Announcing the Final Examination of Peshala Thibbotuwawa Gamage for the degree of Doctor of Philosophy

Time & Location: June 29, 2020 at 10:00 AM in Virtual defense
https://ucf.zoom.us/j/98415577538?pwd=N1Q1MG4yRnRLzkl0adsZM5cXJzZ09

Title: Seismocardiography - Genesis, and utilization of machine learning for variability reduction and improved cardiac health monitoring.

Seismocardiography (SCG) is the measured chest surface vibrations resulting from cardiac activity. Although SCG can contain information that correlate with cardiac health, its utility may be limited by lack of understanding of the signal genesis and a variability that can mask subtle SCG changes. The current research utilized medical imaging reconstruction and finite element method (FEM) to simulate SCG by modeling the propagation of myocardial movements to the chest surface. FEM analysis provided a link between myocardial movements and the SCG signals measured at the chest surface and suggested that myocardial movement is a primary source of SCG. Increased understanding of the sources and propagation of SCG may help increase the utility of SCG as a cardiac monitoring tool.

To reduce the variability of SCG measured in human subjects, unsupervised machine learning (ML) was implemented to group SCG beats into clusters with minimal intra-cluster heterogeneity. The clustering helped reduce the SCG variability and unveiled consistent relations with the respiratory phases and SCG morphology. This clustering reduced noise in calculating signal features and provided additional useful features. The study also analyzed longitudinal SCG from heart failure (HF) patients in order to predict HF readmission. Here, many time- and frequency-domain SCG features were extracted. Certain features showed good correlations with readmission. Using supervised ML algorithms, high classification accuracies (up to 96%) were achieved suggesting high SCG utility for monitoring HF patients and possibly other heart conditions. Effective monitoring followed by timely intervention can lead to improved patient management and reduced mortality.

Major: Mechanical Engineering

Educational Career:
Bachelor's of Mechanical Engineering, BS, 2013, University of Moratuwa
Master's of Aerospace Engineering, MS, 2017, University of Central Florida

Committee in Charge:
Hansen A Mansy, Chair, Mechanical and Aerospace Engineering
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Richard H. Sandler, UCF College of Medicine

Approved for distribution by Hansen A Mansy, Committee Chair, on June 16, 2020.

The public is welcome to attend.