

GUEST EDITORIAL: Special Issue on Social Sensing and Privacy Computing in Intelligent Social Systems

THE dramatic spread of online social network services, such as Facebook, Twitter, Instagram, and Google+, has led to increasing awareness of the power of incorporating social elements into a variety of data-centric applications. These applications, in recent years, apply various sensors with social media platforms to continuously collect massive data that can be directly associated with human interactions. This phenomenon has led to the creation of numerous social sensing systems, such as Biketastic, BikeNet, CarTel, and Pier, which use social sensors (i.e., users) for a variety of social sensing systems and applications. Social sensing has become an emerging and promising sensing paradigm that relies on the voluntary cooperation of users equipped with embedded or integrated sensors.

The privacy issue, considering the above-mentioned situation, may become one of the most paramount concerns to ensure the long-term success of social sensing systems. Most existing approaches are designed for specific cases and/or scenarios. A systematical privacy computing model is urgently needed to quantitatively capture and evaluate the privacy protection solutions, the motivations of privacy disclosure, and so on. This systematical study of privacy issues is particularly important for social sensing systems in order to, e.g., quantitatively unveil the reasons for increasing privacy disclosure.

This special issue is devoted to the most recent developments and research outcomes addressing the related theoretical and practical aspects on social sensing and privacy computing in intelligent social systems, and it also aims to provide worldwide researchers and practitioners an ideal platform to innovate new solutions targeting the corresponding key challenges. This special issue received 34 submissions in total. On the basis of significance, originality, novelty, and presentation, 15 articles were selected to be included in this Special Issue. We will now introduce the 15 accepted articles.

Scanning the Special Issue

Social networks have integrated into the daily lives of most people in the way of interactions. The users' identity, relationships, or other characteristics can be explored from the social networking data. Perception of emotional intelligence (EI) contributes to predicting one's behavior or group behavior. The article entitled "*Sensing Users' Emotional Intelligence in Social Networks*" by Wei *et al.* focused on the exploration of users' characteristics and proposed EI prediction models

based on the sentiment analysis of social networking data. The models are represented by four dimensions, including self-awareness, self-regulation, self-motivation, and social relationships. The authors predicted the EIs of over 100 000 users. The results showed that the distribution of each of the four EI's dimensions of users is roughly normal and EI scores of females are generally higher than males. This is consistent with previous findings. The article suits the topic of exploration of users' characteristics in social sensing of intelligent social systems.

Online social media enable people to share their views, opinions, and emotions toward different events, products, and services. Processing this large volume of social information helps better understanding of peoples' opinion expressed in their writings. However, there are some challenges in extracting reliable information from users' comment, especially their long reviews containing multiple targets. The article entitled "*Improving Sentiment Polarity Detection through Target Identification*" by Basiril *et al.* proposed a new method to detect the main target of reviews and aggregate sentiment toward this target. The results on three data sets of user reviews show that specifying the main target of reviews can improve the performance of about 17% and 12% in terms of accuracy and F1-measure. In addition, the article entitled "*A Framework for Automatic Categorization of Social data into Medical Domains*" by Sharma *et al.* used an ontology-based approach to annotate medical domain data. Using Twitter as the social media platform to filter medical data from general category data, the authors showed an effective framework for filtering all medical-related terms from social media posts. The results showed that the framework can successfully apply ontologies in an approach that is completely unsupervised.

In online social networks, social information is often locally exploited rather than capturing the changes in the entire social network over the time. The article entitled "*A Social Sensing Model for Event Detection and User Influence Discovering in Social Media Data Streams*" by Shi *et al.* proposed a novel dynamic social sensing model, named Dynamic PageRank (DPRank), to evaluate the dynamic topical influence of the users of social information. The experimental results demonstrated the effectiveness of the DPRank model against the existing state-of-the-art methods while identifying the true influence of users and posts in a dynamically evolving social network, which contributes to the research of social sensing and privacy computing in intelligent social systems.

