Title

Designing Efficient and Accurate Behavior-Aware Mobile Systems

Author

Abhinav Parate, *University of Massachusetts - Amherst* Follow

Document Type

Open Access Dissertation

Degree Name

Doctor of Philosophy (PhD)

Degree Program

Computer Science

Year Degree Awarded

Summer 2014

First Advisor

Deepak Ganesan

Subject Categories

OS and Networks | Other Computer Sciences | Systems Architecture

Abstract

The proliferation of sensors on smartphones, tablets and wearables has led to a plethora of behavior classification algorithms designed to sense various aspects of individual user's behavior such as daily habits, activity, physiology, mobility, sleep, emotional and social contexts. This ability to sense and understand behaviors of mobile users will drive the next generation of mobile applications providing services based on the users' behavioral patterns. In this thesis, we investigate ways in which we can enhance and utilize the understanding of user behaviors in such applications. In particular, we focus on identifying the key challenges in the following three aspects of behavior-aware applications: detection, understanding, and prediction of user behaviors; and present systems and techniques developed to address these challenges. In this thesis, we first demonstrate the utility of wristbands equipped with inertial sensors in real-time detection of health-related behaviors such as smoking and eating. Our approach detects these behaviors in a passive manner without any explicit user interaction and does not require use of any cumbersome device. Our results show that we can detect smoking with 95% accuracy, 91% precision and 81% recall in the natural environment. Second, we design a context-query engine for sensing multiple user contexts continuously, accurately and efficiently on mobile devices; the key necessity for understanding and analyzing behaviors. Our context-query engine performs information fusion of contexts for an individual user to enable optimizations like i) energy-efficient sensing, and ii) accurate context inference. Our results show that we can improve accuracy of a context classifier by up to 42% and reduce the number of classifiers required to observe the user state by 33%. Finally, we demonstrate the utility of predicting app usage behavior, in improving the freshness of mobile apps such as Facebook that present users with the latest content fetched from remote servers. We present an app prediction algorithm that utilizes user contexts to predict the app a user is likely to use and pre-fetches the data over the network for the predicted app. We show that our proposed algorithm delivers application content to the user that is on an average fresh within 3 minutes.

Recommended Citation

Included in

OS and Networks Commons，Other Computer Sciences Commons，Systems Architecture Commons

Share