Understanding Students' Personal Rhythms

Anind K. Dey
Human-Computer Interaction Institute
Carnegie Mellon University
anind@cs.cmu.edu

Inspired by the work at Dartmouth on the StudentLife project, my research group has been brainstorming about work we could do on the Carnegie Mellon University campus to improve student health. This position paper provides a brief overview of our vision.

The academic success of students often comes at the cost of their physical and mental health. Sometimes even with those sacrifices, academic success does not follow. This is because the students often face heavy workload that they are not able to manage at their own pace. Appropriate management of time is a skill that can influence success, GPA, and health. Yet guidance about how to acquire a skill like this is mostly anecdotal. Massive Online Open Courses and other technology-enhanced learning systems offer the promise of allowing students to study and learn at their own pace and time. However, despite this personalization, they still do not explicitly help students in planning and organizing their learning around their own personal rhythms – repeated cycles of internal and external events and actions in a person's life including biological, mental, social, and environmental.

To address this issue, we propose the use of intelligent assistants. These assistant or agents can collect and observe low-level information about students from sensors on mobile phones, and human-provided data to detect student activities. They can use these activities to identify patterns in a student's life, and deviations from those patterns. The patterns and deviations (*i.e.*, rhythms) can be crudely categorized as positive or negative, using a combination of information about the student herself, or other similar students. With the categorization of patterns and deviations, an assistant can provide suggestions based on a student's rhythms (such as when to study to avoid procrastination or maximize retention, when to take a break, or when to sleep), to help reinforce positive strategies for being a student. In addition to these interventions, students may benefit from reflection on their routines and their outcomes, and scientists may benefit from having access to such rhythms for building theories about student health, and for building systems that can help people improve their choices about how to spend their time.

However, without an understanding of a person's personal rhythms throughout the day, it is difficult to explore these benefits for student health. Topic models, eigen-value based approaches, probabilistic context-free grammars, and temporal pattern matching has been applied to this problem, but with very limited results in capturing a human-understandable concept of rhythm. In particular, these methods are limited in their ability to extract contextualized rhythms and routines. However, theoretical analyses of habits and behaviors have shown that activities that are part

of routine behaviors must be considered within particular contextual settings. As most approaches do not explicitly model context and actions and their interplay, another approach must be taken to model and extract human rhythms. In our work, we are looking to explore novel modeling approaches.

The intelligent assistants we propose will use these models of rhythms to help students balance their life, health, and academic performance by encouraging and supporting the reflection of personalized rhythms. We seek to make students aware, on a daily basis, of what they could be doing with least effort and optimal outcome. Our goal is to enable students to improve their quality of life when studying in both traditional and future classrooms. Our research has three main objectives that would benefit both individual students and schools as communities:

- Improving academic performance through socio-personal balance and minimizing the cost of success (e.g., stress, health issues, loss of social/personal relationships)
- Lowering barriers to student retention and graduation by aligning educational requirements with student's personal rhythms, e.g., personalized tests and personalized performance measures that not only focus on academic success but also health and wellbeing
- Connecting campus members with similar and dissimilar rhythms to encourage dialog and an exchange of best practices

We envision such a system needing similar kinds of input data as found in StudentLife, such as data from a student's smart phone about physical activity, location, interaction with others, application and information interaction; data about class assignments and performance; eating; sleeping; etc. A holistic data collection seems to be necessary to address this very complex issue.

I have a background in Computer Science, and in Human-Computer Interaction and Ubiquitous Computing more specifically. Much of my research over the past 8 years has focused on generating an understanding of routine behavior for a variety of human behaviors, mostly for developing and delivering appropriate interventions. This work has involved mass data collection on smart phones and the application of machine learning.