GPA: 18.47/20 **(Ranked 1st)** — Advisor: Prof. S. K. Setarehdan

Computer and Technical Skills

Programming Skills: Python (TensorFlow, Keras, scikit-learn, NumPy, SciPy, Pandas, Matplotlib), MATLAB, C/C++

Signal processing, Deep Learning, Human physiological and activity data measurement, Experiment design, User studies

Research Experience

Apple Inc. — *CA, USA*

Health Sensing Machine Learning Intern — *Jan. 2022 - Apr. 2022*

- I am working on developing algorithms for extracting insight from sensor and health data and optimizing performance. Supervisor: Dr. Mohsen Mollazadeh

DawnLight Technologies Inc. — *CA, USA*

Machine Learning Research Intern — *Mar. 2021 - Jun. 2021*

- Developed robust and low-power algorithms for extracting physiological features from radar signal. Supervisor: Dr. Nathan Liu.

Bose Corporation, AI and Data Group Serving Consumer Electronics — *MA, USA*

Machine Learning Intern — *Jun. 2019 - Aug. 2019*

- Developed gesture and activity recognition technology for wearable consumer electronic products. Supervisor: Dr. Marko Orescanin.

University of Massachusetts Amherst, MOSAIC Lab. — *MA, USA*

Graduate Research Assistant — *Sep. 2015 - PRESENT*

- My research focuses on developing light and robust algorithms for computational eyewears, in order to track the user's cognitive state of the mind, e.g. fatigue and drowsiness, emotion, pain, and sleep markers. Supervisor: Prof. Deepak Ganesan.

Selected Projects

Unobtrusive Sensing of Brain Activity and Physiological Signals During Sleep

Problem: current solutions cannot measure the whole range of sleep markers and they impact the sleep pattern due to their use of rigid sensing elements.

- Designed a sleep mask prototype with all-fabric sensing elements (three biopotential electrodes and three pressure sensors).
- The sensors placement is carefully calculated based on the head physiology, enabling robust performance in different sleep postures.
- Researched and developed signal processing (i.e. PCA, EMD, DWT, and STFT) and machine learning (i.e. random forest classifier, HMM, CRF, and etc.) approaches to extract EEG micro-events, EOG, respiration and heart rate, gross body movement, and sleep posture.
- Designed and performed data collection studies to validate our system against clinical polysomnography and compared it with two other commercially-available wearable sleep trackers, i.e., the Fitbit wristband and the Oura Ring. (Python, TensorFlow, scikit-learn)

Unobtrusive Tracking of Facial Pain Gestures

Problem: current state-of-the-art solutions employ cameras to study the facial gestures, which inevitably raises privacy concerns.

- Designed a system to extract the facial muscle activation information (EMG), by leveraging only three dry electrodes embedded in the nose-bridge of a commercially-available computational eyeglass (J!NS MEME).
- Dry electrodes are prone to noise. A neural network regression model is developed to predict and remove the motion artifact based on the extracted information from the embedded accelerometer and gyroscope sensors.
- Deep learning architectures (i.e CNN, RNN, and LSTM) along with transfer learning and personalization techniques are employed to detect 5 different facial action units and pain grimacing gesture from 17 participants. (Python, TensorFlow, Keras, OpenFace)

Low-power Fatigue and Drowsiness Measurement

Problem: processing vision data demands high computational resources, which limits the ability of continuous and long-term use of wearable devices.

- Instead of capturing the whole image, only a few columns of pixels were sub-sampled in order to extract eye features of interest.
- Designed light-weight signal processing and machine learning pipeline (i.e. edge detection, template matching, and logistic regression) and performed extensive evaluation studies for 16 participants. (MATLAB, C++)

Patent

Wearable Textile-based Hydrogel Electrode for Measuring Biopotential

Z. Homayounfar, A. Kiaghadi, ***S. Rostaminia****, D. Ganesan, T. Andrew. U.S. Patent App. 17/091,675* 2021

Selected Publications

Longitudinal Sleep Monitoring for All: Payoffs, Challenges and Outlook *Journal Paper*

T. Andrew, ***S. Rostaminia****, Z. Homayounfar, D. Ganesan. ECS Sensors Plus* 2022

PhyMask: Robust Sensing of Brain Activity and Physiological Signals During Sleep with an All-textile Eye Mask *Journal Paper*

S. Rostaminia*, Z. Homayounfar, A. Kiaghadi, T. Andrew, D. Ganesan. ACM Health* 2021

Enabling Longitudinal Respiration Monitoring Using Vapor-Coated Conducting Textiles *Journal Paper*

L. Allison,* ***S. Rostaminia*****, A. Kiaghadi, D. Ganesan, T. Andrew. ACS Omega* 2021

Multimodal Smart Eyewear for Longitudinal Eye Movement Tracking *Journal Paper*

Z. Homayounfar, ***S. Rostaminia****, A. Kiaghadi, X. Chen, E. Alexander, D. Ganesan, T. Andrew. Matter* 2020

W!NCE: Unobtrusive Sensing of Upper Facial Action Units with EOG-based Eyewear *Journal Paper*

