Invited Speaker and Special Presentation Abstracts

Integrating Genome-Wide Association Studies for Data-Driven Personalized Medicine

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The lab of Atul Butte builds and applies computational tools that convert more than 300 billion points of molecular, clinical, and epidemiological data-measured by researchers and clinicians over the past decade-into new diagnostics, therapeutics, and novel insights into disease. Dr. Butte, a bioinformatician and pediatric endocrinologist, will highlight his team’s recent work on clinical evaluations of patients presenting with personal genomes, enabled by the largest curated database of human disease-associated SNP's. With so many genomes now sequenced from individuals from a variety of ethnic backgrounds, and analyzed in a clinical context, Dr. Butte will present how ethnicity alters the background distribution of disease SNP’s. Finally, Dr. Butte will also present his team’s recent work on environment-wide association studies (EWAS) and how they enable studies of gene-environment interactions.

Applications of Long-Term Personal Digital Archives

*Sudheendra Hangal*
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Over a billion users are acquiring detailed digital life-logs in the form of email archives, instant messenger logs and social network data. While these life-logs contain rich and valuable personal details, they are often based on unstructured text, which is a challenge to make sense of. We explore the question of how these life-logs can be used in everyday applications, and describe three applications useful for mainstream users. First, we show that email archives can be effective tools for the purposes of reminiscence and describe a series of techniques that are useful for this purpose.

Second, we show that links from archives of emails and tweet streams identify high-quality sites personalized for a specific user. Using these sites, we can create a search index that is competitive with personalized Google search. Moreover, it implements personalization on the client side without leaking much information to Big Brother services.

Third, we introduce the concept of an experience-infused browser, a web browser that is aware of the user’s personal history. While surfing the web, the browser contin-
uously looks up terms on the current page in the index of the user’s digital archive, and simply highlights terms on the page that the user has encountered in the past. Our studies show that this system is useful for effectively personalizing a page, as well as for serendipitously remembering things that the user may have forgotten about, thus bringing us closer to the promise of total recall.

Our ideas are implemented in some publicly available systems: Muse (mobisocial.stanford.edu/muse), Slant (mobisocial.stanford.edu/slant) and Experience-infused browser (mobisocial.stanford.edu/exp-browser).

Heart Rhythm Coherence: New Technologies for Improved Wellness and Cognitive Functioning

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The analysis of heart rate variability (HRV), or heart rhythms, provides a reliable measure of autonomic nervous system dynamics that is particularly sensitive to changes in stress and emotional state. Whereas common methods of HRV analysis typically quantify the amount of variability in a given recording, additional information can be gained by heart rhythm pattern analysis. Research has shown that sustained positive emotions lead to a highly efficient and regenerative functional mode associated with increased coherence in heart rhythm patterns and greater synchronization and harmony among physiological systems. A new development in monitoring technology is the recent introduction of heart rhythm feedback trainers (emWave), which monitors heart rhythm patterns and help people develop skills to maintain states of increased heart coherence. The technology is extremely versatile, time-efficient, and easy to use in a wide variety of settings. Heart rhythm feedback trainers are currently utilized in medical, mental health, corporate, and academic settings to improve clinical, psychological, and performance outcomes. This technology holds promise as a powerful and practical tool for the enhancement of health and human potential.

Coherence can be objectively defined and measured and by practicing practical, positive emotion refocusing techniques that enhance states of appreciation, individuals can learn to self-orchestrate coherence with increased consistency, thereby reducing stress and enhancing health, emotional stability, performance and quality of life. Studies conducted across diverse populations have associated the use of coherence building technologies with a wide range of significant positive outcomes both in terms of personal health and wellness including reduced anxiety and depression, enhanced cognitive performance, reduced physical stress symptoms, improved hormonal balance and enhanced immunity. 1-3 Numerous workplace improvements such as improved social cohesion, communication, shorter meeting times, reduced health care costs, and employee turnover have also been demonstrated. Studies show improved academic performance, test scores, and class room behaviors.
Self-Tracking: A Fundamental Pathway for Behavior Change

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Behavior change, especially health behavior change, is a deeply complex topic steeped in insights and exploration from various disciplines. Current research in the field of health psychology has recently explored and highlighted the role of self-tracking as an effective tool for health behavior change. While self-tracking is a promising avenue to explore, there is little insight into the mechanisms by which self-tracking may be providing individuals the means to change their behavior.

In the last few years there has been a swelling movement of individuals using self-tracking tools and systems to better understand and improve aspects of their lives. This growing community, Quantified Self, has blossomed into a worldwide movement of individuals discussing tools, methods and outcomes derived from self-tracking experimentation. The wealth of knowledge from the Quantified Self community provides us with a number of insights into not only how people use self-tracking, but also its possible future use cases as sensor and intelligent systems progress.

I will discuss the psychological background of behavior change theory and practice and how it informs the self-tracking framework I am currently developing. Furthermore, I will outline exciting new strategies currently being explored in behavior change that take advantage of self-tracking and adaptive dynamic intelligent systems for improving health behaviors.

Designing Health Messages: Framing for Exercise and Mindfulness
(Special Presentation)

Frank X Chen, Eric B Hekler, Shauna Shapiro, Abby King
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A new class of technologies is being created that combine the advantages of persuasive technologies, behavioral science, and self-tracking. Exergaming is a persuasive technology using video games as a type of exercise. Early research on a popular exergame shows little health outcome potentially due to decreasing use over time. One possible pathway to improve long term use is observing user intentions and feedback while using the system. Mindfulness processes have dramatic effects on an individual’s mental, physical, and emotional well-being through development of self-awareness and of paying attention with intention with an open, non-judgmental attitude. However, little is known about how lessons of mindfulness can be applied to fostering health behavior change via technology. We describe two preliminary studies exploring how persuasive technologies (that is, a Kinect Dance Central video game and a Smartphone Zen Bell application) can be influenced by attitudes and intentions to promote health and well-being. We conclude with a research agenda for future work in mindfulness and persuasive technology.