

# SOCIAL **Social Intelligence and Technology** TECHNOLOGY

Christopher C. Yang, *Drexel University*

John Yen, *Pennsylvania State University*

Jiming Liu, *Hong Kong Baptist University*

**T**here's no doubt that social media is making a huge impact on our society. It increases the connectivity among social media users by reducing the time and geographical barriers. Information is spreading out in a much faster pace through social networking. Activities in social media aren't limited

to the virtual space—they're also having significant influence on real-world events. Applications have been extended from entertainment and business to many other fields such as healthcare, crisis management, public safety, finance, education, e-government, and more. In the last decade, we've witnessed how social media has made an impact on presidential elections, facilitated emergency response to disasters, enabled social movements such as Occupy Wall Street, and supported health consumers in acquiring healthcare knowledge

to cope with their health conditions. It has also created new problems, such as online bullying and cybercrime. As social media continues to evolve, more effort is needed to identify new opportunities, as well as coping with new problems arising in our society.

Social computing is inherently interdisciplinary, involving researchers, scientists, and practitioners from diverse fields—such as cognitive science, computing, engineering, information science, social science, psychology, sustainability science, economics, business,

human-coupled complex systems, human factors, behavior modeling, neural science, linguistics, security, criminal intelligence, health, and public policy. Thus, as Fei-Yue Wang and his colleagues anticipated, from theoretical and technological perspectives, the scope of social computing will move beyond social information processing toward emphasizing social intelligence.<sup>1</sup> Social intelligence and technology explore the roles of information, the Internet, and mobile technology in improving our understanding about human behaviors and social interaction in human society at the individual, interpersonal, and community levels—building a sustainable social environment, developing social intelligence, and having practical applications with major impacts in solving societal problems such as health, security, energy, and the environment. In the following sections, we provide more detail on some of these instances.

### **National Security and Public Safety**

Extremist, terrorist, and criminal organizations are actively using social media to propagandize their ideology, recruit members, or identify victims while billions of social media users are unaware that their private information has been unlawfully accessed and compromised or that they're being targeted for a cybercrime. Hsinchun Chen<sup>2,3</sup> has explored the social media mining techniques in the Dark Web, which is heavily used by extremist and terrorist groups for communication, recruiting, ideology sharing, and radicalization. Other efforts have been made to identify clusters using temporal coherence analysis<sup>4</sup> and predict participation in the Dark Web.<sup>5</sup> Sex crimes such as human trafficking and sex pornography are also active in social media. Different methods have

been compared to detect child sexual exploitation content.<sup>6</sup> It has also come to light that the distribution of sexually explicit material can be targeted through anti-money laundering due to its lucrative nature.<sup>7</sup>

### **Emergency Response**

Emergency response includes a number of phases with activities aimed at mitigating the impact of disaster to human lives and property. Information relevant to decision making is critical and is spread across a wide range of sources. Social media has emerged as a major communication mechanism for seeking and offering information, resources, and relief, as well as searching for survivors during crisis. Exploiting social media to gain awareness of an incident, how it's impacting society, and what the emerging needs are have become a critical direction for research in effective emergency response.<sup>8</sup> Jie Yin and her colleagues<sup>9</sup> have discussed a system architecture that includes key components such as burst detection, text classification, online clustering, geo-tagging, and visualization interfaces for analyzing social media data for emergency situation awareness.

### **Healthcare**

Social media has also emerged as a major source for data for real-time epidemiology research.<sup>10</sup> Detecting flu trends using search engine queries<sup>11</sup> and tweets<sup>12,13</sup> has proven to be promising. Healthcare social media sites such as MedHelp and Patient-LikesMe have been a useful source for e-patients to seek for informational and emotional support.<sup>14,15</sup> The latest survey of the Pew Internet and American Life Project reported that 72 percent of adult Internet users searched online for health information, and 26 percent adult Internet users read their peers' experience on health or medical

issues.<sup>16</sup> E-patients and caregivers are actively discussing symptoms and medical treatments with other patients who have similar experience. Some research efforts have been made to identify the influential users in healthcare social media sites.<sup>17</sup> Baojun Qiu and his colleagues<sup>18</sup> conducted sentiment analysis on the American Cancer Society Cancer Survivors Network (CSN) and found that more than 75 percent of CSN participants changed their sentiment in a positive direction interacting with online peers. The big data in healthcare social media has proven to be a timely data source for drug safety signal detection, including adverse drug reactions<sup>19,20</sup> and drug-drug interaction.<sup>21</sup> In recent years, mobile apps integrating with wearable sensors are becoming more popular. Continuous health data are captured globally. In this sense, social media is empowering health consumers to take an active role in maintaining their health. Preventive and personalized healthcare can also be developed by aggregating data from heterogeneous sources extensively.

