

Parallel Blockchain: An Architecture for CPSS-Based Smart Societies

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TIME flies fast, it has been already one year since I was appointed as the Editor-in-Chief of this great publication, and thanks to the strong support and dedication of our associate editors, editorial staff, anonymous reviewers, and authors, we have made solid progress and I really enjoy my work and our achievement so far. At this point, significant improvements in the timeliness and quality of the review process, as well as the numbers of manuscripts submitted and articles published have been accomplished.

A week ago, the 2018 annual meeting of the IEEE Panel of Editors (PoEs) was held in Los Angeles, CA, USA, from April 12 to 14, 2018. This is my 10th PoE since 2009, but my first as the EiC of TCSS. The theme of this year's PoE is publication reproducibility. This is a very interesting and important topic, and I hope it will lead the way to a new revolution in academic publishing, i.e., smart publication that would find its authors, readers, and users autonomously. I believe that Blockchain, our new Initiative at the IEEE, will play a major role in this process to smart publication and make our paper be intelligent and have the characteristics of both TRUE and DAO: Trusted, Reliable, Useful, and Efficient, in the fashion of Decentralized and Distributed, Autonomous and Automated, and Organized and Ordered. However, at the moment, I am more interested in the impact of Blockchain on our society, especially to our social systems, computationally or physically. For this, I would like to express my sincere thanks to Drs. Yuan, Rong, and Zhang for the discussion summarized in the end of this article.

Scanning the Issue

1. Representation and Matching of Team Managers: An Experimental Research

Cong Yang, Olaf Flak, and Marcin Grzegorzek

This paper proposes a general manager representation method, which can cover most of the manager types. With the proposed method, team managers can be represented by managerial actions with flexible feature groups, which can be learned and compared by machines. They introduce a matching algorithm for manager analysis, which can return robust and stable manager similarities, as well as detail the matched parts among managerial action sequences. The efficiency of the proposed methods is substantiated by experiments between machines and human perception.

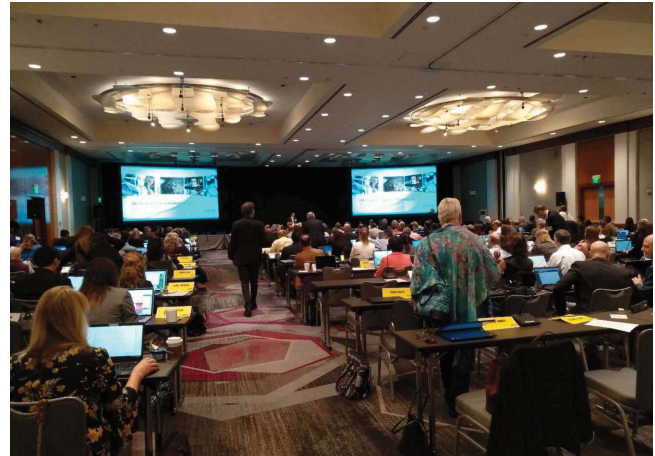


Fig. 1. 2018 IEEE PoEs.

2. Truthful Incentive Mechanisms for Geographical Position Conflicting Mobile Crowdsensing Systems

Ji Li, Zhipeng Cai, Jinbao Wang, Meng Han, and Yingshu Li

Due to the spatial correlation of sensory data in various applications gathered by the mobile crowdsensing platforms, users close to each other in geographical positions usually provide similar sensory data, and it is quite an economic waste for a mobile sensing platform to buy duplicated sensory data with multiple payments to geographically close users. To prevent waste, this paper considered geographical position conflicting mobile crowdsensing systems, and proposed two algorithms to select appropriate mobile crowdsensing participants and calculate the payments to them. Experiments were also conducted based on real-world data sets, and the results showed the efficiency of the proposed algorithms.

