MAHYA SAFAVI

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APPOINTMENT

Teaching Research Specialist *2020-present*
Electrical Engineering and Computer Science Department
University Of California Irvine

EDUCATION

Ph.D. in Signal Processing and VLSI Sep 2013-Feb 2020
EECS Department, University of California Irvine Irvine,CA

M.Sc. in Electrical Engineering, Microelectronics Sep 2010- June 2012
EE Department, Sharif University of Technology Tehran, Iran

B.Sc. in Electrical Engineering Sep 2005- June 2010
ECE Department, University of Tehran Tehran, Iran

RESEARCH INTEREST

Brain Computer Interface (BCI) **Computational NueroScience**
Wearable Systems **Cyber-Physical Systems**
Wireless Sensor Networks **Biomedical Signal Processing**

RESEARCH EXPERIENCE

Investigation of Morphological Variations of Photoplethysmography Signal in Human Epilepsy 2017 -2020
Graduate Research Assistance *UC Irvine, CA*

This study was based on the data recorded from people admitted to UCI Medical Center who were candidates for long-term epilepsy monitoring using EEG signal. The brain and heart signal including surface EEG, ECG, and PPG signal were recorded from the subjects during the time of monitoring.

- Wrote an IRB protocol narrative to record from people with epilepsy in UCI Medical Center.
- Designed an implemented an apparatus to synchronize the EEG recording machine with the PPG recording device.
- Collected data from more than 30 subjects.
- Worked with a team of two undergraduate students to process the data.
- 6 different features from PPG pulse morphology related to hemodynamics were derived and used for seizure detection.

Optimization of MUSIC Source Localization for EEG Signal 2015 -2017
Graduate Research Assistance *UC Irvine, CA*

Two techniques were introduced to reduce the computational burden of the MUltiple SIgnal Classification (MUSIC) algorithm aiming a real-time implementation to be used for brain signal source localization. To shrink the exhaustive search inherent in MUSIC source localization, the first technique divides the cortical surface into multiple regions based on the forward head model. A novel nomination procedure is proposed to pick a few number of cortical regions to be searched for the active sources.

In addition, since the computational complexity of MUSIC is cubically increased with number of electrodes, a new electrode selection algorithm based on the Cramer-Rao bound of the errors is introduced to pick the best set of an arbitrary number of electrodes out of the total. The proposed techniques can reduce the computational complexity by up to 90 %.

Decoding Human Finger Movement from ECoG Signal 2013-2015
Graduate Research Assistance *UC Irvine, CA*

This decoder works based on the fact that finger flexion and extension commands originate in slightly different areas of brain. The locations of the centers of the activity on cortex surface are derived using MUltiple SIgnal Classification (MUSIC) algorithm and used to classify the type of finger movement using K-nearest neighbor classifier.

PPG Data Processing Algorithm for the Heart Health Monitoring Using Samsung Galaxy Wrist Gear July 2018- Sep. 2018
Design Engineer Intern *Livmor Inc., CA*

- Worked with a team to debug an application for Atrial Fibrillation detection using PPG signal.
- Implemented an algorithm to remove motion artifact in PPG signal.

Cursor Controller based on Optical Measurement of Head tilt 2016 -2017
Graduate Research Assistance *UC Irvine, CA*

A wearable wireless mouse-cursor controller was proposed that optically tracks the degree of tilt of the user's head to move the mouse relative distances and therefore the degrees of tilt. It can be used in two different modes to move the cursor, the joystick mode and the direct mapped mode. Experimental results show that this head-controlled mouse to be intuitive and effective in operating the mouse cursor with fine-grained control of the cursor even by untrained users.

VLSI Implementation of an Eigenvalue-based Spectrum Sensing for Cognitive Radio with Utilization of FFT for the Input Signal Channelization 2010-2012
Graduate Research Assistance *Sharif University of Technology, Tehran, Iran*

A novel multiple antenna, high resolution eigenvalue-based spectrum sensing algorithm based on the FFT of the received signal was introduced, enabling the detection of the weak signals at -10 dB SNR. A real-time, low-area, and low-power VLSI architecture was also developed for the algorithm, which was implemented in a 0.18 μm CMOS technology. The proposed design occupies a total area of 3.4 mm^2 and dissipates 78 mW for a 40 MHz sensing bandwidth consisting of 32 sub-channels.

TEACHING EXPERIENCE

Wireless Sensors and Actuator Networks Fall 2020
Instructor *UC Irvine, CA*

Responsibilities included writing the syllabus, designing the assignments, designing the midterm final exams, holding the lecture sessions, office hours.

