

## Real-Time Mobile Analytics: Making sense of the urban world



By Singapore Management University | Editorials  
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When turned into a sensing platform, smartphones can generate powerful insights into consumer activities in the physical world, says SMU Associate Professor Archan Misra.

*AsianScientist* (Nov. 4, 2013) – By Dora Yip – Imagine a scene in the not too distant future. You take a train to the mall to meet a friend for lunch. As you reach your destination, you receive an alert telling you the restaurant you were planning to go to is full. The message also suggests a couple of alternative dining options based on the customised promotions they are offering and their predicted occupancy level 15 minutes from now. You make a quick decision, update your friend, and head to an alternative restaurant.

The act is subtle, seamless and time-saving. Powering it is the ubiquitous smartphone, a device already embedded with a variety of sensors ranging from accelerometers to compasses, microphones, gyroscopes and, more recently, barometers.

This is the vision Associate Professor Archan Misra at the Singapore Management University (SMU) School of Information Systems has for mobile sensing and analytics technology in the future.

“By enabling us to observe, capture and infer the everyday activity traces of millions of individuals, smartphones have already opened up new frontiers in human activity understanding at both the individual and societal scale,” he says.

“What we’re now exploring is the ability to harness this knowledge, in real time, to predict and simplify human behaviour while being engaged in everyday activities such as shopping, dining or commuting, especially in public urban spaces.”

What attracted Professor Misra to mobile sensing research was the potential for it to help individuals make sense of all the data assailing them on a daily basis. This is especially the case in urban environments where individual behaviour is often a response to complex group dynamics and rapidly changing ambient conditions.

“Our most precious resource is human attention. With all the fancy technology permeating our environment today, we are getting overloaded with data. Automated technology can help us sift through the data to give us the high-level insight we care about. Think of it as a concierge-style service based on individualised information.”

The broad implications of Professor Misra’s research have been recognised by industry heavyweights like IBM Research and Xerox Research, who are funding and partnering his team and colleagues on various projects, such as applying mobile sensing to understand shopper behaviour.

“We started off by asking our research and industry partners what they wanted to know about consumers. By combining their responses, we realised there are certain things we can deliver in the short term, like indoor location to within a five to seven metre accuracy. By combining mobile sensing with information from other sensors widely available in indoor public spaces, we can also track whether people are walking, standing in queues, or taking pictures of their friends,” he says.

“We must also appreciate that retail behaviour is influenced not only by who the consumer is as an individual, but also by the dynamic context they are in. You look for different things and consumer experiences when you are alone or with your parents, spouse, children and friends. Being able to understand the size and type of your group is thus very important.”

But preserving individual privacy remains a challenge, and Professor Misra’s view is that participation is best achieved via an opt-in feature, so that consumers can decide whether the benefits of turning on their sensing devices to enjoy certain perks and promotions outweigh the costs of sharing data.

“In all our research, we transform the data so that it meets the needs of analytics. However, we also apply techniques that strip away personal sensitive information so that only the extracted insight is accessible, and not the low-level data,” he says.

### **LiveLabs Urban Lifestyle Innovation Platform**

In April 2012, Professor Misra and his colleague, Associate Professor of Information Systems Rajesh Balan, formally initiated work on the LiveLabs Urban Lifestyle Innovation Platform, which develops advanced mobile computing services and tests lifestyle-driven consumer use of such services in public spaces.

“Singapore provides a living laboratory of real urban challenges, coupled with a very mobile-savvy population,” says Professor Misra.



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After a year of core technology development, LiveLabs went live in August 2013 with a project that aims to accurately track the behaviour of several hundred SMU student participants on campus. Using existing sensors built into participants' smartphones and analytics algorithms, the team will detect, for example, how fast people are walking, whether they are walking up a flight of stairs or using an elevator, how much time students spend in outside-class project activities, and what groups the students are part of.

Successfully applying these promising technologies in the real world environment, however, presents serious challenges. In the real world, sensor signals are tainted with a lot more 'noise', with regular human behaviour (eg. playing a mobile game while waiting in a queue) complicating the data collection process. To transform raw-level sensor streams into a higher-level context (eg. a group of four friends are queuing for movie tickets), the team is optimising query execution on mobile devices and data retrieval over diverse wireless network infrastructures.

LiveLabs has since secured the support of major partners including CapitaMalls Asia, one of Asia's largest mall owners and operators. In the next six months, LiveLabs will roll out a study in one of CapitaLand's major malls to track participants' indoor location and activities accurately. Also in the pipeline are similar studies to be done in partnership with Changi Airport Group and Sentosa Leisure Group.

Within SMU, LiveLabs will be working with the Lee Kong Chian School of Business marketing department to develop more effective advertising and promotional strategies that take into account the real-time nuances of shopper behaviour and avoid the pitfalls of 'spamming'.

The researchers also plan to team up with sociologists and behavioural psychologists from the School of Social Sciences to test theories of individual and group behaviour in real-world settings, such as tweeting behaviour. For example, what contextual factors influence when people forward or retweet a message? Do they forward a tweet when they are having lunch with friends or when they are alone? Are they more likely to tweet something negative if they are waiting in a queue?

"The implications for this type of real-time activity sensing and understanding of consumer interests, moods and intent are pretty profound for the business world. Businesses will be better able to interact with consumers, understand their preferences and even predict their behaviour. This will improve customer satisfaction in the long run.

"This real-time understanding of not just one individual, but of urban spaces, will prove vital in a variety of business operations, whether it is retail and marketing, crowd tasking, inventory management or leisure and tourism," he says.

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