3. Who Spread That Rumor: Finding the Source of Information in Large Online Social Networks With Probabilistically Varying Internode Relationship Strengths

Alireza Louni and K. P. Subbalakshmi

This paper studied the problem of estimating the source of a rumor in large-scale social networks and considered the uncertainty by using random, nonhomogenous edge weights on the underlying social network graph. They proposed a two-stage algorithm that uses the modularity of the social network to locate the source of the rumor, and a method to select these sensor nodes. The proposed algorithm was evaluated by using a large data set from Twitter and Sina Weibo, and the results showed that the proposed two-stage

algorithm outperforms the alternative algorithm in terms of the accuracy of localizing the source.

4. Boosting Information Spread: An Algorithmic Approach *Yishi Lin, Wei Chen, and John C. S. Lui*

Motivated by the observation that incentives could “boost” users so that they are more likely to be influenced by friends, this paper considered a *k*-boosting problem, which aimed at finding *k* users to boost so as to trigger a maximized “boosted” influence spread. To tackle the problem on bidirected trees, they presented a greedy algorithm and a dynamic programming that is a fully polynomial-time approximation scheme. Experiments using real social networks and synthetic bidirected trees verified the efficiency and effectiveness of the proposed algorithms.

5. FlexCCT: A Methodological Framework and Software for Ratings Analysis and Wisdom of the Crowd Applications *Stephen L. France, Mahyar Sharif Vaghefi, and William H. Batchelder*

This paper mainly studied flexible cultural consensus analysis (FlexCCT), which can provide an integrated framework and tool set for analyzing and aggregating ratings. It utilized a likelihood-based statistical model to create aggregate ratings weighted for rater competencies and rater biases, and multiple optimization algorithms were implemented along with a range of model identifiability options to restrict certain subsets of the model parameters. Empirical studies were conducted to demonstrate the utility of FlexCCT on unsupervised wisdom of the crowd problems.

6. Extracting Social Network and Character Categorization From Bengali Literature *Samya Muhuri, Susanta Chakrabarti, and Sabitri Nanda Chakraborty*

This paper aimed to explore the significance of human behavior and complex social relationships in the literature network, which is an emerging area in the computational research domain. They proposed an edge contribution-based centrality and diversity metric of a node to determine the influence of one character over others, a method to analyze the characteristics of protagonist and antagonist from the influential nodes based on the complex graph, and a game theory-based community detection method that clusters the actors with a high degree of relationship. Evaluation on real-world networks demonstrated the superiority of the proposed method over the other existing algorithms.

7. Modeling Market Share Dynamics Under Advertising Effort and Word-of-Mouth Interactions Between Customers *Eugenius Kaszkurewicz and Amit Bhaya*

This paper presented a complete analysis of a new model of market share dynamics under advertising effort, considering word-of-mouth interactions between satisfied customers, dissatisfied defectors, as well as undecided customers. The proposed model described the dynamics of market share from arbitrary nonnegative initial conditions, up to and including the market in which there are no longer any undecided customers, thereby extending both the classical Vidale–Wolfe model and the Lanchester model. Moreover, even under constant

advertising effort and fixed values of interaction coefficients, the proposed model can arise different outcomes depending on the initial fractions of satisfied customers and defectors. The design of a class of advertising policies that attain a desired market share was also presented with numerical simulations.

8. Corporate Communication Network and Stock Price Movements: Insights From Data Mining *Pei-Yuan Zhou, Keith C. C. Chan, and Carol Xiaojuan Ou*

Grounded on communication theories, this paper proposed to use a data-mining algorithm to mine e-mail communication records within a company and its historical stock prices, aiming to detect the association relationships within a company to determine if such patterns may reveal the performance of the company. Using the data-mining algorithm and a set of publicly available Enron e-mail corpus and Enron’s stock prices recorded during the same period, they discovered the existence of association relationships in the data, and these relationships can be used to predict stock price movements with an average accuracy of around 80%. The results confirmed the belief that corporate communication has identifiable patterns and such patterns can reveal meaningful information of corporate performance as reflected by such indicators as stock market performance.