Mobile devices and mobile applications have become the center of people's digital and social lives. However, there are a lack of methods to extract information from the mobile

applications for social sensing and other studies. The article entitled “AMACS: Automated Mobile Application Content Sensing” by Jiang *et al.* proposed an automated mobile application content sensing (AMACS) framework that is a fully automated mobile application content sensing tool with large-scale deployment potential. The results show that the crawler can cover more contents efficiently in mobile applications with low overheads. The mobile content extracted by AMACS is indexed and can be used for application scenarios, such as social sensing and network measurements.

Social network data mining has attracted numerous attention. Traditional criminal suspect analysis methods consume a lot of resources, and criminal data are sensitive. To protect data privacy and improve analysis efficiency, the article entitled “SPCSS: Social Network Based Privacy-Preserving Criminal Suspects Sensing” by Xu *et al.* proposed a novel privacy-preserving criminal suspects sensing (SPCSS) scheme based on social data and criminal data. Specifically, a privacy-preserving data retrieving method was proposed to protect the access pattern. Several building blocks, including encrypted data comparing, secure classification, and regression tree model, were designed to construct SPCSS. Finally, performance evaluation was done, which shows that the scheme can enhance criminal suspects analysis without privacy leakage, while with low overhead.

Community detection is an effective approach to unveil relationships among individuals in online social networks. The article entitled “Community Detection in Online Social Networks: A Differentially Private and Parsimonious Approach” by Ji *et al.* investigated community detection in social networks aiming to protect the privacy of both the network topology and the users’ attributes. The authors proposed a differentially private community detection (DPCD) algorithm and a parsimonious node affiliation recovery (NAR) algorithm. Experimental results demonstrated that DPCD can detect social communities under modest privacy budget, and NAR can perform community detection by querying a limited number of individuals. This article advances the fronts in privacy computing in social systems.

The studies on signed networks are essential to understand the potential conflicts of systems. The article entitled “Privacy-Preserving Global Structural Balance Computation in Signed Networks” Ma *et al.* proposed a privacy-preserving global structural balance computation (PGSBC) framework, aiming to compute the global structural balance (GSB) while preserving the privacy of networks. PGSBC protects sensitive information by using encryption techniques and computes GSB on the encrypted structures by using a greedy algorithm. Extensive results show that PGSBC can effectively compute GSB while preserving the privacy of links’ sensitive information in signed networks. This work promotes the developments of practical aspects on privacy computing in intelligent social systems.

Mobile crowdsensing (MCS) is a novel social sensing scenario, which recruits participants to obtain sensory data by allocating reward to them. However, while the MCS applications execute, the sensory data and personal private information can suffer from security issues. The article entitled

“A Blockchain-Based Reward Mechanism for Mobile Crowdsensing” by Hu *et al.* proposed a novel blockchain-based MCS framework that preserves privacy and secures both the sensing process and the fair incentive mechanism by leveraging the emergent blockchain technology. Through theoretical analysis and simulation, the proposed algorithm can achieve sustainable sensory data provision. The proposed framework shows that the latency increases in a tolerable manner as the number of participants grows. In addition, the article entitled “Conflict-aware Participant Recruitment for Mobile Crowdsensing” by Zhang *et al.* proposed a conflict-aware participant recruitment (CAPR) mechanism. Compared with traditional incentive mechanisms, the proposed mechanism can effectively improve the platform utility and the average task quality while guaranteeing no conflicts in fulfilling sensing tasks.

With the increasing complexity of the intelligent social systems, the protection of various kinds of end-users’ social data becomes more and more urgent. The article entitled “Lightweight Selective Encryption for Social Data Protection Based on EBCOT Coding” by Qiu and Qiu presented a novel design based on the agnostic selective encryption concept to efficiently protect the social data by selectively encrypting only a small portion of the bitstreams in the middle layer of the EBCOT coding system. Experimentation on four common social data formats and the security analysis are performed to verify the effectiveness of our method. The proposed scheme could help to achieve privacy computing in intelligent social systems.

