Computers and Electrical Engineering 81 (2020) 106537

Contents lists available at ScienceDirect

Computers and Electrical Engineering

journal homepage: www.elsevier.com/locate/compeleceng

Editorial

Introduction to the special section on advanced techniques and emerging trends in cyber-social computing☆

1. Introduction

The rapid development of Web 2.0, IoT and Cyber Physical Systems (CPS) has increasingly brought the physical, social and mental spaces intertwined together into the cyberspace. Cyber-social networks have made people's routine life and social activities seamlessly integrated together. This scenario is calling for the diversified computing paradigms and computational intelligent algorithms, to systematically model the new phenomena, behaviors, properties and practices in the cyberspace. New models, strategies, and technologies, ranging from network dynamics, cognitive informatics, and data analytics, can be developed to effectively process the heterogeneous human individual information, along with the broad applications in the cyber-social computing environments. Numerous challenges to be tackled in this context include: how to efficiently manage and handle the massive available cyber-social data generated from various sources, how to systematically understand and recognize behavior patterns associated with the new phenomena across social-physical world, and how to make best use of cyber-social networks along with the computational intelligence hidden in tremendous human associations and interconnections in cyberspace, among others.

This special section aims at bringing together researchers and engineers from both academia and industry to disseminate their innovations on the fundamental theories, models, and technological solutions in terms of development of intelligent applications with cyber-social analytics. Therefore, this it will have a great significance and profound impact on: (i) addressing original theoretical researches and practice-oriented developments in the cyber-physical-social-related field; (ii) presenting the foundational models, methodologies, and architectures, which can improve technologies to deal with emerging challenges in cyber-social computing; (iii) promoting the practical technologies to realize infrastructural frameworks, functional tools, and adaptive services regarding cyber-enabled applications, and (iv) exploring interests to seek potential collaborations, and push forward the development of cyber-social computing with other related frontiers.

2. Papers in the special section

Currently, cyber-social computing has become a hotly discussed topic and drawn considerable attentions ranging from academic institutions to industrial circles. Technical papers and reports demonstrate new challenges not only in system design but also in application development across cyber-physical-social environments. This special section tries to encourage new ideas and novel thoughts from interdisciplinary research fields, in order to promote systematical strategies and solutions in cyber-social computing related research works. Specifically, a series of significant topics are involved in this special section, including: Analysis of Network Dynamics in Cyberspace; Knowledge Modeling and Management in Cyber-Social Networks; Biological Neural Network Modeling across Social-Physical World; Computational Learning Theory in Cyber Environment; Information Diffusion and Sharing Across Multiple Social Cyberspaces; Cyber-Social Data Processing and Intelligence Mining; Cyber-Physical Hybrid System Design; Trust and Reputation in Social Cyberspace; User Behavior

☆ Reviews processed and recommended for publication to the Editor-in-Chief by Guest Editor Dr. Xiaokang Zhou

https://doi.org/10.1016/j.compeleceng.2019.106537

Analysis and Modeling in Social Cyberspace; User Influence Measure and Model in Social Cyberspace; Community Detection and Structural Analysis in Social Cyberspace; Semantic Social Network Analysis; Data-Driven Interdisciplinary Modeling and Analysis; Cyber-Enabled Learning Analytics; Cyber-Physical Healthcare Services; Privacy and Security in Social Cyberspace; Cyber-Empowered Sentiment Analysis and Mental Computing.

In particular, papers accepted for this special section have addressed five major aspects relevant to advanced techniques and emerging challenges in cyber-social computing, including intelligent mechanism for cyber-physical-social systems, cyber-social behavior recognition, social IoT applications, social property and relationship analytics, and advanced recommendation system in cyberspace. The contribution of each paper can be summarized as follows.

Social recommendation has become an important technology along with the high development of social platform and media software on the mobile terminal. A variety of recommendations can be provided based on the heterogeneous information spreading across the cyberspace. The paper addressed by X. Meng, Z. Li, B. Sheng, P. Yang, P. Li, and L. Mao, entitled "A Recommendation System Based on Football Video Information Collection" [1], proposes a soccer recommendation system, in which the video tracking and movement analysis methods are utilized to automatically recognize and track players. The YOLO algorithm is used to recognize the players from football videos, and the KCF method is used to get the player's location information based on the multi-view tracking. According to the physical data and tactical information of players, a collaborative filtering based algorithm is developed to provide recommendations, such as some famous players, to the social platform users. Experiments demonstrate the effectiveness of the proposed method comparing with the GPS tracking results according to some statistic measures, which indicates a good way to collect the players' physical data and their corresponding tactical information via football videos.

