Localized Analysis Framework via Smartphones

Thanks to the proliferation of smartphones, mobile data is opening a world of opportunity with new ways of studying human behavior. A smartphone uses local memory to store a great deal of data about an individual and their surrounding environment. That mobile data includes physical activity, location, personal contacts, phone call logs, text messages, photos, videos, and more. Mobile data is stored on the device automatically every moment, and most of the time, users are not even aware of what is going on in the background of the smartphone.

Smartphones contain extremely rich data, but privacy concerns are significant. Users are unlikely to find it acceptable to have outsiders poking around their phones, and few would give informed consent for others to use their photos and text messages, even for research. However, by harnessing the computing powers of smartphones, I am proposing a new solution for data collection and analysis in which: (1) A smartphone app analyzes locally stored individual data about the user of the device and sends only the analysis results to the research host. (2) Researchers aggregate the individual results and interpret meanings of emerging patterns of the whole sample. In this framework, researchers never collect the raw data; they only have access to the processed individual results.

Mobile data are, unlike traditional data curated by researchers, heterogeneous and not well-quantified. Exploratory analysis using machine learning will play an important role in taking advantage of mobile data, such as text messages, photos, and GPS information. In this study, I will use support vector machines (SVMs) for localized analysis on smartphones and visually inspect the aggregated patterns. I suggest fitting SVMs on each smartphone, sending the individual patterns detected by SVMs to the research host, and recover the underlying overall patterns at the whole sample level.

This study aims to demonstrate the potential utilities of the proposed localized analysis framework using smartphones with an emphasis on exploratory analysis using machine learning. The employed method using SVMs is one of many methods possible in the localized analysis framework. The current study is a showcase of the proposed framework and will demonstrate concrete steps of analysis and interpretation.