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Wearable Acoustic and Vibration Sensing and Machine Learning for Human Health and Performance

Abstract:

Recent advances in digital health technologies are enabling biomedical researchers to reframe health optimization and disease treatment in a patient-specific, personalized manner. This talk will focus on my group's research in three areas of relevance to digital health: (1) cardiogenic vibration sensing and analytics; (2) musculoskeletal sensing with joint acoustic emissions and bioimpedance; and (3) non-invasive neuromodulation for stress. Our group has extensively studied the timings and characteristics of cardiogenic vibration signals such as the ballistocardiogram and seismocardiogram, and applied these signals for cuffless blood pressure measurement, heart failure monitoring, and human performance. We have also leveraged miniature contact microphones to measure the sounds emitted by joints, such as the knees, in the context of movement, and have examined how these acoustic characteristics are altered by musculoskeletal injuries and disorders (e.g., arthritis). Finally, we have developed non-pharmacological treatment paradigms for posttraumatic stress disorder (PTSD) based on non-invasive vagal nerve stimulation and have performed extensively validation of this approach with collaborators in psychiatry and radiology. We envision that these technologies can all contribute to improving patient care with lower cost.