As one kind of variants of the Internet of Things (IoT), the social IoT emerges as an integration of IoT and social computing systems, which enables IoT-based smart applications to provide the social context-aware service. The paper addressed by B. Yong, X. Liu, Q. Yu, L. Huang, and Q. Zhou, entitled "OwlEye: A Hidden Markov Model Based Web Detection System for IoT" [2], designs a hybrid attack detection sensor model, named OwlEye, based on the improvement of the well-known hidden Markov model. The purpose of this study is to defense against code-injection attacks, such as SQL-injection and cross scripting, in the web-layer, which can also protect the data exchange across HTTP based IoT systems. The basic idea is to detect the attack according to the analysis of URIs of GET requests and bodies of POST requests submitted to web servers. The authors introduce the core architecture of the OwlEye for IoT in social environments, including the normal detection module, WAF detection module, and customization and specific APIs detection module. A bidirectional mechanism with the corresponding training algorithm is then developed based on the hidden Markov model. Two different datasets are utilized to conduct the evaluation experiment. The result demonstrates a higher rate of attack detection of the proposed method in protecting IoT devices.

Social modeling based on the analysis of social property and multiple relationships has been well developed in recent years, which results in various applications in cyberspace, such as community discovery, special user finding, and etc. The paper presented by X. Li, G. Xu, Y. Zhou, and W. Yu, entitled "Multi-Layer Network Community Detection Model Based on Attribute and Social Interaction Intensity" [3], shows a model for multi-layer local community detection. Both the node attribute and community structure information are utilized to construct the detection model. In particular, the community similarity intensity is defined and used to measure the similarity of a community structure. An algorithm is developed to detect the local community based on a metric which describes the node attributes and social similarity strength. The experiment result reveals the proposed model can outperform other three similar methods when dealing with the sparse issue in big data environments.

The paper addressed by H. Dino, S. Yu, L. Wan, M. Wang, K. Zhang, H. Guo, and I. Hussain, entitled "Detecting Leaders and Key Members of Scientific Teams in Co-authorship Networks" [4], proposes a recognition framework to identify leaders and key members of scientific teams from a constructed co-authorship networks. The candidate leaders are firstly extracted based on the consideration of the authors' degree centrality and H-index values. Then, a mathematical model called GapYear is built to extract the active publishers from the candidate leaders, who will be viewed as accurate leaders according to their productivity. Based on these, a team formation algorithm is developed to gather non-leader authors with their closest leader node. Finally, a ranking mechanism named DHRank is proposed to calculate and extract the key members of a certain scientific team, in which the degree centrality and H-index value are taken into account in each sub-network. Co-authorship networks constructed using the DBLP data are employed to conduct the evaluation experiment. The result shows the outstanding performance of the proposed method comparing with other four related methods according to the modularity and time complexity.

A variety of cyber-enabled applications and services have been developed along with several intelligent algorithms in hybrid cyber-physical or cyber-social environments during these years. The paper presented by A. Noor, K. Mitra, A. Souza, D. N. Jha, P. P. Jayaraman, U. Demirbaga, N. Cacho, and R. Ranjan, entitled "Cyber-Physical Application Monitoring across Multiple Clouds" [5], builds a framework for multi-virtualization and multi-cloud monitoring in cloud-based cyber-physical systems, called M2CDA. The M2CDA enables the user to monitor the performance of a given cyber-physical application deployed in a multi-cloud and heterogeneous environment. The authors demonstrate the detailed framework design, which mainly contains two components as the monitoring agent and monitoring manager. The former one is used to track the performance of an application running inside the cloud platform, then collect and send the system-level statistics to the manager. The latter one is used for the performance analysis and prediction based on the collected information. Application scenarios based on the proof-of-concept implementation are conducted using the Java virtual machine deployed on Amazon

and Azure clouds. The evaluation results demonstrate the efficiency of the proposed monitoring solution in multi-virtualized and multi-cloud environments.

