Parallel Healthcare: Robotic Medical and Health Process Automation for Secured and Smart Social Healthcares

Fei-Yue Wang, *Fellow, IEEE*

WELCOME to the new issue of the IEEE TRANSACTIONS ON COMPUTATIONAL SOCIAL SYSTEMS (TCSS). I am grateful to report that, as of April 9, 2020, the Citescore of TCSS has reached to 5.26, a new high. Many thanks to all of you for your great effort and support.

After our announcement of preparing a special issue on Smart Emergency Management and Computational Social Systems, we have received many e-mails regarding article submission and even new special issue proposals related to social impact and analysis of COVID-19. In view of these and many new developments in this international pandemic, we have decided to arrange a special issue on Computational Social Systems for COVID-19 Emergency Management and Beyond, please see the Call for Papers in this issue for details.

The COVID-19 and related global social and political fiascos have significantly changed my attitude toward the world and life, at least my mindset about the role of politicians, governments, social institutions, and organizations. Put simply, Twitter, WeChat, Facebook, and so on are far from being sufficient and effective, we need more smart computational social systems with blockchained real/virtual people and software-defined processes inside for justified and fair decision-making and services. In this issue, by reflecting my personal experience in my journey of medical and healthcare research, I would like to address the topics on developing computational social agents and computational social organizations to achieve robotic medical and health process automation for delivering safe, secured, sustainable, sensitive, and smart social healthcare services to all of us.

Scanning the Issue

1. Comparative Analysis of Feature Selection Algorithms for Computational Personality Prediction From Social Media

A. A. Marouf, Md. K. Hasan, and H. Mahmud

Predicting the personality of a user from these digital footprints has become a computationally challenging problem, and it is redefined as predicting each of these traits separately from the extracted features. Traditionally, it takes huge number of features to get better accuracy on any prediction task. In this article, the authors have compared the performance of five feature selection algorithms, namely, the Pearson correlation coefficient, correlation-based feature subset, information gain, symmetric uncertainly evaluator, and Chi-squared method. The performance is evaluated using the classic metrics, namely, precision, recall, f-measure, and accuracy as evaluation matrices.

2. Image Memorability Prediction Using Depth and Motion Cues

S. Basavaraju and A. Sur

This article proposes a deep learning-based prediction model, which utilizes depth and motion cues to predict the image memorability scores. The proposed model contains three deep convolutional neural networks. Each of these three networks is individually trained to utilize one of the three visual factors: visual depth information, optical flow information, and fine-tuned scene and object related features. In the end, all three networks are ensembled to predict the final memorability scores for the given image. An extensive set of experiments are conducted on the large-scale image memorability data set LaMem. From the experimental results, it is observed that the proposed model performs better than the current state-of-the-art model.

3. Time-Evolving Social Network Generator Based on Modularity: TESNG-M

W. Luo, B. Duan, H. Jiang, and L. Ni

This article proposes a time-evolving social network generator based on modularity (TESNG-M). In TESNG-M, according to the community partition of the original network, the evolutionary behavior is simulated by adding or deleting nodes and flipping edges so that a static social network with a specified modularity will be generated. By repeating the static generation process, the authors obtain a dynamic social network with a specified partition and modularity at each time step. Thus, the network generated by TESNG-M can effectively simulate a real dynamic social network and be used for community detection. Furthermore, the specified modularity of static synthetic networks and the dynamic modularity of dynamic synthetic networks could be regarded as the performance baseline of community detection algorithms in static and dynamic social networks, respectively.

4. Modeling Closed Captioning Subjective Quality Assessment by Deaf and Hard of Hearing Viewers

S. Nam, D. I. Fels, and M. H. Chignell

In this article, the authors report on a model of probabilities of deaf and hard of hearing (D/HoH) viewer assessment decisions for closed captioning quality factors based on actual user preferences. An online survey was designed and conducted to collect assessment data for 22 error variation samples from four quality factors: delay, speed, missing words, and

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paraphrasing of captions. The results are analyzed using the signal detection theory framework to create decision probability models for D/HoH viewers. Finally, a formal equation was created to display the user model as a high-level abstraction.

