Extracting useful scientific information from social media

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Credit: AI-generated image (disclaimer)

In the second it takes to 'like' this article, 6,000 tweets, 5,000 profile updates, 4,000 photos and 500 blogs will have been posted on multiple social media platforms. As that second extends to a minute, a day and even a year, more than 2 billion people around the world will have checked in and out of their virtual networks hundreds and thousands of

times. Researchers at A*STAR are putting this wealth of 'breaking news' about what people are thinking, feeling and doing to good use, whether to visualize the spread of the avian influenza virus in virtual space, or to gain new insights into human psychology for better marketing.

"Our work is geared toward studying people-centric issues and human behavior, and translating this knowledge into social technologies that can be deployed in solving real-world problems," explains Quek Boon Kiat from the Social and Cognitive Computing Department at the A*STAR Institute for High Performance Computing (IHPC). The department combines rigorous psychological studies, computational virtuosity and reams of publically available data to serve the needs of business, government and health. "Whatever smart or superior technologies we develop should ultimately be used by people in an organization or in a social setting," adds Yinping Yang, also at the IHPC.

Network-based models

Quek first realized the importance of psychology in designing robotics and computer systems during his PhD. His research involved building behavioral control systems that would enable robots and unmanned vehicles to survive on their own in remote and harsh environments. "It was necessary to look more deeply into human psychology and cognition to find clues, and in this case, design principles, that could guide the development and construction of artificially intelligent systems," he recalls.

Now head of the Integrative Psychological Modelling team at the IHPC, Quek not only develops artificial systems inspired by human cognition, but also uses computational techniques such as network-based models to study human psychology. Network-based models consist of 'nodes'—defined in psychological terms as personality traits, values, beliefs, interests, temperaments and behaviors—and 'links' connecting

them. Researchers in Quek's team collect information about the relationship between these psychological constructs from relevant peer-reviewed papers. "These relationships are then integrated to create the models on which our algorithms can operate," explains Quek.

The psychological insights gained from these models could be used to assess the suitability of job applicants, to match volunteers with appropriate tasks and to customize curricula to individual learners, in addition to many other potential applications in finance, consumer profiling and market segmentation, education, and human capital management.

Yang Yinping (second from right) and Quek Boon Kiat (far right) with colleagues from the Institute of High Performance Computing at the Smart Nation event showcasing their social technologies for sentiment analysis and psychographic profiling. Credit: A*STAR Institute of High Performance Computing

Social contagion

Information in linked social groups can sometimes spread like infectious diseases. Quek's group also develops advanced algorithms to characterize and measure such crowd-level behavior and social contagion, which

could serve as early indicators for their reemergence.

When the Avian influenza strain H7N9 swept through Asia in 2013, for example, signs of outbreaks rippled across social media long before information was released by official channels. Quek's team collaborated with Yang's Social Intelligence Team, and Singapore's Ministry of Health to examine social network activity during that period. They wanted to develop a system that could provide policy makers with timely information about the outbreak and spread of disease and public panic.

They focused on the specific case of China, collecting information released and disseminated on China's most popular social network, Weibo, during the month of April 2013. Among other findings, they discovered that Weibo provided significantly more timely information about the virus's spread than other traditional information channels, including leading news agencies and the World Health Organization. Their analysis provided an empirical basis for implementing a social-media-enabled surveillance and analysis platform for public health officers to track global disease outbreak, analyze the risks and enhance policy decision-making.

Yang's team took the analysis further to assess changes in public sentiment. They examined Singaporean reactions to the spread of H7N9 on Twitter and observed a swell of negative sentiment when confirmed human cases were reported in Taiwan, but not when a large volume of cases were reported in mainland China.

Sentiment analysis and socially intelligent systems

Awareness of sentiment change is essential for governments seeking to communicate with the public during times of crisis but can also be critical for businesses. In developing applications that can enhance business and social processes, Yang uses the essential knowledge and

skills gained during her PhD in information systems—a field that combines computer science, management science, social psychology and behavioral sciences.

Her team is developing linguistic processing tools to mine publically available social media exchanges for meaningful information about social sentiment. Their innovative algorithms rely on a variety of dictionaries to decipher emoticons, internet slang, colloquial expressions, and even the native 'Singlish' language, which draws from dialects such as Hokkien, Cantonese and Malay. The information is then processed using advanced linguistic analytic modules, cloud computing and big data technologies such as parallel processing. "The data is huge, and it comes in real time," says Yang. "The IHPC has a lot of in-house knowledge and engineering capabilities to collect, process and retrieve big data, so we've benefitted from that collaboration."

Beyond sentiment analysis, Yang and her team want to make artificial intelligences, or AIs, more intelligent with well-intended psychological tactics. In 2014, they developed socially intelligent software agents for e-commerce negotiations. The software agents bargained online with study participants over the purchase of laptop computers, negotiating on unit price, order size, additional services and delivery time. The team found that by tactfully disclosing information about their priorities during negotiations, the agents were able to reach outcomes that satisfied both parties in 80 per cent of the cases.

Use of these agents could spread beyond traditional business applications. "The underlying mechanism applies to the social environment as well, where multiple issues are at stake and you need to arrive at a decision," says Yang. Not all people handle conflict well. In sensitive cases requiring mediation—such as divorce—computers could act as good surrogates to avoid emotional upset. And with the endless examples of how humans negotiate their small and large differences over

social networks, the AIs' decisions will be extremely well-informed.

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