Monitoring and addressing stress

19 Aug 2019

Nur Camellia Binte Zakaria, a PhD graduate from the SMU School of Information Systems, seeks to use WiFi network data to identify and help stressed-out students.

By Alvin Lee

SMU Office of Research and Tech Transfer – Imagine being in university with exams just round the corner and mugging for days on end. Throw in sleep deprivation and disagreement with classmates on meeting assignment deadlines. Then top it off with an argument with your significant other. It all adds up to one word: stress.

While most tertiary institutions have counsellors to help students manage the inevitable pressures, it is perhaps better to identify those who might be struggling to cope before it affects their grades or mental well-being. One researcher at SMU is attempting to do just that using WiFi network data.

"We are collecting data that infer behaviour directly from the environment," explains Nur Camellia Binte Zakaria, a recently graduated PhD student at the SMU School of Information Systems (SIS). Her project, named StressMon, "leverages the LiveLabs WiFi indoor localisation system as well the GruMon Group detector system which basically feeds on the location system produced by LiveLabs to cluster connected devices together into logical groups."

She adds: "When a person connects to the campus WiFi, it logs the connection that your mobile device makes to a WiFi access point, a nearby one. With some probability, we can derive that you and I are in this room at a certain time for whatever duration. This WiFi indoor localisation system allows us to localise an individual using their phone as the 'best' proxy for user movements because users bring their phones virtually wherever they go."

StressMon uses this data, which is anonymised, to ascertain individual and population baselines against which individuals are compared. Camellia elaborates: "We are drawing behavioural comparisons against the past periods of your own and your population. So it looks at my baseline and how much I differ from it. But it also looks at how different I am from my peers who are in the same class as me.

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“For example, the trend of a person who spends too much time working compared to everyone else in his or her group might be indicative of severe stress. We are also looking at group interaction patterns, such as the time they spend studying with their peers on campus.”

StressMon does not require students or users to download an app, but one does need to turn on the WiFi connection on their mobile devices for StressMon to track them and collect the necessary data. It is not something that every student is comfortable doing, and some students do fall back on their own data plans to avoid being tracked.

Delivering intervention

Camellia further explains that StressMon does not detect stress in real-time but instead it looks at changes in behaviour via an algorithm over six-day intervals. Data covering a 15-day period is needed when determining the need for intervention in cases of depression.

“We believe a system which prioritises accurate detection of the more critical cases is the right tradeoff for an early warning solution. Depression is a condition which is evaluated over a two-week period using clinically-verified assessments. Our system monitors user behaviour over two weeks to compare the changes in their routines, similar to the period of assessment for depression at present.”

While the actual benefit of the tracking such as being referred to trained psychiatrists has not yet been fleshed out or implemented, Camellia reassures that the project is about providing social benefit. With users’ explicit permission, data can be decrypted to provide personalised intervention. But even in cases where individual identities are not known, Camellia says it is still possible to address issues of stress.

“That is under the collective level of intervention,” she says. “There are many ways in which we can help someone we don't know. We could have lecturers act as mediators. If StressMon is able to inform instructors of an unknown and highly stressed individual in his or her class, that intervention need not be directly delivered to the student.

“Lecturers could tailor the syllabus to make it less stressful or just provide mindful tips, or perhaps encourage them to do some light activities.”

Future research

The idea of “applying mobile systems to solve immediate concerns of mental health” has been the focus of Camellia’s research since the start of her PhD journey, she tells the Office of Research & Tech Transfer. For StressMon, Camellia worked with Associate Professor Rajesh Krishna Balan, and Associate Professor Youngki Lee, who is now at Seoul National University in South Korea. Camellia is looking forward to exploring other health-related systems to provide personal assistance for everyday users, including people with disabilities and disadvantages.

“Software systems as a research area includes a broad range of topics from data mining, network security, and systems attached to mobile computing,” says Camellia. “The idea of mobile computing and psychology would comfortably sit in the category of applied science. Where I am as a researcher is connecting this basic research of developing, testing hypothesis, and fundamentally using my knowledge in mobile computing to address problems related to health. This involves an equal understanding of human behaviour.”

Advances in mobile computing have enabled much potential for researchers to understand human behaviour, which include physical, cognitive, emotional, and social aspects.

“Understanding how a user interacts with the commodity device provides us with various sensing modalities related to physical. How much time you spend in a particular place allows us to infer the kind of activities you are engaged in, for example using GPS. And then we also have cognitive, in the sense that we can understand how human beings process information through the ways applications are being utilised.

“Then there are emotional responses where people respond to situations – the state of mind, the mental well-being, which is really quite what I am focused on. And finally, social behaviour, which is not just interacting in a virtual space but also how people interact with one another.”

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