

Viswam Nathan

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SUMMARY: PhD candidate with expertise in signal processing, statistical analysis, sensor design, firmware and software development, with focus on biomedical applications with wearable sensors.

RESEARCH INTERESTS:

- *Signal Processing with Emphasis on Robustness*
 - *Wearable Sensor System Design*
 - *Embedded System Design including Circuits, Hardware and Software*
 - *Statistical Analysis for Biomedical Data*
 - *Machine Learning*
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EDUCATION:

Texas A&M University, *PhD in Computer Science & Engineering*, Expected May 2018 – GPA – 4.0

- **Thesis:** Characterizing the Noise Associated with Sensor Placement and Motion Artifacts and Overcoming its Effects for Body-Worn Physiological Sensors

The University of Texas at Dallas, *Master of Science in Computer Engineering*, May 2015 – GPA – 4.0

The University of Texas at Dallas, *Bachelor of Science in Computer Engineering*, May 2012 – GPA – 3.927

EXPERIENCE:

Texas Instruments, *Applications Engineer Intern*,

- *Summer 2016:* System development of analog front end for X-ray scanner
- *Summer 2015:* Firmware and algorithm development for wrist-based optical cardiac activity sensor

Texas A&M University, Embedded Signal Processing Lab, *Research Assistant*, 08/15 – present

- Extensive experience using MATLAB for signal processing and statistical analysis
- Designed experiments for human subject studies

University of Texas at Dallas, Embedded Signal Processing Lab, *Research Assistant*, 08/12 – 05/15

- PCB design and assembly, including a PCB for reconfigurable EEG electrodes
 - Built a GUI in Visual Studio to display 16 channels of streaming EEG data in real-time
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RESEARCH PROJECTS:

- **Particle Filter based Tracking of Heart Rate**
 - Formulated particle filter framework to track heart rate in the presence of motion artifacts
 - Fusion of multiple sensors including real ECG, PPG and accelerometer data for improved estimates
 - **Reconfigurable EEG for Brain Computer Interface**
 - Analyzed skin sensor interface noise for dry electroencephalography (EEG) electrodes
 - Novel reconfigurable contact concept to reduce noise and adapt to varying conditions
 - **Non-invasive Blood Pressure Measurement**
 - Helped develop ‘BioWatch’, a wrist-based device for continuous BP measurement
 - Extensive study into signal processing and sensor design for pulse wave velocity estimation
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PUBLICATIONS:

Journal Papers:

J4) **Viswam Nathan**, Roozbeh Jafari, "Particle Filtering and Sensor Fusion for Robust Heart Rate Monitoring using Wearable Sensors", *IEEE J-BHI*, accepted for publication.

J3) **Viswam Nathan**, Roozbeh Jafari, "Design Principles and Dynamic Front End Reconfiguration for Low Noise EEG Acquisition with Finger Based Dry Electrodes", *IEEE T-BioCAS*, vol. 9, no. 5, pp. 631-640, October 2015.

J2) Simi Susan Thomas, **Viswam Nathan**, Chengzhi Zong, Karthikeyan Soundarapandian, Xiangrong Shi, Roozbeh Jafari, "BioWatch: A Non-invasive Wrist-based Blood Pressure Monitor that Incorporates Training Techniques for Posture and Subject Variability", *IEEE J-BHI*, vol.20, no.5, pp. 1291-1300, September 2016.

J1) Yuan Zou, **Viswam Nathan**, Roozbeh Jafari, "Automatic Identification of Artifact-related Independent Components for Artifact Removal in EEG Recordings", *IEEE J-BHI*, vol.20, no.1, pp. 73-81, January 2016.

Conference Papers:

C10) Bassem Ibrahim, **Viswam Nathan**, Roozbeh Jafari, "Exploration and Validation of Alternate Sensing Methods for Wearable Continuous Pulse Transit Time Measurement Using Optical and Bioimpedance Modalities", *IEEE EMBC*, Jul 11-15, 2017, Jeju Island, South Korea.

C9) Zachary Trujillo, **Viswam Nathan**, Gerard L. Coté, Roozbeh Jafari, "Design and Parametric Analysis of a Wearable Dual-Photoplethysmograph Based System for Pulse Wave Velocity Detection", *IEEE ISCAS*, May 28-31, 2017, Baltimore, MD

C8) Qingxue Zhang, Chakameh Zahed, **Viswam Nathan**, Drew A. Hall, Roozbeh Jafari, "An ECG Dataset Representing Real-World Signal Characteristics for Wearable Computers", *IEEE BioCAS*, October 22-24, 2015, Atlanta, GA

C7) **Viswam Nathan**, Ilge Akkaya, Roozbeh Jafari, "A Particle Filter Framework for the Estimation of Heart Rate from ECG Signals Corrupted by Motion Artifacts", *IEEE EMBC*, August 25-29, 2015, Milan, Italy.

C6) **Viswam Nathan**, Roozbeh Jafari, "Reducing the Noise Level of EEG Signal Acquisition through Reconfiguration of Dry Contact Electrodes", *IEEE BioCAS*, October 22-24, 2014, Lausanne, Switzerland.