5. Opinion Dynamics With Cross-Coupling Topics: Modeling and Analysis

H.-S. Ahn, Q. V. Tran, M. H. Trinh, M. Ye, J. Liu, and K. L. Moore

To model the cross couplings of multiple topics, this article develops a set of rules for opinion updates of a group of agents. The rules are used to design or assign values to the elements of weighting matrices. The cooperative and anticooperative couplings are modeled in both the inverse-proportional and proportional structures. The behaviors of opinion dynamics are analyzed using a nullspace property of the state-dependent matrix-weighted Laplacian matrices and a Lyapunov candidate. Various consensus properties of the state-dependent matrix-weighted Laplacian matrices are predicted according to the interagent network topology and interdependent topical coupling topologies.

6. Deep Representation Learning for Location-Based Recommendation

Z. Huang, X. Lin, H. Liu, B. Zhang, Y. Chen, and Y. Tang

This article proposes a novel deep representation learning-based model (DRLM) for improving recommendation accuracy. DRLM mainly focuses on learning to accurately represent semantic features of points of interest (POIs) and users. Specifically, four cooccurrence matrices are constructed to produce four different original features for each POI, and a principal component analysis algorithm is utilized to generate a semantic feature of each POI from its four original features. A three-modal simple recurrent unit network is given to constructed semantic features of users using semantic features of POIs, times, and locations. The minimum description length (MDL)-based and skyline-based strategies are proposed to address the cold-start issues for new users and new POIs, respectively. Experiment results show that DRLM can achieve superior performance in terms of high recommendation accuracy and effectiveness in handling the cold-start problem.

7. A Social Crowdsourcing Community Case Study: Interaction Patterns, Evolution, and Factors That Affect Them

K. Zaamout, T. Arjannikov, and K. Barker

This article applies methods from social network analysis and related fields to help answer important questions relevant to social crowdsourcing community (SCC). They demonstrate the applicability of these methods by analyzing five years of interactions in a private SCC starting from its inception. This analysis reveals the patterns in members' interactions within the SCC and key factors that affect them. In addition, the analysis reveals the patterns in the evolution of these interactions.

8. Alleviating New User Cold-Start in User-Based Collaborative Filtering via Bipartite Network

Z. Zhang, M. Dong, K. Ota, and Y. Kudo

This article develops a novel approach that incorporates a bipartite network into user-based collaborative filtering (UBCF) for enhancing the recommendation quality of new users. They collect niche items and map the corresponding rating matrix to a weighted bipartite network, and then a new weighted bipartite modularity index merging normalized rating information is presented to conduct the community partition that realizes coclustering of users and items. Finally, for each individual clustering that is much smaller than the original rating matrix, a localized low-rank matrix factorization is executed to predict rating scores for unrated items. Items with the highest predicted rating scores are recommended to a new user. Experimental results show that the proposed approach is superior in terms of both recommendation accuracy and diversity and can alleviate the new user cold-start issue of UBCF effectively.

9. Pedestrian Choice Modeling and Simulation of Staged Evacuation Strategies in Daya Bay Nuclear Power Plant

L. Yang, X. Wang, J. J. Zhang, M. Zhou, and F.-Y. Wang

This article establishes an exit choice model for pedestrians in the plume planning area based on a random forest model. The proposed model is trained and verified with the survey data of residents around the Daya Bay Nuclear Power Plant collected from a serious game-based questionnaire system. Combining the pedestrian choice with the agent-based pedestrian behavior simulation model, the evacuation process of a nuclear accident is simulated. Based on the detailed evacuation simulation model, a comparative experiment is performed to evaluate the staged evacuation strategy in such scenarios. Simulation results indicate that staged evacuation may not be the best strategy all the time, and the number of groups highly impacts its performance.