S. Rostaminia*, A. Lamson, S. Maji, T. Rahman, and D. Ganesan. Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT UbiComp)* 2019

Continuous Measurement of Interactions with the Physical World with a Wrist-worn Backscatter Reader *Journal Paper*

A. Kiaghadi, P. Hu, J. Gummeson, ***S. Rostaminia****, D. Ganesan. ACM Transactions on Internet of Things (TIOT)* 2019

iLid: Low-power Sensing of Fatigue and Drowsiness Measures on a Computational Eyeglass *Journal Paper*

S. Rostaminia*, A. Mayberry, D. Ganesan, B. Marlin, J. Gummeson. ACM IMWUT UbiComp* 2017

Honors & Awards

2021 **Best PhD Forum Presentation**, International Conference on Embedded Wireless Systems and Networks (EWSN), Netherlands.

2021 3MT Campus Finalist, University of Massachusetts Amherst, USA. Video url: `https://youtu.be/9Fra5JqWQX4`

2020 **First Place Graduate Poster Award**, ACM Richard Tapia Celebration of Diversity in Computing Conference, USA.

2017 **Best Poster Award**, Capital Region Celebration of Women in Computing Conference (CAPWIC), USA.

2017 Got certification in the competitive NIH mHealth Summer Training Institute, University of California, Los Angeles, USA.

2017 Microsoft Research and ACM Full Scholarship CRA-W Grad Workshop, USA.

2015 **Ranked 1st** among students in bioelectrical engineering, University of Tehran, Iran.

2015 **Ranked 3rd** among 120 students in electrical engineering, University of Tehran, Iran.

2015 Distinguished B.Sc. student award, with honorary acceptance for the M.S. program, Tehran, Iran.

2010-4 Recipient of the grant for undergraduate studies from the Iranian National Elites Foundation, for outstanding academic success, Tehran, Iran.

2010 **Silver medal** of the National Physics Olympiad, Tehran, Iran.

Invited Talks

The World Behind Our Eyeglasses! *MA, USA*

Turing Computer Science Program, UMass Amherst. *Aug. 2019*

Unobtrusive Sensing of Upper Facial Action Units with EOG-based Eyewear *MA, USA*

Data Science for Health and Well Being workshop, Data Science Research Symposium, UMass Amherst. *Apr. 2019*

Professional Service

2021	Serving on the ACM Symposium on Eye Tracking Research and Applications (ETRA) as Publicity Chair and Associate Chair for short papers track program, Stuttgart, Germany.
2020	Reviewer for the ACM Symposium on User Interface Software and Technology (UIST).
2020	Reviewer for the International ACM Conference on Automotive User Interfaces and Interactive Vehicular Applications (AutomotiveUI).
2018-19	Graduate Student Representative, College of Information and Computer Sciences, University of Massachusetts Amherst.
2018	TPC member of ACM S^3 workshop in conjunction with MobiCom, New Delhi, India.
2017-18	Reviewer for proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT).
2017-18	Officer of Iranian Graduate Students Association (IGSA) in University of Massachusetts Amherst, USA.
2014-15	Vice president of Scientific and Educational Committee in the student branch of ISBME (Iranian Society for Biomedical Engineering) in University of Tehran, Iran.
2013	Student Committee member of 20^{th} Iranian Conference on Biomedical Engineering, Tehran, Iran.

Teaching Experience

Sp. 2019	Teacher Assistant in “Data Visualization and Analysis”, UMass Amherst, Instructor: Prof. A.Sarvghad.
Sp. 2014	Teacher Assistant in “Engineering Mathematics”, University of Tehran, Instructor: Prof. J.Rashed.
Fa. 2013	Teacher Assistant in “Electromagnetics”, University of Tehran, Instructor: Prof. L.Yousefi.
Sp. 2013	Teacher Assistant in “Engineering Mathematics”, University of Tehran, Instructor: Prof. M.Taheri.
Su. 2013	Teacher of “Physics for National Olympiad”, Nemuneh High School, Tehran, Iran.
Su. 2012	Teacher of “Physics for National Olympiad”, Farzanegan High School, Sary, Iran.
Fa. 2012	Teacher Assistant in “Electrical Circuit I”, University of Tehran, Instructor: Prof. J.Rashed.

Certifications

2017	Certification in competitive NIH mHealth Summer Training Institute, University of California, Los Angeles, USA.
2017	Certification in Red Cross “Citizen CPR” program, Environmental Health and Safety, UMass Amherst, USA.
2013	Certification in Workshop of ”Effecting of Bio-electromagnetic Waves on Pregnancy”, 20^{th} Iranian Conference on Biomedical Engineering, Tehran, Iran.
2012	Certification in Workshop of ”Teaching Assistant Training”, University of Tehran, Iran.