mSelf – Using Mobile Sensors to Self-monitor and Improve Health, Wellness, and Performance

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ABSTRACT

Mobile sensors can track human states, the surrounding context, daily behaviors, and exposures to environmental risk factors in the natural field environment. Real-time analysis of such sensor data makes it possible to deliver personalized recommendations to improve health, wellness, and performance. Widely used GPS-navigation systems that provide just-in-time directions for traffic-aware navigation and activity trackers that help users set and achieve daily physical activity goals are widely used early examples.

The increasing availability of mobile sensors that allow collection of raw sensor data, along with mobile big data software platforms that allow labeled collection, curation, modeling, and visualization of such data for development and validation of new markers and sensor-triggered interventions, is opening up exciting new research directions. They include novel sensor systems for self-tracking of health, wellness, and performance.

This talk will introduce examples of such sensors [1] (AutoSense, MotionSense) and mobile big data computing platforms [2] (mCerebrum and Cerebral Cortex) developed by the NIH-funded Center of Excellence for Mobile Sensor Data-to-Knowledge (MD2K), which are being used in ten field studies at ten different sites and are freely available as open-source projects. This platform has already resulted in development and validation of sensor-based detectors of smoking, stress, conversation, craving, and cocaine use, and sensor-triggered just-in-time stress interventions. Markers under development include impulsive eating, drinking, brushing, flossing, lung fluid congestion, and fatigue for health and wellness; and task performance, cognitive ability, conscientiousness, executive functions, interruption, alertness, adaptability, citizenship, counterproductive behaviors, and neuroticism for work performance.

The talk will use the example of MD2K's mobile big data platforms and recently developed markers to highlight the mobile computing, data modeling, and big data computing research challenges emerging in such mobile sensor systems. It will also expose the audience to unique validation challenges facing new sensor-based markers and sensor-triggered interventions that must work for each individual in their natural field environment and deliver high-utility with minimal burden. Finally, it will highlight novel privacy challenges emerging in such systems, which hold tremendous potential to improve health, wellness, and performance, but have tightly-coupled behavioral privacy challenges [3]. The talk will end by describing the vision of mobile self (mSelf) and emphasize the need to work in multidisciplinary teams to successfully realize this vision.

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Mobile Sensors; Mobile Health (mHealth); Behavior Modeling; Just-in-time interventions

BIOGRAPHY

Santosh Kumar is a Professor of Computer Science at the University of Memphis where he holds the Lillian & Morrie Moss Chair of Excellence. His research focuses on using mobile sensors for self-monitoring of health, wellness, and performance. He and his students have developed computational models to infer human health and behaviors such as stress, conversation, smoking, craving, and cocaine use from wearable sensor data. He leads several large multidisciplinary projects in mobile sensors funded by National Institutes of Health (NIH), National Science Foundation (NSF), and IARPA. It includes the NIH-funded MD2K Center of Excellence, involving 20 scientists in computing, engineering, behavioral science, and medicine from 13 universities. Santosh was named one of America's ten most brilliant scientists under the age of 38 by Popular Science in 2010. In 2015, he was named Tennessee's first chair of excellence in Computer Science.

REFERENCES

1. E. Ertin, et. al. "AutoSense: Unobtrusively Wearable Sensor Suite for Inferencing of Onset, Causality, and Consequences of Stress in the Field," *ACM SenSys*, pp. 274-287, 2011.
2. MD2K Center of Excellence: https://md2k.org/.
3. N. Saleheen, et. al., "mSieve: Differential Behavioral Privacy in Time Series of Mobile Sensor Data," *ACM UbiComp*, pp. 706-717, 2016.