10. An Energy Function for Computing Structural Balance in Fully Signed Network

X. He, H. Du, X. Xu, and W. Du

This article discusses the new mechanism of balance theory and designs a new energy function to measure the global structural balance. An optimization algorithm that minimizes the energy function to detect the communities in structural balance is proposed, and experiment results show the excellent effectiveness and efficiency of the proposed method. An application on the investigated data from Shenzhen, China, is also provided to explain the social significance of structural balance.

11. Optimal Block Withholding Strategies for Blockchain Mining Pools

R. Qin, Y. Yuan, and F.-Y. Wang

This article mainly studies the block withholding attack issue faced by mining pools. Considering the case that there are two pools, where only one pool can attack the other pool, they propose an optimal block withholding strategies for pools. They also illustrate that attacking is not always the optimal strategies for the pools, and present the conditions for attacking. With computational experiment approach, several experiments are designed to validate the proposed strategies, and the results can provide important managerial insights for pools in blockchain mining.

12. Reasons for Failures of CRM Implementations

M. Y. Tazkarji and T. Stafford

Utilizing a grounded theory methodology, this article spans the disciplines of marketing and information systems in the

process of inducing the reasons for customer relationship management (CRM) failure and success, and it aims to uncover factors affecting the high failure rate of CRM software. Results indicate that implementation factors play a significant role in CRM outcomes. It shows that there are many factors contributing to the failure of CRM implementations. While factors coded under the "people" and the "technology" categories are complicated and require organizational collaboration, factors coded under the "process" category are more manageable since they can be addressed prior to CRM implementation. Thus, their findings supply both researchers and practitioners with detailed descriptions of factors that ought to be dealt with in order to avoid CRM failure.

13. Cell-DEVS for Social Phenomena Modeling

H. Khalil and G. Wainer

Motivated by the need for formal methods as well as supporting tools to model and simulate social systems, this article proposes cellular discrete-event system specification as a formalism for modeling social systems. It also proposes the use of a toolkit that implements the formalism of cellular discrete-event system specifications to implement and visualize models of social systems. Examples of social system models that are different in sizes, nature, and rules controlling the interactions within those systems are presented. It shows that cellular discrete-event system specification with its unique features can successfully deal with the shortcoming of other modeling techniques. In addition, it shows that together with its supporting toolkit, cellular discrete-event system specification is suitable for modeling, simulating, implementing, and visualizing social systems.

14. Detecting and Characterizing Extremist Reviewer Groups in Online Product Reviews

V. Gupta, A. Aggarwal, and T. Chakraborty

This article develops a feature-based supervised model to classify candidate groups as extremist entities and run multiple classifiers for the task of classifying a group based on the reviews written by the users of that group, to determine if the group shows signs of extremity. A three-layer perceptron based classifier turns out to be the best classifier. They further study behaviors of such groups in detail to understand the dynamics of brand-level opinion fraud better. These behaviors include consistency in ratings, review sentiment, verified purchase, review dates, and helpful votes received on reviews. Surprisingly, they observe that there are a lot of verified reviewers showing extreme sentiment, which on further investigation lead to ways to circumvent existing mechanisms in place to prevent unofficial incentives on Amazon.

15. An Agent-Based Model of Collective Decision-Making: How Information Sharing Strategies Scale With Information Overload

D.-J. van Veen, R. S. Kudesia, and H. R. Heinimann

This article proposes an agent-based model that simulates information sharing in teams, where critical information is distributed across its members. They test how robust various information sharing strategies are to information overload and bounds on rationality in terms of the speed and accuracy of collective decision-making. Their results suggest distinct strategies depending on whether speed or accuracy is imperative and, more broadly, shed light on how intelligence is best attained in collective decision-making.

