Joe Breda

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Education

2019 - 2025 Ph.D. **University of Washington**
Paul G. Allen School of Computer Science & Engineering
Advisor: *Shwetak Patel*

2015 - 2019 B.S. **University of Massachusetts Amherst**
Electrical & Computer Engineering
Advisor: Jay Taneja

Current Academic Research Projects

Flu Prediction with Smartwatches *Preparing for Nature*

- Running 35 person flu challenge study at the NIH where Fitbit users are infected with the flu and continuously monitored by a suite of biomarker sensors.
- Developing AI model to detect signals of immune response in raw data from smartwatches between the moment of infection and earliest flu test positive results.
- Follow-up proposal awarded $150,000 through Samsung GRO Grant [A8].

Operator: Cross-Device AI Agent for Adaptive Smart Environments *Working Paper*

- Developing an AI agent architecture to automatically manage smart home devices based on environmental sensors which iteratively learns new policies through reinforcement learning on both explicit and implicit human feedback.

OnlineLiaison: AI Agent for Capturing Public Comment on Urban Subreddits *Working Paper*

- Developing LLM agents for extracting and analyze public sentiment towards local policy and urban design from 20 years of urban subreddits data (i.e., r/Seattle, r/NYC, etc.) as a supplement to existing public comment sessions.

Vibring: Through-body Acoustic Biosignals for Surface Interaction *Preparing for UIST'25*

- Developed a contact microphone based smart ring and audio ML model to classify surface of swiping based interaction using through-body acoustic signatures.

Passively Crowd Sensing Bicycle Safety *Accepted to CHI'25*

- Developed and deployed 15 smart bicycle handlebars which measure the proximity of passing cars and modeled safety across the road network using crowd sensed data.
- Recently accepted for publication at CHI 2025 [P14] and patent submitted [PT1].

Sensing Nighttime Lighting Conditions on Urban Sidewalks *Accepted to CHI'25*

- Developed a smartphone middleware for crowd sensing ambient lighting conditions on urban streets passively as users walk with their phones to improve pedestrian navigation
- Recently accepted for publication at CHI 2025 [P13] and patent submitted [PT2].

Industry Experience

Google Student Researcher Seattle, WA May 2021-Oct.2022

- Developed computer vision model and modular data generation pipeline to predict road safety from satellite images using Tensorflow, C++, and Google EarthEngine.
- Lead to Google Gift Grant [A5].

Google Student Researcher Seattle, WA May 2020 – Sept. 2020

- Developed MapReduce pipeline for generating synthetic population datasets for urban simulation used for modeling traffic and disease monitoring.

Publications

P14 ProxiCycle: Passively Mapping Cyclist Safety Using Smart Handlebars for Near-Miss Detection
Joseph Breda, Keyu Chen, Thomas Ploetz, Shwetak Patel
CHI 2025

P13 NightLight: Passively Mapping Nighttime Sidewalk Light Data for Improved Pedestrian Routing
Joseph Breda*, Daniel Campos Zamora*, Shwetak Patel, Jon Froehlich
CHI 2025

P12 Exploring and Characterizing Large Language Models for Embedded System Development and Debugging
Zachary Englhardt, Richard Li, Dilini Nissanka, Zhihan Zhang, Girish Narayanswamy, **Joseph Breda**, Xin Liu, Shwetak Patel, Vikram Iyer
CHI Late Breaking Work 2024

P11 'I will just have to keep driving': A Mixed-methods Investigation of Lack of Agency within the Thai Motorcycle Rideshare Driver Community
*Nussara Tieanklin, ***Joseph Breda**, Tim Althoff, Kurtis Heimerl
CSCW 2024

P10 Thermal Earring: Low-power Wireless Earring for Longitudinal Earlobe Temperature
Qiuyue Shirley Xue, Yujia Liu, **Joseph Breda**, Mastafa Springston, Vikram Iyer, Shwetak Patel
IMWUT 2024

P9 Understanding People's Concerns and Attitudes Toward Smart Cities
Pardis Emami-Naeini, **Joseph Breda**, Wei Dai, Tadayoshi Kohno, Kim Laine, Shwetak Patel, Franziska Roesner
CHI 2024

