From: rslannounce on behalf of Kawin Setsompop
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Subject: EE Thesis defense, Itamar Terem (Nov 4, 11am)
Date: Thursday, October 23, 2025 8:49:19 PM
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University PhD Dissertation Defense

Department of Electrical Engineering

Itamar Terem

Magnetic Resonance Imaging of Pulsatile Brain Motion and Its Applications

Advisor: Kawin Setsompop

Date: Tuesday, November 4, 2025
Time: 11:00 am (refreshments at 10:45 am)
Location: AllenX, 101X
Zoom Link: https://stanford.zoom.us/j/99830344995?pwd=hPdglIJPlto97VtyU9NSCIDYvIOVEg.1
Password: 610912

Heart–brain interactions, including cardiac-induced brain pulsatility, are increasingly recognized as critical components of brain homeostasis and function. These pulsatile dynamics arise from the transmission of cardiac pressure and flow through the cerebral vasculature and are influenced by tissue mechanical properties, vascular compliance, and cerebrovascular hemodynamics. Magnetic Resonance Imaging (MRI), a noninvasive and nonionizing imaging modality, enables the acquisition of high-contrast structural and functional images at macroscopic resolution. While several MRI techniques have been developed to capture brain pulsations, they are predominantly phase-based approaches that require specialized acquisition schemes and are not routinely used in clinical imaging.

In this dissertation, I present a new framework for extracting and quantifying cardiac-induced brain motion from standard magnitude cine MRI data. I first introduce Amplified Magnetic Resonance Imaging (aMRI), a novel algorithm designed to reveal subtle pulsatile brain motion from conventional MRI acquisitions. Building upon this approach, I develop Quantitative Amplified MRI (q-aMRI), which extends aMRI to enable the quantification of sub-voxel cardiac-induced displacement fields in physical units. Using q-aMRI, I demonstrate that novel imaging biomarkers can be derived from these displacement fields, providing insight into how cardiac-induced brain motion evolves across the lifespan and how abnormal motion patterns are associated with neurodegenerative conditions such as dementia.

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