The analysis of social behaviors have increasingly attracted a large number of researchers, especially in mobile and sensing computing environments. The paper addressed by Andrew T-Y. Chen, M. Biglari-Abhari, and K. I-K. Wang, entitled "Investigating Fast Re-Identification for Multi-Camera Indoor Person Tracking" [6], focuses on the re-identification in person tracking applications based on activities captured by multiple cameras within an indoor context. The authors present a comprehensive comparison among different methods in terms of metric learning and classification during the person re-identification process. The metric learning is used for the feature vector transformation, while the classification is used for the individual identification. The basic algorithm for feature extraction and identity classification, and the design of text environment are introduced. Specifically, several typical algorithms, such as Large Margin Nearest Neighbor (LMNN), Information Theoretic Metric Learning (ITML), Sparse Determinant Metric Learning (SDML), Least Squares Metric Learning (LSML), Local Fisher Discriminant Analysis (LFDA), Relevant Components Analysis (RCA), and Neighborhood Components Analysis (NCA) for metric learning, and Support Vector Machine (SVM) and Multi-Layer Perceptron (MLP) for classification, are selected to evaluate their different performances on UoA-Indoor re-identifications. They discuss and summarize the special findings based on the different test datasets used for multi-camera indoor person tracking finally.

The paper addressed by Z. Gao, H. Guo, Y. Xie, H. Lu, J. Zhang, W. Diao, and R. Xu, entitled "An Improved Localization Method in Cyber-Social Environments with Obstacles" [7], focuses on the sensor localization technology in social computing environments. The authors propose a computational method to collect and analyze the angle and intensity information based on WiFi signals from mobile base stations. The nonlinear inequality constrained-unscented Kalman filter (NIC-UKF) method is employed for interference filtering, which can localize the sensor position more efficiently. They discuss the detailed implementation process of NIC-UKF, including the initialization phase, unscented transformation phase, prediction phase, and update phase. Simulation-based experiments conducted using MATLAB demonstrate the high performance of the proposed method in terms of its localization accuracy and calculation time. The result indicates the strong stability and high precision of this method especially in dealing with the linear or curvilinear motion.

The paper presented by M. Marchiori and M. de Vecchi, entitled "Secrets of Soccer: Neural Network Flows and Game Performance" [8], addresses an interesting study on soccer analysis. In addition to the individual player's behavior itself, the authors focus more on the whole of activities in the play field, and thus proposes a new model for soccer analysis and prediction. In details, through involving the neural network flows, the soccer field can be viewed as a brain container, in which the players play the role of neurons. The authors introduce a concept of "team brain", which is with responsibility for transforming the team match into a brain-like network structure, and investigate the correlation between the efficiency of a team brain structure and the final game results. They also analyze the impact of several factors, such as time and size of neural zones, to the performance of the team brain, as well as their relationships to the goals and game progression.

The paper presented by J. Jiang, H. Wang, and W. Li, entitled "Time Decay Factor Based Trust Model for Social Networks" [9], builds a trust model considering the time decay factor. Specifically, the direct trust is mainly taken into account, and a set of usually used social network characteristics, including user attribute, reputation, communication frequency, and relationship type, is analyzed to calculate the trust value between users in a multi-dimensional way. The Newton's cooling law is employed to determine the time decay factor, which affects the change of the trust value between two users along with the impact from the mentioned three social characteristics over time. Experiments conducted based on the real world data demonstrate the effectiveness of the proposed method comparing with other existing trust models.

The paper presented by W. Cai, Y. Wang, R. Lv, and Q. Jin, entitled "LC-G-P: An Efficient Location Recommendation Scheme Based on Clustering and Data Fusion" [10], combines the clustering and data fusion technologies together to improve the location-based social recommendation. Based on users' check-in similarity, the Louvain algorithm is selected for the community clustering because of its fast operation speed on sparse network. The characteristic based collaborative filtering algorithm is then employed to calculate the location score in each generated community. To deal with the large scale location-based social network problem, an information fusion method is proposed to obtain a comprehensive location rating considering three factors of geographic distance, location popularity and user characteristic together. Comparing with the traditional recommendation methods, experiments using the Foursquare dataset demonstrate the outstanding performance of the proposed method in terms of the accuracy and efficiency measures.