### **In This Issue**

The articles selected for this special issue of *IEEE Intelligent Systems* are examples of advances made by using social intelligence to solve societal issues. For example, in the first article, "Real-Time Crisis Mapping of Natural Disasters Using Social Media," Stuart Middleton and his colleagues mapped geoparsed real-time Twitter data streams to the locations of areas at risk of disaster, extracted from multiple sources—including gazetteer, street map, and volunteered geographic information sources. They conducted two studies, using data from Hurricane Sandy in 2012 and an Oklahoma tornado in 2013, to evaluate their proposed platform. A high precision was achieved in both studies.

## THE AUTHORS

**Christopher C. Yang** is an associate professor in the College of Computing and Informatics at Drexel University. Contact him at [chris.yang@drexel.edu](mailto:chris.yang@drexel.edu).

**John Yen** is a professor and director of strategic research initiatives in the College of Information Sciences and Technology at Pennsylvania State University. He is also the director of the Intelligent Agents Laboratory, and a founding member of the Cancer Informatics Initiative. Contact him at [jjyen@ist.psu.edu](mailto:jjyen@ist.psu.edu).

**Jiming Liu** is the chair professor in computer science and associate dean of the Department of Computer Science at Hong Kong Baptist University. Contact him at [jiming@comp.hkbu.edu.hk](mailto:jiming@comp.hkbu.edu.hk).

Next, in the article “Analyzing the Political Landscape of 2012 Korean Presidential Election in Twitter,” Min Song and his colleagues conducted a study to analyze the social and political issues of the Korean presidential election using Twitter data. In particular, they employ temporal Latent Dirichlet Allocation (LDA) to validate the relationship between the extracted topics and the related real-time events.

In the article “User Recommendations in Reciprocal and Bipartite Social Networks—An Online Dating Case Study,” Kang Zhao and his colleagues developed a collaborative filtering model for user recommendation in reciprocal and bipartite social networks. The reciprocal and bipartite social networks assume that there are two types of users in the network and a relationship can only be established between two users if they both agree. For examples, job applicants and recruiters in a job application network and male and females users in a dating social networking site are examples of reciprocal and bipartite networks. The authors leverage users’ historical activities to develop a collaborative filtering model, focusing on users’ tastes and attractiveness. By capturing this information, the proposed collaborative filtering model outperforms the baseline collaborative filtering models.

Finally, in “Reducing Mistrust in Agent–Human Negotiations,” Yinping Yang and her colleagues conducted a behavioral experiment and found that a software agent can alleviate mistrust in human counterparts in multi-issue negotiations by proactively volunteering additional information during a negotiation that might not ordinarily be disclosed.

and technology. Understanding the practical problems in a domain and the nature of social media are critical in developing advanced social intelligence and technology techniques. As social media continues to evolve, there are unlimited opportunities to explore, as well as new challenges to face. ■

