MD2K First Year Update

The MD2K Center, headquartered at the University of Memphis, is tasked with developing the software, tools, and science to use mobile sensor data to improve health. As its first year wraps up, the Center of Excellence for Mobile Sensor Data-to-Knowledge (MD2K) has made significant progress towards its goal of using mobile sensor data to realize precision medicine. This includes facilitating the gathering, analysis, visualization and interpretation of health-related mobile sensor data. Such a capability is critical to discovering new insights on the role of behavioral and environmental context in the onset and progression of those diseases, which will lead to new methods for early detection and prevention. The ultimate goal is to develop timely and personalized mobile health interventions for early detection and prevention of adverse health events, which will help realize the vision of Precision Medicine, as articulated by President Obama in January.

The MD2K team comprises 20-plus faculty, 20-plus students, four staff and three software engineers, who work on 10 areas – mobile sensors, sensors-to-markers, markers-to-predictors, just-in-time intervention design, smoking cessation research, congestive heart failure research, MD2K-computation (big data software, including MD2K software), MD2K-Training, MD2K-consortium and MD2K-administration. The MD2K team is advised by the CTO of Microsoft (Dr. Harry Shum), President of St. Jude Medical (Dr. Eric Fain), Director of UCLA CTSI (Dr. Steve Dubinett) and a behavior change visionary and entrepreneur (Dr. Vic Strecher).

The University of Memphis recently hosted the entire MD2K research team at the FedEx Institute of Technology for its annual meeting (more details here). More than 80 investigators, postdocs and students participated in the two-day event that brought together researchers and experts in the fields of computer science, statistics, behavioral health and healthcare from 16 institutions. Sessions were broadcast online for members of the mHealth community who were unable to attend in person.

In its first year of research, the MD2K team has made remarkable progress in converting mobile sensor data into markers of adverse health events and risk factors. This includes a multi-sensor approach for detecting when a newly abstinent smoker lapses for the first time in a smoking cessation attempt, which fulfills a long-standing need of the smoking research community. This computational model, called puffMarker, was led by Nazir Saleheen, a PhD student working with MD2K Director Dr. Santosh Kumar and was recently published at ACM UbiComp. (Full citations and links to this and other MD2K papers can be found here.)

A second work demonstrated the feasibility of detecting stress from heart beats and breathing patterns. This computational model, called cStress, was led by Dr. Karen Hovsepian, a former postdoc of Dr. Kumar (now a faculty member at Troy University) and published at ACM UbiComp. The cStress model has recently been shown to be informative and actionable in improving interaction among couples.

These two papers were among the 59 that the MD2K team has published in its first year. The majority of these articles have appeared in high-profile venues that include ACM UbiComp, ACM CHI, ACM Sigcomm, ACM MobiCom, IEEE CVPR, ACM SIGMOD, and ACM KDD in data science research, and Circulation, Nature Reviews Cardiology, Journal of Consulting and Clinical Psychology, Nicotine & Tobacco Research, Drug & Alcohol Dependence, Psychophysiology, and Translational Behavioral Medicine, in health research. In addition, MD2K team has given 93 talks at 63 meetings in the past year.
The just-concluded MD2K annual meeting included a poster/demonstration session, which featured 22 posters and five demos. The posters detailed research featured in published work funded by the MD2K grant. An archive of the posters and their abstracts can be found here.

MD2K software that will enable mobile sensor data collection, analysis, visualization and interpretation is scheduled to be released by the end of this year. This software will be used in designing and delivering just-in-time mobile intervention to reduce stress in smoking cessation studies with 800 daily smokers at Northwestern Medical School and Rice University.

For congestive heart failure (CHF) management, a pilot study has already commenced at the Ohio State Medical School to evaluate the EasySense sensor for early detection of worsening lung fluid congestion in CHF patients. This will be followed (in early 2016) by an outpatient study in 225 CHF patients.

Year one also witnessed a successful mHealth Training Institute at UCLA where 35 scholars from across the country (selected from 170 applicants) were trained in mHealth. The scholars came from 27 different institutions and represented 10 different disciplines. The scholars spent one-week at UCLA, where they were trained by 12 core faculty and 11 visiting faculty. They worked in an interdisciplinary team on a new mHealth project under close mentoring by mHealth experts. More information about the institute is available here.

Finally, MD2K has established close partnerships with two major corporations – Microsoft, which will contribute their Bands in MD2K user studies, and Procter & Gamble, which will contribute their smart toothbrushes for the oral health user studies.