16. AMNN: Attention-Based Multimodal Neural Network Model for Hashtag Recommendation

Q. Yang, G. Wu, Y. Li, R. Li, X. Gu, H. Deng, and J. Wu

This article proposes an attention-based multimodal neural network model to learn the representations of multimodal microblogs and recommend relevant hashtags. They convert the hashtag recommendation task into a sequence generation problem, and propose a hybrid neural network approach to extract the features of both texts and images and incorporate them into the sequence-to-sequence model for hashtag recommendation. Experimental results on the data set collected on Instagram and two public data sets demonstrate that the proposed method outperforms state-of-the-art methods. Their model achieves the best performance in three different metrics: precision, recall, and accuracy.

17. BTR: A Feature-Based Bayesian Task Recommendation Scheme for Crowdsourcing System

W. Dai, Y. Wang, J. Ma, and Q. Jin

This article proposes a feature-based Bayesian task recommendation (BTR) scheme. The key idea to deal with the dynamics of the crowdsourcing system lies in that the BTR learns the latent factor of the task through the task features instead of task ID and then learns the user's preference according to their historical behaviors. Specifically, based on task features and the user's historical behavior records, BTR can not only timely provide crowdworkers with personalized task recommendations but also solve the task cold-start problem. The simulations based on the real crowdsourced data set demonstrate that BTR performs better than other typical schemes that target at recommending the newly arrived tasks to crowdworkers.

18. Security and Trust in Blockchains: Architecture, Key Technologies, and Open Issues

P. Zhang and M. Zhou

This article discusses the basic architecture of blockchains as well as its potential security and trust issues at data, network, consensus, smart contract, and application layers. Then, the related literature work is analyzed in terms of the issues at these layers. Some open issues are also presented and discussed.

19. Overlapping Community Detection Using Multiobjective Genetic Algorithm

A. Kumar, D. Barman, R. Sarkar, and N. Chowdhury

This article proposes an overlapping community detection method based on NSGA-II, where the internal link density within the community using fuzzy membership values is maximized, and the external link density of the communities is minimized. A mutation operator has been proposed to restrict the randomness in the chromosome, and an updation operator has also been proposed to modify a chromosome after crossover and mutation operation. The proposed method can handle different network structures properly. The effectiveness of the proposed method is validated by experiments, and the empirical results reveal that the proposed method has succeeded to obtain better generalized normalized mutual information and comparable extended modularity values.

20. P^3: Privacy-Preserving Scheme Against Poisoning Attacks in Mobile-Edge Computing
P. Zhao, H. Huang, X. Zhao, and D. Huang

This article proposes the privacy-preserving scheme, i.e., privacy-preserving scheme against poisoning (P^3), which utilizes the feature learning model to infer the social relationships among users from their location data and then constructs the inferred social graph. Thereafter, it searches the optimal map between the inferred social graph and the social graph from social networks to identify the poisoning locations. Experiments on two real-world data sets, two baseline works, and two kinds of poisoning attacks have demonstrated the privacy preservation against the poisoning attacks in MEC P^3.

21. Docschain: Blockchain-Based IoT Solution for Verification of Degree Documents
S. Rasool, A. Saleem, M. Iqbal, T. Dagiuklas, S. Mumtaz, and Z. ul Qayyum

This article introduces the docschain to tackle the limitations of the blockcerts. Docschain seamlessly incorporates within the existing workflow of degree issuance by operating over the hard copies of the degree documents. This is achieved through optical character recognition, and the record of each degree document is stored along with the details of the corresponding OCR template to understand the semantics of the data stored at different sections of the degree document. In contrast to blockcerts, docschain also supports the bulk submission of degree details for both the previously and newly graduated students.