9. Characterizing and Countering Communal Microblogs During Disaster Events *Koustav Rudra, Ashish Sharma, Niloy Ganguly, and Saptarshi Ghosh*

This paper mainly studied communal tweets during a disaster event and developed a classifier to distinguish communal tweets from noncommunal ones with the consideration of the potentially adverse effects of communal tweets during disasters. They also studied the communal tweets posted during five recent disaster events, as well as the users who posted such tweets. Their results showed that a large proportion of communal tweets are posted by popular users, and most of them are related to media and politics. They also proposed an event-independent classifier to automatically identify anticommunal tweets and also indicate a way to counter communal tweets, and developed a real-time service to automatically collect tweets related to a disaster event and identify communal and anticommunal tweets from that set.

10. Multiplex Influence Maximization in Online Social Networks With Heterogeneous Diffusion Models *Alan Kuhnle, Md Abdul Alim, Xiang Li, Huiling Zhang, and My T. Thai*

This paper mainly studied the influence maximization problem on a multiplex with each layer endowed with its own model of influence diffusion in online social networks (OSNs). They identified a new property called generalized deterministic submodular and formulated influential seed finder with the greedy algorithm. Since the size of a multiplex comprising multiple OSNs may encompass billions of users, they formulated an algorithm knapsack seeding of network that runs on each layer of the multiplex in parallel. Experiments on real and synthesized multiplexes validated the efficacy of the proposed algorithms for the problem of influence maximization in the heterogeneous multiplex.

11. 3-HBP: A Three-Level Hidden Bayesian Link Prediction Model in Social Networks

Yunpeng Xiao, Xixi Li, Haohan Wang, Ming Xu, and Yanbing Liu

This paper tries to investigate the internal and external factors that affect the formation of links and proposes a three-level hidden Bayesian link prediction model by integrating the user behavior as well as user relationships to link prediction. First, based on the user multiple interest characteristics, a latent Dirichlet allocation (LDA) traditional text modeling method is applied into user behavior modeling. Second, due to the power-law characteristics of user behavior, LDA is improved by Gaussian weighting. Furthermore, taking the impact of common neighbor dependences in link establishment, the model can be extended with hidden naive Bayesian algorithm. The authors analyze the effects of external driving factors and combine internal driving factors to link prediction by quantifying the dependences between common neighbors. Experimental results indicate that the model can mine user latent interest distribution and improve the performance of link prediction effectively.

12. Modeling Human Behavior on Social Media in Response to Significant Events

Yulia Tyshchuk and William A. Wallace

The objective of this paper is to address the human behavior modeling in the context of behaviors that occur in response to significant events. Relevant theories of human behavior are presented as well as a methodology, utilizing natural language processing and social network analysis, for measuring the elements of human behavior. The methodology provides numerical measures for each element, which serve as the input data for the multivariate statistical model used to answer research questions in a case study of human behavior in response to a natural disaster. Also, three behaviors associated with the warning response process are modeled for this case study: 1) obtain and propagate the warning; 2) seek additional information/confirmation; and 3) take the prescribed action. Once the dynamics of human behavior as expressed in social media are understood, models can be built to predict human behaviors well in advance of their recommended or anticipated occurrence, thus the research findings can be used in emergency management.

13. A Sociocomputational Approach to Predicting Bioweapon Proliferation

Ghita Mezzour, William Frankenstein, Kathleen M. Carley, and Larry Richard Carley

This paper develops a computational methodology that predicts countries that will seek bioweapons (BW). The methodology consists of a sociocultural model and indicators that computationally capture expert opinions about why and how countries acquire BW, which systematically examines all countries in the world and can be used by non-BW experts based on publicly available data. The methodology is validated by examining the methodology's ability to predict historical BW proliferators.

14. Distributed Rumor Blocking With Multiple Positive Cascades

Guangmo Tong, Weili Wu, and Ding-Zhu Du

This paper studies a more realistic scenario when there are multiple positive cascades of the rumor spread generated by different agents. For the multiple-cascade diffusion, the peer-to-peer-independent cascade model is proposed for private social communications. The main contribution of this paper is an analysis of the rumor blocking effect (i.e., the number of the users activated by rumor) when the agents noncooperatively generate the positive cascades. The results show that the rumor blocking effect provided by the Nash equilibrium will not be arbitrarily worse even if the positive cascades are generated noncooperatively. In addition, a discussion on how the cascade priority and activation order affect the rumor blocking problem is given. Finally, the Nash equilibrium of the proposed games is experimentally examined by simulations done on real social network structures.