Fundamentals of Digital Design and Lab Fall 2014, Summer 2017, Winter2018, Fall 2018
Graduate Teaching Assistant *UC Irvine, CA*

Digital Signal Processing Fall 2015
Graduate Teaching Assistant *UC Irvine, CA*

Discrete time Signals and Systems Summer 2014, Spring 2015
Graduate Teaching Assistant *UC Irvine, CA*

Computer Organization Lab Winter 2015, Winter 2019
Graduate Teaching Assistant *UC Irvine, CA*

Network Analysis Lab II Spring 2019
Graduate Teaching Assistant *UC Irvine, CA*

Senior Design Project Fall 2017
Graduate Teaching Assistant *UC Irvine, CA*

TECHNICAL STRENGTHS

EDA tools	Xilinx Vivado, Altera Quartus, QuestaSim, Code Composer Studio
HDL Languages	Verilog, VHDL
Programming Languages	C, Matlab, Python
Machine Learning packages	Scikit Learn, Keras, Tensorflow
Web Development	HTML5, CSS, JavaScript, jQuery, Bootstrap, Node.js, MongoDB MySQL, React.js

WORK EXPERIENCE

Design Engineer Intern July 2018-Sep 2018
Livmor Inc. Irvine,CA

PUBLICATION

Journal Publications

1. **S. M. Safavi**, R. Sabino, N. Valisharifabad, H. Chen, A. HeydariGorji, D.Tran, J. Lin, B. Lopour, P. H. Chou, "Analysis of Cardiovascular Changes Caused by Epileptic Seizures in Human Photoplethysmogram Signal," submitted to IEEE Journal of health and bioinformatics, 2020.
2. **S. M. Safavi**, B. Lopour, P. H. Chou, "Reducing the Computational Complexity of EEG Source Localization with Cortical Patch Decomposition and Optimal Electrode Selection," IEEE Transaction on Biomedical Engineering, 2017.
3. **S. M. Safavi**, M. Shabany, "A Real-time, Low-power Implementation for High-resolution Eigenvaluebased Spectrum Sensing", Springer Journal of analog Integrated Circuits and Signal Processing, October 2013.

Conference Publications

1. **S. M. Safavi**, N. Valisharifabad, R. Sabino, D.Tran, J. Lin, B. Lopour, P. H. Chou," Investigation of Morphological Variations of Photoplethysmography Signal in Human Epilepsy," *42.nd IEEE EMBC, 2020.*
2. H. Chen, S. Meenakshi, A. HeydariGorji, **S. M. Safavi**, P. H. Chou, Ch. Lee, R. Chang, "BlueBox: A Complete Recorder for Code-Blue Events in Hospitals," *IEEE International Symposium on VLSI Design, Automation and Test (VLSI-DAT), 2019.*
3. Ch. Lee, Y. Liang, P. H. Chou, A. Heydari Gorji, **S. M. Safavi**, W. Shih, W. Chen, "Ecomicro: a miniature self-powered inertial sensor node based on bluetooth low energy", *IEEE ISPLED 2018.*
4. Heydari Gorji, **S. M. Safavi**, Ch. T. Lee, P. H. Chou, "Head Mouse: A Simple Cursor Controller Based on Optical Measurement of Head Tilt", *IEEE SPMB 2017.*
5. **S. M. Safavi**, S. Meenakshi Sundaram, A. Heydari Gorji, N. Udaiwal, P. H. Chou, "Application of Infrared Scanning of the Neck Muscles to Control a Cursor in Human-Computer Interface", *39.th IEEE EMBC, 2017.*

6. **S. M. Safavi**, S. J. Lee, B. Lopour, P. H. Chou, "Complexity Reduction Techniques in MUSIC-based EEG Source Localization," *IEEE Global conference on Signal and Information Processing, 2016.*

7. **S. M. Safavi**, A. S. Behbahani, A. M. Eltawil, Z. Nenadic, A. Do, "A cortical Activity Localization Approach for Decoding Finger Movements from Human Electrocorticogram Signal," *37th IEEE Asilomar conference on Signals, Systems, and Computers, 2015.*

8. **S. M. Safavi**, M. Shabany, "AVLSI Architecture for Multiple Antenna Eigenvalue-based Spectrum Sensing", *IEEE International Conference on Electronics, Circuits, and Systems (ICECS), December 2012.*