C5) **Viswam Nathan**, Roozbeh Jafari, "Characterizing Contact Impedance, Signal Quality and Robustness as a Function of the Cardinality and Arrangement of Fingers on Dry Contact EEG Electrodes", *IEEE EMBC*, Aug 26-30, 2014, Chicago, IL.

C4) Simi Susan Thomas, **Viswam Nathan**, Chengzhi Zong, Ebunoluwa Akinbola, Praveen Aroul, Lijoy Philipose, Karthikeyan Soundarapandian, Xiangrong Shi, Roozbeh Jafari, "BioWatch - A Wrist Watch based Signal Acquisition System for Physiological Signals including Blood Pressure", *IEEE EMBC*, Aug 26-30, 2014, Chicago, IL.

C3) Omid Dehzangi, **Viswam Nathan**, Chengzhi Zong, Chang Won Lee, Insoo Kim, Roozbeh Jafari, "A Novel Stimulation for Multi-Class SSVEP-Based Brain-Computer Interface using Patterns of Time-Varying Frequencies", *IEEE EMBC*, Aug 26-30, 2014, Chicago, IL.

C2) Roozbeh Jafari, Omid Dehzangi, Chengzhi Zong, **Viswam Nathan**, "BCIBench: A Benchmarking Suite for EEG-based Brain Computer Interface", *Optimizations for DSP and Embedded Systems (ODES-11)*, February 14-16, 2014, Orlando, FL.

C1) Yuan Zou, Omid Dehzangi, **Viswam Nathan**, Roozbeh Jafari, "Automatic Removal of EEG Artifacts Using Electrode-Scalp Impedance", *ICASSP 2014*, May 4-9, 2014, Florence, Italy.

Book Chapters:

BC1) **Viswam Nathan**, Simi Susan Thomas, Roozbeh Jafari, "Smart Watches for Physiological Monitoring: A Case Study on Blood Pressure Measurement", pages 231–252. *Springer International Publishing*, Cham, 2017.

Magazine Articles:

M1) **Viswam Nathan**, "Wearable brain computer interface are we there yet?", *Magazine XRDS: Crossroads*, vol.20, no.2, pp. 56-60, ACM, 2013.

Demonstration and Workshop Papers:

WP2) Simi Susan Thomas, **Viswam Nathan**, Chengzhi Zong, Praveen Aroul, Lijoy Philipose, Karthikeyan Soundarapandian, Xiangrong Shi, Roozbeh Jafari, "BioWatch: A Wrist Watch based Physiological Signal Acquisition System", *ACM/IEEE IPSN*, April 15-17, 2014, Berlin, Germany.

WP1) **Viswam Nathan**, Jian Wu, Chengzhi Zong, Yuan Zou, Omid Dehzangi, Mary Reagor, Roozbeh Jafari, "A 16-channel Bluetooth Enabled Wearable EEG Platform with Dry-contact Electrodes for Brain Computer Interface", *ACM International Conference on Wireless Health*, November 1-3, 2013, Baltimore, MD.

ACADEMIC AND PROFESSIONAL ACTIVITIES:

- **Reviewer**
 - *Journals*: IEEE JETCAS, IEEE Sensors, IEEE JBHI, IEEE TBioCAS, IEEE IoT, Transactions on CPS, IEEE TBME.
 - *Conferences*: BioCAS, DAC, IPSN.
- **Preparing Proposals**
 - Undertook 80% of effort in preparing a proposal to NIH for a research project exploring continuous cuff-less blood pressure monitoring using a wearable device.
 - Prepared document detailing proposed system design, signal processing and experiment design.
- **Teaching**
 - Served as teaching assistant for a Microcontrollers course for a total of 3 semesters at both graduate and undergraduate levels.
 - Responsible for designing course final projects, creating new lectures, drafting exam questions, managing lab work and grading.
- **Human Subject Experiments**
 - Extensive experience in designing and conducting *in vivo* experiments with human subjects incorporating various physiological devices including EEG, ECG, Arterial BP and PPG sensors.
 - Familiar with IRB protocols, requirements and documentation for ethical and safe experiments.
- **Reference Designs for Industrial Partners**
 - In collaboration with Texas Instruments, was responsible for the firmware, signal processing and system development for a suite of personal health monitoring devices measuring signals and parameters including ECG, heart rate and body composition.
 - The systems were reference designs for state-of-the-art analog front ends from Texas Instruments, and were showcased at CES 2013.

SKILLS:

Programming Languages – Java, C, C#, C++, HSPICE, Assembler, Verilog, BYOND

Software – MATLAB, Code Composer, Altium, IAR, Visual Studio, LabView, Synopsys, Cadence

Hardware – Microcontrollers, Biomedical sensors, Standard lab equipment, Logic Analyzer

HONORS:

University of Texas at Dallas, *Louis Beecherl, Jr. Graduate Fellow*, - \$4000 stipend award for graduate studies

University of Texas at Dallas Dean's List, Fall 2008, Spring 2009, Fall 2009, Fall 2010 and Spring 2012

University of Texas at Dallas, *Academic Excellence Scholar*, – Complete tuition coverage for Bachelor's degree and additional \$2000 stipend each semester for housing/supplies

NSF Travel Award, Allowance up to \$900 to attend Wireless Health 2013 conference

TECHCON 2016 Conference, Best-in-session award for research on use of particle filter for heart rate estimation