15. A Distributed HOSVD Method With Its Incremental Computation for Cyber-Physical-Social Systems

Xiaokang Wang, Wei Wang, Laurence T. Yang, Siwei Liao, Dexiang Yin, and M. Jamal Deen

Cyber-physical-social systems (CPSSs), integrating cyber, physical, and social spaces together, bring both conveniences and challenges to humans. For practical applications and user convenience, Big Data computation should avoid redundant computations on historical data when dealing with periodic incoming data. This paper proposes a columnwise high-order singular value decomposition (HOSVD) algorithm to realize dimensionality reduction, extraction, and noise reduction for tensor-represented Big Data. First, the distributed HOSVD is proposed using the columnwise Jacobi-based approach to realize the distributed computation of HOSVD. Second, big streaming data are continuously produced and the intermediate results could be recorded for the next computational step. Third, a similar columnwise incremental HOSVD scheme is proposed to support online computation on temporally incremental data streaming. The performance of the two HOSVD-based schemes illustrates the scalability of the proposed efficient real-time Big Data processing methods.

16. Disjoint Community Detection in Networks Based on the Relative Association of Members

Kamal Taha

This paper proposes a hybrid system called disjoint community detection based on the relative association of member (DCD-RAM) that detects disjoint communities. It adopts most of the underlying techniques of the four approaches, i.e., the network-centric, hierarchy-centric, vertex-centric, and group-centric approaches. Most of these approaches work well in only networks with certain topologies. DCD-RAM aims at overcoming the limitations of each of the four approaches to enable it to work well in networks with all types of topologies by: 1) measuring the betweenness of each edge; 2) employing a novel logarithm-based formula; 3) employing a novel agglomerativelike formula; and 4) employing a novel belonging formula that helps in discovering disjoint communities.

The authors evaluate DCD-RAM by comparing it empirically and experimentally with nine methods, and results show marked improvement.

17. Modern Food Foraging Patterns: Geography and Cuisine Choices of Restaurant Patrons on Yelp

Qi Xuan, Mingming Zhou, Zhi-Yuan Zhang, Chenbo Fu, Yun Xiang, Zhefu Wu, and Vladimir Filkov

This paper uses a Yelp data set to study modern human food foraging patterns with respect to both geography and cuisine. To understand spatial patterns, the authors cluster reviewed restaurants geographically and construct a taste similarity network, representing the topology of restaurant cuisine space. They find that people steadily expand their foraging domains from the nearest to them to the distant in geography and from the most familiar to the novel in cuisine. Using longitudinal data of restaurant reviews, a geographical foraging network and a taste foraging network are built for each patron based on which three kinds of entropies are proposed to characterize foraging patterns. The research shows that the modern foraging patterns of restaurant patrons in both geography and cuisine are of high regularity, indicating that their behaviors are rather predictable. The foraging patterns are also associated with individual social status in the community. Namely, people having a higher variety in the restaurant cuisines they have visited, but fewer actual locations they visited, tend to attract more followers.

18. Dynamics of Uncertain and Conflicting Opinions in Social Networks

Jin-Hee Cho

This paper studies the evolution of opinions where people are not sure of their own opinions and/or their opinions may be conflicting to others in social networks. Two types of agents, informed agents and uninformed agents, are modeled. Based on subjective logic, it considers a binomial opinion to deal with an opinion with a degree of uncertainty. Also, two types of trust attitudes for agents are developed to update their opinions upon their interactions with other agents: uncertainty-based trust (UT) and similarity-based trust (ST). The research results show that more informed agents slow down the convergence of the opinions under UT, while they can quickly lead to opinion convergence under ST. In addition, ST leads uncertain opinions to two extremes, either 0 or 1, if consensus exists. On the other hand, UT can make opinions converge to a certain point between two extreme opinions although the converged point is significantly affected by the dominant agents' opinions. Furthermore, under UT, more informed agents with high centrality increase the dissonance of opinions, while more informed agents with low centrality offer better chances for opinion consensus in both UT and ST.