P8 Feverphone: Accessible Core-Body Temperature Sensing for Fever Monitoring Using Commodity Smartphones
Joseph Breda, Mastafa Springston, Alex Mariakakis, Shwetak Patel
IMWUT 2023 **Won Distinguished Paper Award**

P7 SpiroMask: Measuring Lung Function Using Consumer-Grade Masks
Rishiraj Adhikary, Dhruvi Lodhavia, Chris Francis, Rohit Patil, Tanmay Srivastava, Prerna Khanna, Nipun Batra, **Joseph Breda**, Jacob Peplinski, Shwetak Patel
ACM Transactions on Computing for Health 2023

P6 Passively Sensing SARS-CoV-2 RNA in Public Transit Buses
Jason Hoffman, Matthew Hirano, Nuttada Panpradist, **Joseph Breda**, Parker Ruth, Yuanyi Xu, Jonathan Lester, Bichlien H. Nguyen, Luis Ceze, Shwetak Patel
Science of the Total Environment 2022

P5 Phone-based Ambient Temperature Sensing Using Opportunistic Crowdsensing and Machine Learning
Amee Trivedi, Phuthipong Bovornkeeratiroj, **Joseph Breda**, Prashant Shenoy, Jay Taneja
Sustainable Computing 2021

P4 Hanging Gardens of Babylon: Reframing Urban Agriculture as an Opportunity for Social Engagement
Joseph Breda, Esther Jang, Kurtis Heimerl, Shwetak Patel
Self-Sustainable CHI 2020

P3 Hot or Not: Leveraging Mobile Devices for Ubiquitous Temperature Sensing.
Joseph Breda, Amee Trivedi, Chulabhaya Wijesundara, Phuthipong Bovornkeeratiroj, David Irwin, Prashant Shenoy, Jay Taneja
BuildSys 2019

P2 Staring at the Sun: A Physical Black-box Solar Performance Model
Dong Chen, **Joseph Breda**, David Irwin
BuildSys 2018

P1 Fancy That: Measuring Electricity Grid Voltage Using a Phone and a Fan.
Joseph Breda and Jay Taneja
COMPASS 2018

Patents

PT2 **NightLight: Passively Mapping Night-time Sidewalk Light Data for Improved Pedestrian Routing** — Filed March 31, 2025
Patent derived from [P13].

PT1 **SMART HANDLEBAR CAP FOR SENSING BICYCLE SAFETY** — filed May 24, 2024
Patent derived from [P14].

Teaching Experience

TA3 **Embedded Systems Capstone Teaching Assistant** — Winter 2024
See [TA2].

TA2 **Embedded Systems Capstone Teaching Assistant** — Spring 2024
Mentored teams of students on end-to-end capstone projects and lead lectures on embedded ML and Android BLE.

TA1 **Embedded Systems Teaching Assistant** — Fall 2023
Tutored embedded systems during office hours and graded assignments

Awards

A8 **Samsung Global Research Outreach (GRO) Grant** — November 2024
Primary author on **$150,000** grant proposal extending my prior work collaborating with the NIH for flu monitoring and early detection.

A7 **Distinguished Paper Award at Ubicomp 2024** — October 2024
For work on my first author paper [P8].

A6 **Computing for the Environment Initiative Grant** — June 2022
Primary author on 2 project proposals totaling **$100,000** of funding ($50,000 each) for developing computer systems for sustainability.

A5 **Google Gift Grant** October 2021
Primary author of **$60,000** grant to study human mobility patterns.

A4 **Weil Family Endowed Fellowship in Computer Science & Engineering** September 2019
Selected for award upon PhD admission.

A3 **Graduated from Commonwealth Honors College** May 2019
For completing honors undergraduate thesis, later published as [P3].

A2 **Graduated Magna Cum Laude** May 2019
Top 10% of graduating class within the ECE department.

A1 **Commonwealth Honors College: Honors Research Grant** December 2018
Awarded research funding for proposed honors thesis.

Skills

Technical & Research Skills: Empirical Study, Signal Processing, Artificial Intelligence Training & Evaluation, Fine-Tuning Large Models, Deployment & User Study, Embedded Systems Prototyping, Applied Large Language Models, Computer Vision, Prompt Tuning, Audio Processing, 3D modeling, Grant Writing, Statistical Analysis, Survey Methods, Crowdsourcing, Semi-Structured Interviews.