Parallel Medicine and Parallel Healthcare for Robotic Medical and Health Process Automation

My interest in medical research started in the Summer 1990 after I arrived as a young assistant professor and the director of Robotics and Automation Laboratory, the University of Arizona, Tucson, Arizona, USA. Professor A. Terry Bahill of Systems and Industrial Engineering Department, a colleague and mentor in many aspects for over two decades, was a world-renowned researcher in bioengineering and applied physiology, and I was particularly intrigued by his works on applying expert systems and artificial intelligence for various medical and health problems. In 1991, I received my first research support from Professor Terry T. Triffet, then associate dean for research in UA's College of Engineering and Mines and the director of UA/NASA Space Engineering Research Center, and his visiting scientist Dr. Herbert S. Green, a well-known professor from Australia in quantum physics with deep interest in AI, especially AI methods for playing Go game, on computer-based functional modeling and analysis of cerebral cortex, cerebellum, and hippocampus, in association with their work on the brain and nervous system. Through Terry and Bert, I was fortunate to know Professor Douglas G. Stuart, another Australian, then chair of UA's Department of Physiology and associate dean for research in the College of Medicine, and joined his NIH-funded Arizona Laboratory as a research professor for motor control and neuroscience in 1992. My association with Doug, Bert, and Terry led me to the idea of building knowledge structures into neural networks using fuzzy logic and constructing modular 9-layer neuro-fuzzy networks for the implementation of "local simple, remote complex" center-edge architectures [1], [2].

In Doug's team, I learnt a great deal from medical doctors and scientists, from intracellular recording in nerve cells to implant electrodes into brains of awake animals, and that motor control in his lab is the regulation of movement in organisms that possess a nervous system, like reflexes, more about spinal-cord neurobiology than the control of electronic motors for robotic motion in my own lab. Especially, I benefited greatly from Doug's passionate and innovative way of treating and training his students, from undergraduates, graduates, postdocs, all the way to junior faculty members like myself. With the help of Doug, I had a close and productive collaboration and friendship with Dr. Edmund Arbas of UA's College of Medicine, Professor Arthur Prochazka from Division of Neuroscience at the University of Alberta (Canada), and Dr. Jiping He from Bioengineering Department in the Arizona State University. I was extremely happy to see my work on fuzzy logic and related suggestions were adapted by Arthur in his algorithmic research and hardware design on tremor suppression and visuomotor control [3]. Jiping and I shared a common background in robotics and control engineering and planned to investigate the possibility of controlling robots via brain-computer interface. Most of my effort in Arizona Lab was working with Ed on applying fuzzy-logic based pattern recognition for pheromonal information processing, rule analysis and experiment design for finding Moth's olfactory-guided locomotion mechanisms. But Ed's tragic and untimely and death in the Summer of 1995 at Sonora Mexico's beach had shocked me with profound sadness and put my collaboration with Doug's group into a full stop.

This 5-year initial medical research experience had presented me with a unique and personal perspective as well as deep understanding and great appreciation on the nature of interdisciplinary research and teamwork, and made me realized that I need a different and new approach to work in a field that requires skills and trainings from multiple subjects and disciplines, and the future direction must be with systems thinking and knowledge automation, or in today's parlance, medical robotic process automation.

The ACP Approach for Integrative and Predictive Medicine

My second phase of medical research began with my friendship with Professor Chih-Ming Ho of the University of California at Los Angeles in late 1990s and then continued with his former PhD students Dr. Pak Kin Wong of the University of Arizona and Dr. Xianting Ding of Shanghai Jiaotong University in China from middle 2000s. Chih-Ming and I share the common background in mechanics, but his professional interests have moved from turbulent flow, to mico-electro-mechanical-systems (MEMS), microfluidics, and finally, to AI personalized medicine. With Xianting, we are still working on parallel drugs for dosage optimization and smart delivery. And with PK, we had a few productive years in the desert oasis in applying computer games and computational experiments for drug design and fast screening and testing, and under the influence of Integrative Medicine and the corresponding

