25

Algorithms for opioid use detection derived from daily digital patterns of workers

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Background

In the U.S., opioid overdose is now an epidemic that has caused over 450,000 deaths from 1999-2018. Corporations are experiencing large numbers of employee losses due to addiction and overdose. Although early detection of opioid use is critical to prevent permanent damage to the brain and body, diagnostic examination tends to be ordered only to confirm cognitive behavioral problems or deaths.

Corporations are systematically logging employee computer use and behavior pattern. The efficacy of this data referred to as a "digital fingerprint" can be improved if additional data stream of bio-signals from employee psychophysiological changes become available. In an attempt to understand the behavioral and physiological changes triggered by opioids and to allow for possible early intervention, the relationship between alcohol consumption and job performance based on simultaneous collection of bio-signals and "digital fingerprints" has been investigated by our team via the T3 grant process.

Hardware Development

A prototype mouse with sensor hardware has been developed. Sensors measure various bio-signals attached to the PC peripheral input devices. Currently, pulse oximeter, galvanic skin response, and skin temperature sensors are attached. The number and type of sensors may change depending on the sensitivity of the sensors to target psychophysiological symptoms.

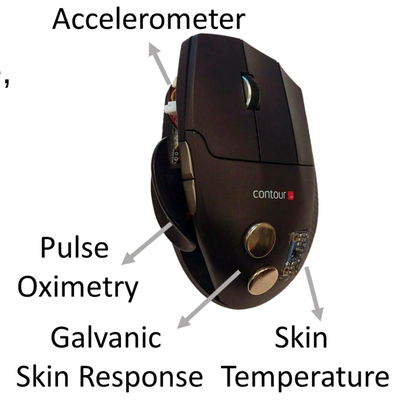

Figure 1. Prototype Mouse Hardware

Pilot Study

A pilot experiment has been conducted to test the efficacy of the bio-signals collected from the sensors. Participants performed multiple cognitive test blocks consisting of a series of tasks testing the cognitive executive functions (Figure 2).

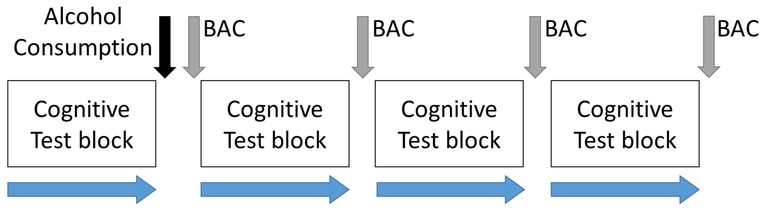

Figure 2. Experiment Protocol

After the first cognitive test block, participants consumed alcohol at controlled doses, based on their body weight, to increase the participant's blood alcohol content to 0.04%. Participants repeated the cognitive test block until their BAC level decreased below 0.01%. Preliminary analysis revealed that the collected bio-signals are sensitive enough to show the changes correlated with BAC level changes (Figure 3).

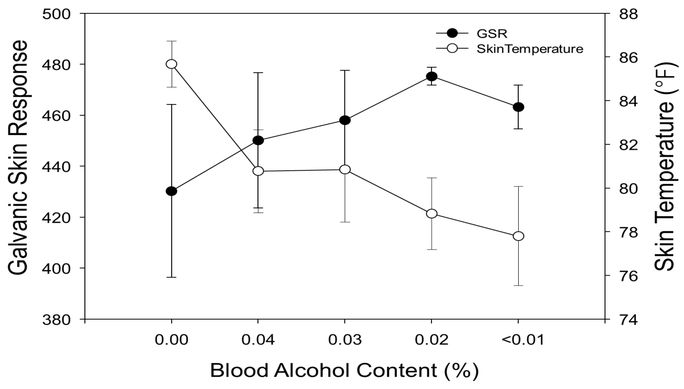

Figure 3. Skin temperature and GSR changes with BAC level change

Progress

Pilot data collection in the lab continues, to extract features for the development of machine learning algorithms and detection software (Figure 4). PCT Patent Applications have been filed and an SBIR was submitted in June with a local startup company.

Figure 4. Project roadmap and current progress