Online Proceedings

SESSION 2O

BIOMARKERS AND DIAGNOSTICS

Session Moderator: Paul Yager, Bioengineering
MGH 389
3:30 PM to 5:15 PM

* Note: Titles in order of presentation.

A Ubiquitous Screening Technology for Sleep Apnea
Parker Scott (Parker) Ruth, Sophomore, Bioengineering, Computer Engineering
Mary Gates Scholar, UW Honors Program
Mentor: Shwetak Patel, Computer Science & Engineering
Mentor: Edward J. Wang

Obstructive sleep apnea (OSA) is a condition estimated to affect 5% to 15% of the population, in which individuals stop breathing for extended periods while asleep. Treatment is usually successful when provided; however, the vast majority of OSA patients go undiagnosed, in part because the superficial symptoms of OSA in a wakeful state are varied and nonspecific, including drowsiness, hypertension, heart disease, diabetes, and depression. The current diagnostic gold standard is an overnight sleep study, which is expensive and requires access to a specialized sleep medicine facility. This motivates a need for a convenient and accurate technology to screen for sleep apnea in homes and clinics. A ubiquitous screening solution must be both sensitive to slight variations, and specific to apnea in spite of many interfering physiological factors; these challenges are further complicated by the constraints of low-cost sensing devices. Our approach is to detect persistent changes in the sympathetic nervous system that are caused by frequent apnea events; although these changes cannot be measured directly, they manifest in discernible changes to heart signals. To test our system we record cardiac and respiratory signals while participants execute a series of breathing maneuvers, such as breath holding and breath rate control. We record in parallel with (1) a smartphone running a custom application and (2) a commercially available wireless biomedical recorder. Using digital signal processing, we extract informative features from the locations and amplitudes of peaks and troughs in the PPG, SCG, and ECG signals. Equipped with these extracted features and the ground truth diagnoses provided for each patient by the Harborview Sleep Medicine Center, we use existing machine learning libraries to train a predictive model for apnea. We expect results to demonstrate a correlation between cardiac regulation and sleep apnea severity.

POSTER SESSION 3

MGH 241, Easel 159
2:30 PM to 4:00 PM

The Influence of Urban Runoff on Coho Salmon: Removing Organic Contaminants from Storm Water
Sarah Marie White, Recent Graduate, Environmental Science, UW Tacoma
Mentor: Edward Kolodziej, Science and Mathematics/ Civil and Environmental Eng.
Mentor: Katherine Peter, Center for Urban Waters

River ecosystems depend on services salmon populations provide. Coho salmon, Oncorhyncus kisutch, supply valuable nutrients for mammals and birds and offer economic benefits for the Pacific Northwest. Salmon rely on water quality in freshwater streams during successful seasonal spawning. However, for over the past 15 years, research determined that urban stormwater results in the mortality of Coho salmon. Exposure to urban stormwater is toxic to Coho salmon, killing them in hours. This phenomenon is known as pre-spawn mortality (PSM), and it kills salmon before they reproduce. If this phenomenon continues, Coho salmon could go extinct. Previous studies have linked highway runoff and pre-spawn mortality. However, they indicate that basic water quality parameters such as temperature and pH and "typical" stormwater toxicants such as metals and pesticides are not the cause of PSM. Current hypotheses point to an unknown organic contaminant that is linked to urbanization and is probably present from roadways or cars. Previous studies have also shown that bioinfiltration of stormwater through a mixture of sand and compost can protect Coho salmon. The goal of this study was to investigate removal of organic contaminants in a pilot-scale compost-amended bioswale (CABS). The pilot-scale CABS was based on a field-scale bioswale that is operated by WA DOT and located on SR-518. In this study, we developed methods to extract water with suspended sediment (whole water), as well as extract filtered water and total suspended sediment (TSS) separately. Whole water and filtered water were extracted by solid phase extraction (SPE), using Infinity®SPE cartridges. TSS was measured using EPA Method 160.2, and captured solids were ex-

tracted with methanol. Extracts were then analyzed by liquid chromatography-high resolution mass spectrometry. These methods were then applied to evaluate removal of organic contaminants in the bioswale, including performance at multiple hydraulic retention times.