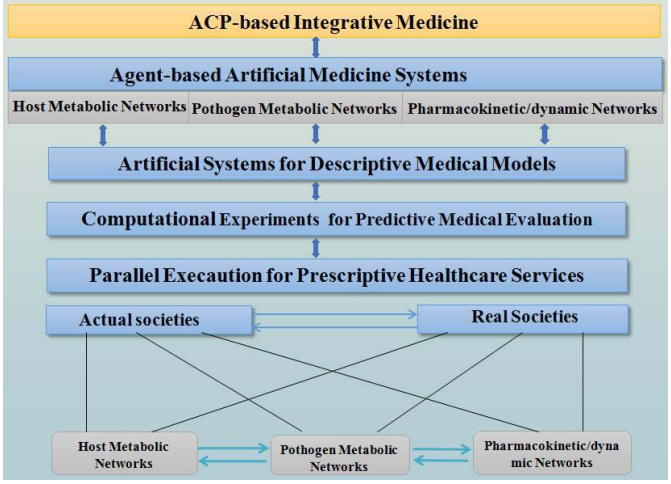

Fig. 1. The ACP-based framework and process for integrative medicine.

higher-order "System of Systems" thinking promoted by UA's celebrity doctor and holistic health/new age guru Andrew T. Weil, we established our own ACP-based framework and process for integrative medicine by dividing the medical procedures into three interactive stages: descriptive, predictive, and prescriptive [4]–[6], in the hope for a precision, proactive, and personalized smart public and open medical and healthcare provider system for all.

Fig. 1 presents the basic framework and process of the ACP approach for integrative medicine from [6] to address the fundamental medical challenges from the inherent complexities of interacting complex biological networks in normal physiology, host metabolism and defense mechanisms, pathological pathways, pharmacogenetics, pharmacokinetics, pharmacodynamics, and many more. The key idea is same as for other parallel systems, using artificial systems and software-defined processes to generate big data with computational experiments, and then reduce the big data to precision knowledge or small intelligence for particular medical/healthcare problems of individuals with machine learning and AI technology [7].

Parallel Medicine and Parallel Healthcare Services

My work on social computing and parallel intelligence brought me into parallel medicine and parallel healthcare services, my third phase of medical research in late 2000s, thanks to my collaboration on medical informatics and smart healthcare with friend and former colleague Professor Hsinchun Chen of the University of Arizona and James A. Hendler of Rensselaer Polytechnical Institute, Troy, NY. In 2014, with the help of my former PhD student Xiaobo Shi, we created the Institute for Smart Medicine and Healthcare at the Qingdao Academy of Intelligent Industries, with the initial focus on a parallel medical treatment systems for gout, a common but complex form of arthritis characterized by sudden, severe attacks of pain, swelling, redness and tenderness in the joints. Gout is a big local and historical medical issue in the coastal Qingdao (Tsingtao) due to its famous seafoods and beers (Tsingtao Beer), and a fast emerging and growing health problem nationwide, especially among young generations due to rapid societal ad dietary changes in modern China. The AI system, called Parallel Gout, with the largest database for gout treatment and drug analysis, was launched online on September 2016 at the Qingdao University Hospital and have served over 7000 patients over 28000 times so far with an average performance comparable with that of the best doctors in the field [8]. Since 2016, a dozen of other parallel medical systems for gastrointestinal diagnostics, surgical operations, eye treatment, skin care, etc., have been investigated and designed with support and help from doctors across China [9].

The unexpected eruption of worldwide AI enthusiasm has disrupted my original plan for research and development of parallel intelligent medical systems. More importantly, my personal experience with doctors and hospital managers makes me realize that AI technology and smart medical systems alone are enough for real significant changes in our medical and healthcare systems under the current regulations, governances, organizational structures and management policies. For example, while a huge amount of medical data is available but actually a very little of them are actually allowable for fair and efficient use, big data become no data for many medical AI and machine learning systems. There is an urgent need of AI technology for improving organizational and management works in medical and healthcare services, as a matter of fact, many critical issues are social, not medical or scientific, this is the reason we must develop new computational social systems with AI and blockchain for this purpose.

