UNDERSTANDING USER BEHAVIOUR BY MINING SMARTPHONE USAGE PATTERNS AND EXPLORING THEM TO IMPROVE USER EXPERIENCE

UNIVERSITY OF BIRMINGHAM

AUTHOR
KARTHIKEYA UDUPA KUPPAR MANJUNATH

SUPERVISOR
DR. MIRCO MUSOLESI & DR. VELJKO PEJOVIC

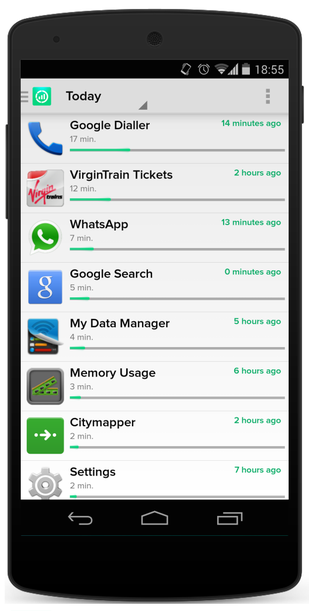
Introduction

Over the past decade we have seen several technological advancements which have created a huge impact on mobile platforms, allowing them to evolve not only in terms of usability and dependability but also have made them economically feasible for the masses. Trends in several emerging markets indicate that there is not only a tremendous increase in mobile activity but also a clear indication that the people are moving from traditional computing platforms to mobile devices. This makes mobility all the more interesting and essential area in terms of research.

The objective of the research was to establish a framework for mobile applications to extract contextual data from the mobile devices, use the platform to develop an application to collect real-world information from real users and then to further mine the data and extract information and use it for future applications which would not only improve the mobile platform's usage experience but also help us understand the way users interact with mobile devices in a better manner.

Context Sensing Framework & WebSense: Collection of Information

The Context Sensing Framework was developed as a ready to integrate component with any android to assist in extraction of contextual information. WebSense was developed upon this framework to collect various types of contextual data. The information was then sent to a server component developed for this purpose. The server also provided several APIs for the app to provide trends in app and web usage.



WebSense Android Application

User Application Usage
User Web Usage
Location
Bluetooth Connections/Proximity
Battery
WiFi Connectivity/Near-by Points
Events
Phone Status/Settings
Screen Status
Network Signals & Near-by Towers

Context Sensing Framework

mongoDB

node.js

Customised Network

WebSense Android App

Web Services API For Prediction/ Trends/Recommendation

Machine Learning Algorithms Applied On Applicable Data

WEKA The University of Waikato

MapReduce, Geo-Clustering, Location Identification & Tagging

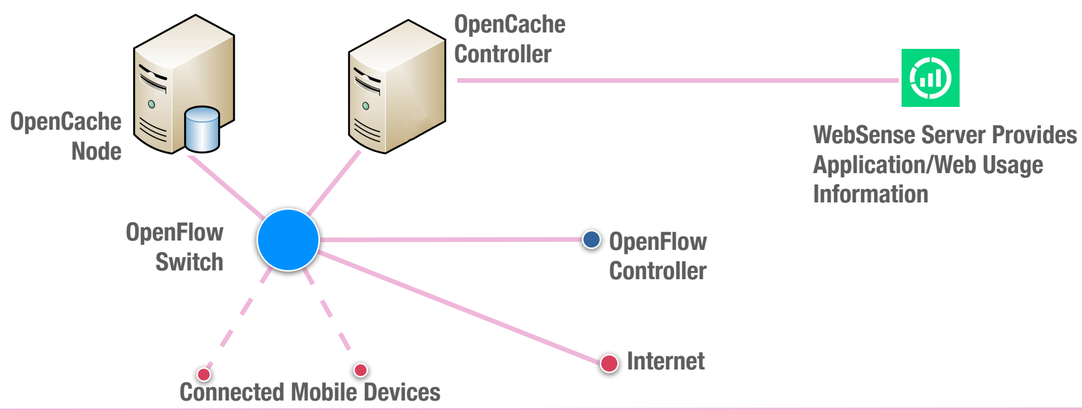
foursquare

User Activity Prediction Model

App usage however was the primary focus of the research. The collected data was processed and ran through several geo-clustering and cleansing techniques to extract key locations such as a person's house and office locations and tag the usage appropriately. Similarly, other public places were identified using reverse geocoding and the data was tagged into several categories. Machine learning algorithms were then applied to the data to extract user prediction models and to unearth interesting observations about app usage.

Improving Network Design with Software Defined Networking, OpenFlow & OpenCache

The prediction API provides us with methods that allow us to understand what people use at a certain place and at a certain time. This gives us a window of opportunity to improve the experience of the user by altering networking design by utilising the information at hand. We use technologies like Software-defined networking and OpenCache to provide a model to showcase a novel idea for network improvement. Allowing networks to cache requests before-hand to provide a smoother experience for the user.



Results and Conclusion

The data was analysed and various models were created from it. The app usage data was processed to identify home and office location for each individual, based on which the data was tagged, cleaned and ran though machine learning algorithms. Application category was the the parameter that was being tried to be correctly classified. The accuracy of the prediction varied from person to person with some as high as 95.75% with an average of 65% throughout the group. A model was generated based on the various categories of locations that were detected by reverse geo-coding the data, based on the location and time, the category of the application used at that instance was classified with an positive rate of 95%.

The information used to build model however is based on a limited set of people without much diversity, with a bigger and diverse pool of user a even more accurate model can be build for both web and app usage. As shown by the new networking model several other changes can also be made in the way applications are designed to provide ways in which network and mobile usability in general can greatly be benefited.