19. Nature-Inspired Computational Model of Population Desegregation Under Group Leaders' Influence

Kashif Zia, Dinesh Kumar Saini, Arshad Muhammad, and Alois Ferscha

This paper presents an agent-based model of population desegregation and provides a thorough analysis of the social behavior leading to it, namely, the contact hypothesis. Based on the parameters of frequency and intensity of influence of group leaders on the population, the proposed model is

constituted by two layers: 1) a physical layer of the population that is influenced and 2) a virtual layer of group leaders. The model of negotiation and the survival of group leaders are governed by the nature-inspired evolutionary process of queen ants, also known as foundress dilemma. A geographic information system-driven simulation is performed, which reveals that: 1) desegregation is directly proportional to the frequency of group leaders' contact with the population and 2) mostly, it remains ineffective with an increase in the intensity of group leaders' contact with the population. The mechanism of group selection (the conflict resolution model resolving the foundress dilemma) reveals an exciting result concerning negative influence of cooperative group leaders. Most of the time, desegregation decreases with increase in cooperative leaders enforcing desegregation when compared with fierce leaders enforcing segregation.

20. A Quantitative Study of Factors Influence on Evacuation in Building Fire Emergencies

Yuling Hu, Xiao Wang, and Fei-Yue Wang

In order to decrease casualties in fire disasters and to improve the efficiency of evacuation, exploring and revealing the impact of influence factors on evacuation are of vital importance. This paper focuses on the influence of fire and human factors on evacuation processes directed by evacuation strategies in building structure. Interactions between fire environment and evacuees are considered in a systematic view. The main research ways are building artificial evacuation systems and performing computational experiments. Also, a case is given to illustrate the research approach, and quantitative results have been analyzed. The work in this paper can be used for optimizing occupant distribution and composition, estimating evacuation strategies, and ultimately for improving evacuation efficiency.

21. PMP-Based Set-Point Optimization and Sliding-Mode Control of Vehicular Platoons

Ge Guo and Dandan Li

This paper investigates the problem of set-point optimization and speed tracking control for fuel-time efficient platooning of vehicles on freeways. A two-layered control architecture is presented for vehicular platooning systems: a set-point optimization layer and a vehicle tracking control layer. In the first layer, a speed planning algorithm is derived to calculate the speed set point for the platoon by averaging the optimal speed of each vehicle, which is obtained by solving a fuel-time optimization problem using Pontryagin's minimum principle. The second layer contains a set of distributed sliding-mode controllers for vehicle tracking control, which can guarantee string stability of the vehicular platoon with a desired inter-vehicle spacing. The effectiveness of the presented method is demonstrated via simulations and experiments.

22. Influence Propagation Model for Clique-Based Community Detection in Social Networks

Noha Alduaiji, Amitava Datta, and Jianxin Li

This paper addresses the problem of temporal interaction biased community detection using a four-step process. First, a partition approach is developed using an objective function based on a clique structure to enhance the time efficiency of our methodology. Then, an influence propagation model is

developed that gives the greatest weight to active edges or to inactive edges in close proximity to active edges. Third, the expansion-driven algorithms are proposed to efficiently find the activity biased densest community. Finally, the authors verify the effectiveness of the extended community metric and the efficiency of the algorithms using three real data sets and a case study conducted on Twitter Dynamic data set. The results show that only a few users have interactions or communications at fixed time intervals. Finding active communities that demonstrate constant interactions between its members comprises a reasonable perspective.

23. An Analysis of Taxi Driver's Route Choice Behaviors Using the Trace Records

Li Li, Shuofeng Wang, and Fei-Yue Wang

This paper analyzes the route choices of Beijing taxi drivers regarding four frequently mentioned cost-based route choice rules: pursuing shortest time or distance, avoiding passing signalized intersections, or making left/right turnings. Test results show that route choices of drivers are not always optimal according to either of these rules. Instead, this paper argues that taxi drivers are bounded rational and usually choose a satisfactory route, which belongs to one of the few routes that consume the shortest times. Also, it shows that more than 90% observed traces can be explained by this simple explanation.