Parallel Hospitals and Digital Personal Doctors

The current phase of my medical and healthcare research is on parallel hospitals and digital personal doctors, this is a new form of computational social systems necessary for enabling smart medical and healthcare services. I hope those techniques would fundamentally improve our medical practices and healthcare industry, make them affordable, effective, and sustainable to all of us.

A parallel hospital is a real physical hospital combined with one or many virtual digital hospitals, you might want to call them digital twins of hospitals, but I still prefer to call them artificial hospitals or software-defined hospitals since twins are often too difficult to achieve. In today's clouds-edges architecture, a significant part of artificial hospitals will be hosted by remote clouds and the reminding part will be embedded in the local edges in actual hospitals or service centers, designed and constructed under the principle of "local simple, remote complex". The current hospital information systems provide a good foundation to support parallel hospitals, but far from enough. With artificial hospitals, we can effectively and efficiently organize various AI and machine learning techniques to implement medical and healthcare robotic process automation (RPA) and incorporate blockchain and related technique for legally collecting and distributing information while protecting privacy and security. Artificial hospitals can also provide the infrastructure to support digital personal doctors for individual patients with federated information control, federated operation management, and federated machine learning for safe, sensitive, and smart medical and healthcare services. Digital nurses, digital patients, etc., can also be introduced and hosted by artificial hospitals.

In many aspects, artificial intelligence for intelligent hospitals much come from the corresponding artificial hospitals: descriptive, predictive, and prescriptive intelligence with descriptive, predictive, and prescriptive medical and healthcare knowledge and functions, respectively, through software-defined systems, computational experiments, and parallel execution. Of course, to be secure and sustainable, we have to consider power outages, network failures, AI engine disruption, natural disasters, and other unavoidable accidents, so parallel emergency management is still critical and important [7].

To me parallel hospitals and digital doctors will not replace human doctors and most of current medical professionals, they will move human doctors into better positions and create new and more medical and healthcare jobs with less tedious and laborious works and more enjoyable creative roles. Human monitoring and machine recommendation will be a new condition and norm of medical decision-making and operations. This will make medical and healthcare knowledge automation a reality soon, enable a paradigm shift in medical education and practices, and bring a revolution to individual and public healthcare services.

I hope this will be my new and last phase of medical research and the future of smart medicine and healthcare.

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FEI-YUE WANG
The State Key Laboratory for Management and Control of Complex Systems
Institute of Automation
Chinese Academy of Sciences
Beijing 100190, China
e-mail: feiyue.trans@gmail.com

Fei-Yue Wang (Fellow, IEEE) received the Ph.D. degree in computer and systems engineering from 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. In 2002, he joined the Laboratory of Complex Systems and Intelligence Science, CAS, as the Director, where he was the Vice President of research, education, and academic exchanges with the Institute of Automation from 2006 to 2010. In 2011, he was named as 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 elected as a fellow of INCOSE, IFAC, ASME, and AAAS. In 2007, he was a recipient of the National Prize in Natural Sciences of China and was awarded the Outstanding Scientist by ACM for his research contributions in intelligent control and social computing. He was also a recipient of the IEEE Intelligent Transportation Systems (ITS) Outstanding Application and Research Awards in 2009, 2011, and 2015, and the IEEE SMC Norbert Wiener Award in 2014. He has been 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 the *IEEE ITS Magazine* from 2006 to 2007. He was the EiC of the IEEE INTELLIGENT SYSTEMS from 2009 to 2012 and the IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS from 2009 to 2016. He is also the EiC of the IEEE TRANSACTIONS ON COMPUTATIONAL SOCIAL SYSTEMS and the Founding EiC of the IEEE/CAA JOURNAL OF AUTOMATICA SINICA and the *Chinese Journal of Command and Control*.