The paper presented by D. Sahraoui, H. Ning, C. Shan, J. Ma, R. Huang, and K. I-K. Wang, entitled "Cyberentity and Its Consistency in the Cyber-Physical-Social-Thinking Hyperspace" [11], introduces an idea of cyber-physical-social-thinking (CPST), and focuses on the emphasis of temporal parts, life cycle, and inter-relations of cyber entities in the hyperspace. The CPST is defined as the combination, communication, and inter-relation of multiple spaces, including the cyber, physical, social and thinking spaces, which also incorporates social entities and thinking entities. Following the introduction of several fundamental concepts, such as physical, social, thinking, and cyber entities, the authors discuss the endurance-based mapping and perdurance-based mapping. A cyber entity mapping model is conducted to capture the conventional entity's properties and reflect the mapped entity's property changes. A smart home use case based on a food ordering system is presented to demonstrate the feasibility of the proposed model.

The paper addressed by A. Guo, J. Ma, G. Sun, and S. Tan, entitled "A Personal Character Model of Affect, Behavior and Cognition for Individual-Like Research" [12], focuses on the individual-like research, and introduces a general model of individuals' characteristics called personal character model of affect, behavior and cognition (ABC). Based on the basic aspects and structure of personal character model, the authors discuss two core parts of characteristics in this model: one are the

characteristics of affect, behavior and cognition, and another one are the three pairs of relational characteristics between any two of them. Its corresponding computing process is then explained with a series of formal descriptions. As a core feature of the proposed model, it consists of individual characteristics in different aspects based on analysis of personal data with different forms, thus puts forward a general process for personal characteristics computing. The authors try to fill a research gap between personality and personal data, and attain a comprehensive understanding of personality computing. In addition, the case study based experiment using the data collected from twenty subjects is conducted to analyze the personal emotional stability and attention ability.

3. Final thoughts

In response to the call for this special section we received 48 submissions. After a two-phase review process by an international editorial committee, a total of 12 papers, presenting the majority of topics mentioned above, were accepted. The accepted papers cover a wide range of topics in the domain of cyber-social modeling and applications, such as recognition and recommendation based on multiple information collection and data fusion, monitoring and detection across cyber-physical-social systems, and modeling and analysis from cyber-enabled applications in social computing environments.

The accepted papers, have attracted authors from five different countries, including the UK, China, New Zealand, Italy, and Japan, and demonstrated several significant topics, ranging from intelligent algorithm design to advanced application development in cyber-physical-social environments. Therefore, this special section will hopefully promote the establishment of systematic knowledge in cyber-social computing, and the development of cyber-enhanced technologies in the highly mingled cyberspace.

The guest editors sincerely hope the works accepted in this special section will promote the advanced knowledge in relevant scientific and academic fields. We would like to extend our gratitude to all authors who submitted papers, and to the referees for their time and diligence during the review process providing high-quality comments that helped the authors to improve their works. We would like to extend our gratitude to the Editor-in-Chief for giving the opportunity to prepare this special section, and for his productive advice during the whole process. The editors would also like to thank the editorial staff of Elsevier for all their patience and continual support to this special section.

Guest editors:

Xiaokang Zhou*
Faculty of Data Science, Shiga University, Hikone, Japan

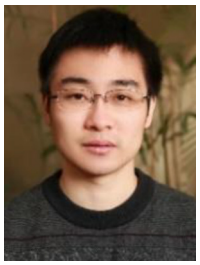
Laurence T. Yang
Department of Computer Science, St. Francis Xavier University, Antigonish, Canada

Jia Hu
Engineering Math and Physica Sciences College, University of Exeter, Exeter, UK

*Corresponding author.
E-mail address: zhou@biwako.shiga-u.ac.jp (X. Zhou)