24. The Reserve Price of Ad Impressions in Multichannel Real-Time Bidding Markets

Juanjuan Li, Xiaochun Ni, and Yong Yuan

This paper studies the publisher's strategy on the reserve price and probes its impact on his/her revenues. The authors first discuss the reserve price of ad impression in a single-channel sales model, including the online RTB channel or the off-line direct channel, aimed to study its impact on the publisher's revenue. Then, they analyze the impact of the reserve price on the multichannel settings. Finally, experiments are conducted using empirical log data collected from real-world RTB markets to validate our models and analyses, and the experimental results indicate that: 1) in the single-channel sales model, publishers should set the reserve price for only the online-channel ad impressions while not for the off-line-channel ones and 2) in the multichannel ad impression sales, publishers should set both off-line and online reserve prices for revenue maximization.

Blockchain and Social Systems

In this issue, I would like to introduce an emerging technology that gains increasingly intensive research interests in the recent one or two years, that is, Blockchain. Blockchain is widely claimed as one of the disruptive technologies and is now experiencing rapid development in both academia and industry. In my opinion, blockchain has the full potential of revolutionizing the increasingly centralized cyber-physical-social systems (CPSSs) in applications.

IEEE Initiatives and Our Efforts

The IEEE is now attaching great importance to the blockchain technology. The IEEE Future Directions Committee (FDC), represented by the societies/councils of

the IEEE, has officially approved the formation of the IEEE Blockchain Initiative (BCI) effective from January 1, 2018. The BCI will be the hub for all IEEE blockchain projects and activities. Partially due to my strong interests and past research efforts in blockchain, I was asked to participate in several IEEE blockchain activities on behalf of the IEEE Systems, Man, and Cybernetics Society and Council of RFID. Actually, I was one of the strong supporters for the IEEE BCI proposal at February 2017's IEEE TAB in New Orleans. In October 2017, we attended the IEEE Initiative Incubator Workshop on Blockchain organized by the IEEE FDC at Arlington, Virginia. In January 2018, we attended the Blockchain Asset Exchange meeting organized by the IEEE Standard Association at Las Vegas, as well as TAB meetings on Blockchain in February 2018 at Orlando, FL, USA.

We have established a series of international academic conferences entitled "the IEEE/International Federation of Automatic Control (IFAC) Conference on Blockchain and Knowledge Automation (ICBKA)," which is sponsored by the IEEE SMC Technical Committee (TC) on Social Computing and Social Intelligence and co-sponsored by IFAC TC 9.1 on Economic, Business, and Finance Systems. I am currently serving as the Chair of these two TCs. ICBKA 2017 was successfully held in Denver, CO, USA, and ICBKA 2018 will be held in Changshu, Jiangsu, China, co-located with the 2018 IEEE Intelligent Vehicles Symposium (IV 2018). We have also established the "IEEE SMC TC on Blockchain," which was officially approved and become effective recently. Moreover, we launched two special issues on blockchain soliciting papers before June 2018, namely, the "Blockchain-based Secure and Trusted Computing for IoT" in our TCSS and also the "Blockchain and Economic Knowledge Automation" in the IEEE TRANSACTIONS ON SYSTEMS, MAN AND CYBERNETICS: SYSTEMS. I view all these activities as our initial efforts from SMC society to pin down blockchain onto SMC research map and warmly welcome your participation and contribution.

Blockchain and CPSS-Oriented Smart Societies

Blockchain can be considered as a novel architecture for CPSS-oriented smart societies. In the literature, decentralized autonomous social systems have long been ideal models and the future visions of researchers from social sciences and distributed artificial intelligence. Typically, these decentralized autonomous social systems are self-controlled in a bottom-up fashion, with each involved agent being sufficiently intelligent to make decisions and coordinate their behaviors or strategies via negotiating with other agents. As an emerging decentralized architecture and distributed computing paradigm underlying Bitcoin and other cryptocurrencies, blockchain can be utilized to establish such decentralized autonomous applications, ecosystems, and even societies, with the advantages of creating better usage of the legacy devices, infrastructure, and resources in a secured and trusted fashion.

