JOHNS HOPKINS
BIOMEDICAL ENGINEERING

BME SPECIAL SEMINAR

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Wednesday April 5, 2023
12:30pm-1:30pm
Clark 110 and via zoom:
https://bit.ly/3LY3Yrr

Faculty Host: Sri Sarma

Monitoring and modeling the autonomic nervous system: the bridge between the brain and the body

Abstract: In both complex clinical settings and chronic disease, the nervous system coordinates across many systems of the body. This role is carried out by the autonomic nervous system (ANS), the body's hidden control system that is responsible for our unconscious functioning. However, as a complex and distributed network of nerves deep within the body, the ANS is a poorly understood part of basic neurophysiology. Traditional approaches to tracking the autonomic nervous system, for instance with wristwatch heart rate variability, have shown inconsistent findings and lack sufficient rigor for clinical use. In this talk, I will provide examples from both the operating room and from at-home chronic disease monitoring where I use three strategies to overcome challenges in precise, dynamic monitoring of the ANS. First, I will demonstrate how I used a multimodal approach to track unconscious pain in the operating room for more robust inference when a unimodal approach was subject to confounds. Second, I will give an example of how I constructed the first physiology-based interpretable statistical model for sweat gland activity that allowed me to precisely and accurately estimate underlying phenomena we cannot directly measure. Finally, I will illustrate how I engineered solutions for continuous, at-home monitoring in chronic disease settings using wearable sensors to shed light on patient-specific complexity and variability and suggest hypotheses about individual disease etiology. Together, I will provide a vision of how engineering new technological solutions for the ANS will enable the healthcare community to understand individual complexity and variability in disease, track disease progression and symptoms even in patients who cannot self-report, personalize disease management, and provide objective measures for factors like pain and stress that are the subjects of harmful stereotypes in healthcare.

Bio: An alumnus of Johns Hopkins, Dr. Subramanian received B.S. degrees in Biomedical Engineering and Applied Mathematics & Statistics in 2015 from JHU. She received her Ph.D. in 2021 from the Harvard-MIT Division of Health Sciences and Technology under the mentorship of Emery Brown. Her thesis work involved building interpretable physiology-based statistical models for autonomic nervous system responses to track unconscious pain processing during surgery. Now, as a postdoctoral fellow at Stanford with Professors Sean Mackey, Department of Pain Medicine, and Todd Coleman, Department of Bioengineering, she is developing systems and methods for continuous, at-home physiological monitoring to uncover autonomic underpinnings of complex chronic diseases such as migraine and functional digestive disorders. She is a Schmidt Science Fellow and Stanford Data Science Postdoctoral Fellow.