## References

1. F. Wang, D. Zeng, K.M. Carley, and W. Mao, “Social Computing: From Social Informatics to Social Intelligence,” *IEEE Intelligent Systems*, vol. 22, no. 2, 2007, pp. 79–83.
2. H. Chen, “From Dark Web to Geo-Political Web: Exploring the Value of Social Media Informatics,” *Proc. European Intelligence and Security Informatics Conf.*, 2012; doi:10.1109/EISIC.2012.70.
3. H. Chen, “Dark Web: Exploring and Mining the Dark Side of the Web,” *Proc. European Intelligence and Security Informatics Conf.*, 2011; doi:10.1109/EISIC.2011.78.
4. C.C. Yang, X. Tang, and X. Gong, “Identifying Clusters from Dark Web with Temporal Coherence Analysis,” *Proc. IEEE Int’l Conf. Intelligence and Security Informatics*, 2011, pp. 167–172.
5. X. Tang, C.C. Yang, and M. Zhang, “Who Will Be Participating Next? Predicting the Participation of Dark Web Community,” *Proc. ACM SIG-KDD Workshop on Intelligence and Security Informatics*, 2012, article no. 1.
6. Westlake, M. Bouchard, and R. Frank, “Comparing Methods for Detecting Child Exploitation Content Online,” *Proceedings of European Intelligence and Security Informatics*, 2012, pp. 156–163.
7. A. Antoniou and G. Sinha, “Laundering Sexual Deviance: Targeting Online Pornography through Anti-Money Laundering,” *Proc. European Intelligence and Security Informatics*, 2012, pp. 91–98.
8. S. Mehrotra et al., “Technological Challenges in Emergency Response,” *IEEE Intelligent Systems*, vol. 28, no. 4, 2013, pp. 5–8.
9. J. Yin et al., “Using Social Media to Enhance Emergency Situation Awareness,” *IEEE Intelligent Systems*, vol. 27, no. 6, 2012, pp. 52–59.
10. M.V. Marathe and N. Ramakrishnan, “Recent Advances in Computational Epidemiology,” *IEEE Intelligent Systems*, vol. 28, no. 4, 2013, pp. 96–101.
11. J. Ginsberg et al., “Detecting Influenza Epidemics Using Search Engine Query Data,” *Nature*, vol. 457, 2009, pp. 1012–1014.
12. V. Lamps and N. Cristianini, “Nowcasting Events from the Social Web with Statistical Learning,” *ACM Trans. Intelligent Systems and Technology*, vol. 3, no. 4, 2012, article no. 72.
13. M. Paul and M. Dredze, “You Are What You Tweet: Analyzing Twitter for Public Health,” *Proc. 5th AAAI Int’l Conf. Weblogs and Social Media*, AAAI, 2011, pp. 265–272.
14. K. Chuang and C.C. Yang, “Interaction Patterns of Nurturant Support

**W**e hope you find the articles in this special issue to be a useful introduction in social intelligence





**DISASTER ROBOTICS**  
Robin R. Murphy  
A comprehensive, authoritative, and accessible reference for disaster robotics that covers theory, specific deployments, and ground, air, and marine modalities.  
Intelligent Robotics and Autonomous Agents series  
248 pp., 43 illus., \$45 cloth

**CERTIFIED PROGRAMMING WITH DEPENDENT TYPES**  
A Pragmatic Introduction to the Coq Proof Assistant  
Adam Chlipala  
A handbook to the Coq software for writing and checking mathematical proofs, with a practical engineering focus.  
440 pp., \$50 cloth

**THE HORIZONS OF EVOLUTIONARY ROBOTICS**  
edited by Patricia A. Vargas, Ezequiel A. Di Paolo, Inman Harvey, and Phil Husbands  
An authoritative overview of current research in this exciting interdisciplinary field.  
Intelligent Robotics and Autonomous Agents series • 312 pp., 81 illus., \$50 cloth

The MIT Press ■ [mitpress.mit.edu](http://mitpress.mit.edu)

Exchanged in Online Health Social Networking,” *J. Medical Internet Research*, vol. 14, no.3, 2012; doi:10.2196/jmir.1824.

15. M. Zhang and C.C. Yang, “Social Support and Exchange Patterns in an Online Smoking Cessation Intervention Program,” *Proc. IEEE Int’l Conf. Healthcare Informatics*, 2013, pp. 219–228.
16. S. Fox, “The Social Life of Health Information,” *Pew Research FactTank*, 15 Jan. 2014; [www.pewresearch.org/fact-tank/2014/01/15/the-social-life-of-health-information](http://www.pewresearch.org/fact-tank/2014/01/15/the-social-life-of-health-information).
17. X. Tang and C.C. Yang, “Ranking User Influence in Healthcare Social Media,” *ACM Trans. Intelligent Systems and Technology*, vol. 3, no. 4, 2012, article no. 73.
18. B. Qiu et al., “Get Online Support, Feel Better—Sentiment Analysis and Dynamics in an Online Cancer Survivor Community,” *Proc. IEEE Int’l Conf. Social Computing*, 2011, pp. 274–281.
19. C. Yang et al., “Social Media Mining for Drug Safety Signal Detection,” *Proc. ACM CIKM Int’l Workshop on Smart Health and Wellbeing*, 2012, pp. 33–40.
20. C.C. Yang, H. Yang, and L. Jiang, “Postmarketing Drug Safety Surveillance Using Publicly Available Health Consumer Contributed Content in Social Media,” *ACM Trans. Management Information Systems*, vol. 5, no. 1, 2014, article no. 2.
21. H. Yang and C.C. Yang, “Harnessing Social Media for Drug-Drug Interactions Detection,” *Proc. IEEE Int’l Conf. Healthcare Informatics*, 2013, pp. 22–29.

**cn** Selected CS articles and columns are also available for free at <http://ComputingNow.computer.org>.