Deep neural networks have been widely used to enable intelligent social systems, especially for prediction and classification tasks. The data used for training are usually provided by crowdsourcing workers and the training process, and the published learning model may violate their privacy. To address this issue, the article entitled “DNN-DP: Differential Privacy Enabled Deep Neural Network Learning Framework for Sensitive Crowdsourcing Data” by Gu *et al.* developed a differential privacy-enabled deep neural network learning framework (DNN-DP) that intentionally injects noise to the affine transformation of the input data features and provides differential privacy protection for the crowdsourced sensitive training data. Theoretical analysis and thorough experiments demonstrate that DNN-DP can preserve differential privacy in the computation and, meanwhile, obtain the acceptable data utility.

With the rapid development of heterogeneous multimedia data systems and applications, there is a growing challenge to handle heterogeneous data safely and efficiently in cloud computing. The article entitled “Secure Tensor Decomposition for Heterogeneous Multimedia Data in Cloud Computing” by Fu *et al.* proposed a unified secure tensor singular value decomposition (S-tSVD) algorithm that addresses several aspects of this challenge simultaneously. Experiments demonstrate that the specific S-tSVD decomposition not only enables effective data mining and dimensionality reduction, but it also ensures the accuracy of the decomposition result and the data privacy protection. This article provides the basic big data privacy protection framework support for this special issue.

With the rapid development of smart cities, sensors collect a large amount of data, which provides the data foundation for the construction of domain knowledge graphs. Domain concept extraction is critical to the construction of domain knowledge graphs. The article entitled “*Automatic Concept Extraction Based on Semantic Graphs From Big Data in Smart City*” by Qiu *et al.* proposed a novel method, semantic graph-based concept extraction (SGCCE), to extract the domain concepts. First, the similarities between the terms are calculated. Then, semantic graphs are constructed. Finally, community detection algorithms are used to analyze the semantic graphs. The best score of the SGCCE is 0.726, and the modularity is 0.698. This article solves the problem of information processing and knowledge discovery from the social and sensor data.

Cybersecurity is interdisciplinary, as noted by Erol *et al.* in their article entitled “*Toward Artificial Emotional Intelligence for Cooperative Social Human–Machine Interaction.*” Specifically, the authors presented a novel affection-based perception architecture for cooperative human–robot interaction (HRI), designed to recognize human emotional states. This allows the human user to foster a natural bonding with the robotic artifact. They also proposed a method to close the loop using measured emotions to grade HRIs, which can be used as a reward mechanism to adaptively adjust the robot’s behavior. In addition, emotion levels from the users can be detected through vision and speech inputs processed by deep neural networks. Findings from their evaluation demonstrated the potential deployment of the proposed approach in a real-world setting. For example, their emotion transition prediction showed that the proposed approach performs very well when trained on a particular user, and the use of transfer learning in their approach resulted in the retraining of the network using the user data to be undertaken locally with limited processing power and resources onboard.

In conclusion, we have introduced the 15 accepted articles, showing the ongoing interests of social sensing and privacy computing in intelligent social systems. We would like to express our deep thanks to the Editor-in-Chief, Prof. Fei-Yue Wang, for providing us with the opportunity to host this special issue in the IEEE TRANSACTIONS ON COMPUTATIONAL SOCIAL SYSTEMS. We also thank all the authors who submitted their articles. Last but not least, we thank the thoughtful work of the many reviewers who have provided invaluable evaluations and recommendations.

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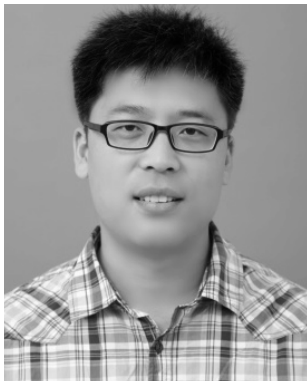
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