Blockchain is essential to knowledge automation, a direction for further development of artificial intelligence technology and a general framework for dealing with management and

control of CPSS type complex systems. The goal of knowledge automation is from UDC to AFC, that is, dealing with the issues of uncertainty, diversity, and complexity with the capacity of agility, focus, and convergence.

Blockchain is also a fundamental architecture for the coming era of Internet of Minds, which is the next level of the Internet (of Information) and Internet of Things. Instead of connecting information or devices, blockchain has the potential of connecting intellectual resources from an individual agent all over the world, forming a “society of mind.” For instance, various kinds of knowledge-intensive tasks, including gene sequencing and deep learning optimization, have been crowdsourced to individual miners based on the reward of blockchain-powered cryptocurrencies. This will be the future trend of how our individuals, enterprises, and societies are organized. Therefore, I believe that while big data and artificial intelligence represent the upgraded new factors of production and forces of production, respectively, blockchain will definitely reshape the relationship of production in the era of Internet of Minds.

Parallel Blockchain

Blockchain, as a distributed shared ledger in essence, can serve as a data hub in the CPSS-oriented parallel world, bridging its cyber, physical, and social spaces. On the one hand, online information, including cyber big data and social signals, can be naturally stored and analyzed in blockchain systems. On the other hand, blockchain can be utilized together with the Internet of Things, and the resulting novel framework of “blockchain of things” can be used to digitalize the off-line physical devices, assets, and entities, which will be registered as smart properties and integrated into the blockchain. As such, blockchain can be widely used in hybrid applications with online-off-line and human-machine interactions.

Due to the inherent uncertainty, diversity, and complexity in blockchain systems, there is still a critical need of an effective method in the evaluation, optimization, and innovation of the existing blockchain framework. I believe that parallel blockchain is one of the future trends in this line of thinking. The parallel blockchain follows the research framework of ACP approach, namely, Artificial societies + Computational experiments + Parallel execution. In the A part, the real-world blockchain system will be modeled and analyzed. We hypothesize that we can also establish one or more artificial blockchain systems in the code space of smart contracts. Based on these coevolving actual and artificial blockchain systems, we can design and conduct diversified computational experiments in the C part to evaluate and verify specific behavior, mechanisms, and strategies involved in the

blockchain systems. These experiments can be designed as what-if type of scenario inference and simulation based on the predefined if-then rules. The optimal solution will emerge in large numbers of computational experiments and in the P part as feedback to actual blockchain systems. This A-C-P step repeats infinitely, leading the actual blockchain system eventually approximating its optimal artificial counterparts.

Blockchain has been emerging as a hot research topic in computational social systems, and many issues need to be addressed and further investigations are critical for its future development. Therefore, to stimulate innovation in this new direction, TCSS launched the special issue entitled “Blockchain-based Secure and Trusted Computing for IoT,” aiming to call for the state-of-the-art works on blockchain and IoT. We are also planning to launch a new series of academic conference entitled the “IEEE World Congress on Blockchain,” with the target of a world-leading flagship conference dedicating to blockchain. Let us give a serious consideration to this so called disruptive innovation and expect a blockchain-powered smart society in the near future.

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Fei-Yue Wang (S'87–M'89–SM'94–F'03) received the Ph.D. degree in computer and systems engineering from the Rensselaer Polytechnic Institute, Troy, NY, USA, in 1990.

He joined The University of Arizona, Tucson, AZ, USA, in 1990, where he became a Professor and the Director of the Robotics and Automation Laboratory and the Program in Advanced Research for Complex Systems. In 1999, he founded the Intelligent Control and Systems Engineering Center, Institute of Automation, Chinese Academy of Sciences (CAS), Beijing, China, under the support of the Outstanding Overseas Chinese Talents Program from the State Planning Council and 100 Talent Program from CAS. In 2002, he joined the Laboratory of Complex Systems and Intelligence Science, CAS, as the Director, where he was the Vice President for Research, Education, and Academic Exchanges with the Institute of Automation from 2006 to 2010. In 2011, he was the State Specially Appointed Expert and the Director of the State Key Laboratory for Management and Control of Complex Systems, Beijing. His current research interests include methods and applications for parallel systems, social computing,

parallel intelligence, and knowledge automation.

