Mobile Measurement of Behavioral and Social Health at Population Scale

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Abstract

Daily behaviors such as stress, addiction, diet, exercise, and social interactions are the strongest determinant of health and mortality. Mobile phones can be used to help individuals abstain from unhealthy behaviors (e.g., addiction) and motivate them to initiate and maintain healthy behaviors (e.g., regular exercise). Such interventions, however, require reliable measurement of daily behaviors in the mobile environment. Sensors worn on the body and embedded in mobile phones collect data to enable inference of daily behaviors, but the challenge is the non-specificity of the measures such sensors collect when used in the natural environment.

In the AutoSense project, we have developed a comprehensive suite of wearable sensors that can be worn in the mobile environment to collect multiple physiological indices of stress and addictive behavior (e.g., ECG, Respiration, Alcohol, etc.). AutoSense is complemented by a software framework on the mobile phone called FieldStream that collects physiological measurements from AutoSense sensors, processes them to derive behavioral inferences, and uses these behavioral events to solicit self-reports on the phone, all in real-time. The entire end-to-end system has been worn by 100+ human volunteers for 3,000+ hours in their natural environments as part of various scientific user studies. From these real-life sensor measurements, we have developed robust models to infer psychological stress, to detect conversation episodes, and to detect smoking episodes in the field. In this talk, I will introduce the AutoSense and FieldStream platforms and describe the advances we are making in automatically inferring daily behaviors such as stress, conversation, smoking, craving, and drug usage, from sensor measurements collected in the natural environment.

Bio

Santosh Kumar is an Associate Professor of Computer Science and Faudree Professor at the University of Memphis. He received his Ph.D. in Computer Science and Engineering from the Ohio State University in 2006, where his dissertation work won the SBC Presidential Fellowship award. In 2010, the Popular Science magazine named him one of America’s ten most brilliant scientists under the age of 38 for leading the development of the AutoWitness burglar tracking system and the AutoSense wearable sensor system. On the theory side, he is known for establishing new models of coverage with wireless sensors such as barrier coverage for intrusion detection and trap coverage for target tracking.

His current work focuses on mobile health, where he leads the AutoSense project as part of the Genes Environment Initiative (GEI) at NIH and the FieldStream project, a large NetSE project from NSF. On these projects, he leads a multidisciplinary team of researcher from Carnegie Mellon, Georgia Tech, UCLA, UMass Amherst, Ohio State, University of Minnesota, and University of Pittsburgh. In 2011, he chaired the national meeting on “mHealth Evidence” hosted at NIH and co-organized by NIH, NSF, Robert Wood Johnson Foundation, and McKesson Foundation. More information on him is available at his homepage: http://www.cs.memphis.edu/~santosh/.

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