mHealthLab: A 100 user multi-year testbed for mobile health sensing

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The growth in popularity of wearables like smart watches and fitness trackers presents a tremendous opportunity to leverage these devices to collect clinically valid real-time measures of health from individuals in support of precision, personalized medicine. We are currently in the initial stages of establishing a mHealth student testbed to accelerate the process of designing robust mHealth detectors for a variety of targets including affect, smoking, eating, drinking, sleep, exercise and other targets. Our testbed, mHealthLab, will comprise a testbed of over 100 mobile phones, associated data connectivity, wrist-worn sensor platforms such as the Microsoft Band and Android Wear as well as server infrastructure to support data collection, storage and data visualization.

From a research perspective, we have three objectives. Our first objective is to enable longer-term evaluation of mHealth algorithms in real-world settings. There have been several mHealth detectors developed by the research community but evaluation has been short-term due to the inherent difficulty in conducting a user study over long time-scales. The primary goal of our testbed is to help narrow the gap by enabling more longitudinal data collection and evolution of algorithms. Our second objective is to explore problems in personalization of detection models to individual users, and design techniques that can continually learn about user patterns to improve classifier performance. Existing user studies often lack iterative refinement that is essential to improve classification accuracy to levels where they are practical in real-world settings. Our third objective is to design systems that can bridge the gap between complex detection pipelines that are needed to deal with noise, sensor dropout, context, and a variety of real-world confounders versus the resource constraints of embedded platforms used on wearable sensor devices. Towards this goal, we are exploring methods to automatically split complex detection pipelines across cloud-phone-wearable devices.

Author Bio and Expertise: Deepak Ganesan is an Associate Professor at UMass Amherst and has worked for over a decade at the intersection of wireless sensing for health, wireless and mobile sensing, and low-power embedded systems. He has extensive experience in the use of mobile health sensors including detection of behavioral targets such as cocaine use and smoking, understanding interactions between multiple behaviors through multi-modal sensing, prediction of future behavioral context, design of novel ultra-low power behavioral sensing platforms such as computational eyeglass for visual context sensing, and incentive strategies for mobile health. He is one of the thrust leads for the NIH funded MD2K Center for Excellence on Mobile Sensor-to-Knowledge (`http://md2k.org`) and on the advisory board of the Center for Personal Health Monitoring at UMass Amherst, a $40 million center for new health devices.

Benjamin Marlin is an Assistant Professor of Computer Science in Fall 2011 where he co-founded and co-directs the Laboratory for Machine Learning and Data Science. His research interests are in machine learning with a focus on models and algorithms for multivariate time series data. His applied work focuses on machine learning-based analytics for clinical and mobile health (mHealth). Marlin was a fellow of the

Pacific Institute for the Mathematical Sciences and the Killam Trusts at the University of British Columbia prior to joining UMass. He received his PhD in machine learning from the University of Toronto. Marlin is a 2014 NSF CAREER award recipient and a 2013 Yahoo! Faculty Research Engagement Program award recipient. Marlin has served on the senior program committee of top machine conferences including UAI and NIPS, and is an organizing committee member for ICML 2015. He served as general co-chair of the 2014 Meaningful Use of Complex Medical Data symposium.

Prashant Shenoy is currently a Professor of Computer Science at the University of Massachusetts Amherst. He received the B.Tech degree in Computer Science and Engineering from the Indian Institute of Technology, Bombay and the M.S and Ph.D degrees in Computer Science from the University of Texas, Austin. His research interests lie in distributed systems and networking, with a recent emphasis on cloud and green computing including sustainability aspects of the smart grid and smart buildings. He has been the recipient of the National Science Foundation Career Award, the IBM Faculty Development Award, the Lilly Foundation Teaching Fellowship, and the UT Computer Science Best Dissertation Award, and several best paper awards at leading conferences. He serves on editorial boards of the ACM Transactions on the Web and the Multimedia Systems journal and program chair of ACM eEnergy and ACM BuildSys. He has previously served as the program chair for ACM Multimedia, ACM Sigmetrics, World Wide Web, Performance, Multimedia Computing and Networking, IEEE Comsnets, and was the founding chair for USENIX Hotcloud . He is a distinguished member of the ACM and a fellow of the IEEE.