Dr. Wang was the General or Program Chair of more than 30 IEEE, INFORMS, ACM, and ASME conferences. He was the President of the IEEE ITS Society from 2005 to 2007, the Chinese Association for Science and Technology, USA, in 2005, and the American Zhu Kezhen Education Foundation from 2007 to 2008. He was the Vice President of the ACM China Council from 2010 to 2011, and the Chair of IFAC TC on Economic and Social Systems from 2008 to 2011. He is currently the President-Elect of the IEEE Council on RFID. Since 2008, he has been the Vice President and the Secretary General of the Chinese Association of Automation. He was the Founding Editor-in-Chief (EiC) of the *International Journal of Intelligent Control and Systems* from 1995 to 2000 and *IEEE ITS Magazine* from 2006 to 2007. He was the EiC of IEEE INTELLIGENT SYSTEMS from 2009 to 2012 and the IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS from 2009 to 2016. He is currently the EiC of the IEEE TRANSACTIONS ON COMPUTATIONAL SOCIAL SYSTEMS, and the Founding EiC of the IEEE/CAA JOURNAL OF AUTOMATICA SINICA and the IEEE CHINESE JOURNAL OF COMMAND AND CONTROL. He was a fellow of INCOSE, IFAC, ASME, and AAAS. He was a recipient of the National Prize in Natural Sciences of China and the Outstanding Scientist by ACM for his research contributions in intelligent control and social computing in 2007, the IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS Outstanding Application and Research Awards in 2009, 2011, and 2015, and the IEEE SMC Norbert Wiener Award in 2014.



Yong Yuan (M'15–SM'17) received the B.S., M.S., and Ph.D. degrees in computer software and theory from the Shandong University of Science and Technology, Qingdao, China, in 2001, 2004, and 2008, respectively.

He is currently an Associate Professor with the State Key Laboratory for Management and Control of Complex Systems, Institute of Automation, Chinese Academy of Sciences, Beijing, China. He is also with the Qingdao Academy of Intelligent Industries, Qingdao. His current research interests include social computing, computational advertising, blockchain, and smart contracts.



Chunming Rong (M'95–SM'04) is currently the Head of the Center for IP-based Service Innovation, University of Stavanger, Stavanger, Norway, and an Adjunct Chief Scientist leading Big-Data Initiative at IRIS. His current research interests include data science, cloud computing, security, and privacy.

Mr. Rong has been a member of the Norwegian Academy of Technological Sciences since 2011. He was the Vice President of the CSA Norway Chapter from 2015 to 2016. He has extensive contact network and projects in both industry and academic. He is a Co-Chair of the IEEE Blockchain and the Chair of the IEEE Cloud Computing. He is also the Founder and a Steering Chair of the IEEE CloudCom conference and workshop series. He is the Steering Chair and an Associate Editor of the IEEE TRANSACTIONS ON CLOUD COMPUTING and a Co-Editor-in-Chief of the *Journal of Cloud Computing* (ISSN: 2192-113X) (Springer). He has extensive experience in managing large-scale research and development projects funded by both industry and funding agencies in Norway and EU.



Jun Jason Zhang (S'06–M'09–SM'14) received the B.E. and M.E. degrees from the Huazhong University of Science and Technology, Wuhan, China, in 2003 and 2005, respectively, and the Ph.D. degree from Arizona State University, Tempe, AZ, USA, in 2008, all in electrical engineering.

He is currently an Associate Professor of electrical and computer engineering with the University of Denver, Denver, CO, USA. He has authored or co-authored over 80 peer-reviewed publications. His current research interests include complex systems, artificial intelligence, knowledge automation, and their applications in intelligent power and energy systems.

Dr. Zhang is a Co-Chair of the IoT Technical Committee of the IEEE Council of RFID. He is an Associate Editor of the IEEE TRANSACTIONS ON COMPUTATIONAL SOCIAL SYSTEMS and *Acta Automatica Sinica*.