References

[1] X. Meng, Z. Li, B. Sheng, P. Yang, P. Li, and L. Mao, A recommendation system based on football video information collection, Comput Electr Eng.
[2] B. Yong, X. Liu, Q. Yu, L. Huang, and Q. Zhou, OwlEye: a hidden markov model based web detection system for IoT, Comput Electr Eng.
[3] X. Li, G. Xu, Y. Zhou, and W. Yu, Multi-layer network community detection model based on attribute and social interaction intensity, Comput Electr Eng.
[4] H. Dino, S. Yu, L. Wan, M. Wang, K. Zhang, H. Guo, and I. Hussain, Detecting leaders and key members of scientific teams in co-authorship networks, Comput Electr Eng.
[5] A. Noor, K. Mitra, A. Souza, D.N. Jha, P.P. Jayaraman, U. Demirbaga, N. Cacho, and R. Ranjan, Cyber-Physical application monitoring across multiple clouds, Comput Electr Eng.
[6] A.T. Chen, M. Biglari-Abhari, and K. Wang, Investigating fast *re*-identification for multi-camera indoor person tracking, Comput Electr Eng.
[7] Z. Gao, H. Guo, Y. Xie, H. Lu, J. Zhang, W. Diao, and R. Xu, An improved localization method in cyber-social environments with obstacles, Comput Electr Eng.
[8] M. Marchiori and M. Vecchi, Secrets of soccer: neural network flows and game performance, Comput Electr Eng.
[9] J. Jiang, H. Wang, and W. Li, Time decay factor based trust model for social networks, Comput Electr Eng.
[10] W. Cai, Y. Wang, R. Lv, and Q. Jin, LC-G-P: an efficient location recommendation scheme based on clustering and data fusion, Comput Electr Eng.
[11] D. Sahraoui, H. Ning, C. Shan, J. Ma, R. Huang, and K. Wang, Cyberentity and its consistency in the cyber-physical-social-thinking hyperspace, Comput Electr Eng.
[12] A. Guo, J. Ma, G. Sun, and S. Tan, A personal character model of affect, behavior and cognition for individual-like research, Comput Electr Eng.



Xiaokang Zhou is currently a lecturer with the Faculty of Data Science, Shiga University, Japan. He received the Ph.D. degree in human sciences from Waseda University, Japan, in 2014. From 2012 to 2015, he was a research associate with the Faculty of Human Sciences, Waseda University, Japan. He also works as a visiting researcher in the RIKEN Center for Advanced Intelligence Project (AIP), RIKEN, Japan, from 2017. Dr. Zhou has been engaged in interdisciplinary research works in the fields of computer science and engineering, information systems, and social and human informatics. His research interests include ubiquitous and social computing, big data mining and analytics, machine learning, behavior and cognitive informatics, cyber-physical-social-system, cyber intelligence and cyber-enabled applications. He has published more than 60 refereed papers in high-quality academic journals, international conference proceedings and book chapters. His research works published in academic conferences have won several positive praises, including several best paper awards in the noted international conferences. Dr. Zhou has worked as program chair/co-chair and TPC member for several noted international conferences sponsored by IEEE and Springer. He has served as guest editor for several reputable scientific journals, including FGCS, JPDC, MTAP, Ad Hoc Networks, WWW, and CEE. Dr. Zhou is a member of the IEEE CS, and ACM, USA, IPSJ, and JSAI, Japan, and CCF, China.

Laurence T. Yang got his BE in Computer Science and Technology and BSc in Applied Physics both from Tsinghua University, China and Ph.D in Computer Science from University of Victoria, Canada. He is a professor and W.F. James Research Chair at St. Francis Xavier University, Canada. His research includes parallel and distributed computing, embedded and ubiquitous/pervasive computing, and big data. He has published around 400 international journal papers in the above areas, of which half on top IEEE/ACM Transactions and Journals, others mainly on Elsevier, Springer and Wiley Journals.

He has been involved actively act as a steering chair for 6+ IEEE international conferences. Now he is the chair of IEEE CS Technical Committee of Scalable Computing (2018-), the co-chair of IEEE SMC Technical Committee on Cybermatics (2016-) and the vice-chair of IEEE CIS Technical Committee on Smart World (2016–2018).

In addition, he was the editors-in-chief of several international journals. Now he is serving as an editor for many international journals (such as IEEE Systems Journal, IEEE Access, Future Generation of Computer Systems (Elsevier), Information Sciences (Elsevier), Information Fusion (Elsevier), Big Data Research (Elsevier), etc.). He has been acting as an author/co-author or an editor/co-editor of more than 25 books from well-known publishers. He has been invited to give around 40 keynote talks at various international conferences and symposia.

Jia Hu is a Lecturer in Computer Science at the University of Exeter. His research interests include performance evaluation, next generation networking, resource allocation and optimization, and network security. He has published over 50 research papers within these areas in prestigious international journals and at reputable international conferences. He serves on editorial boards and has guest-edited many special issues on major international journals. He has served as Chair/Co-Chair of many international conferences. His research has been supported by UK EPSRC, EU, China NSFC, and the industry such as Huawei. He was the recipient of the best paper award at IEEE SOSE'16 and IUCC'14