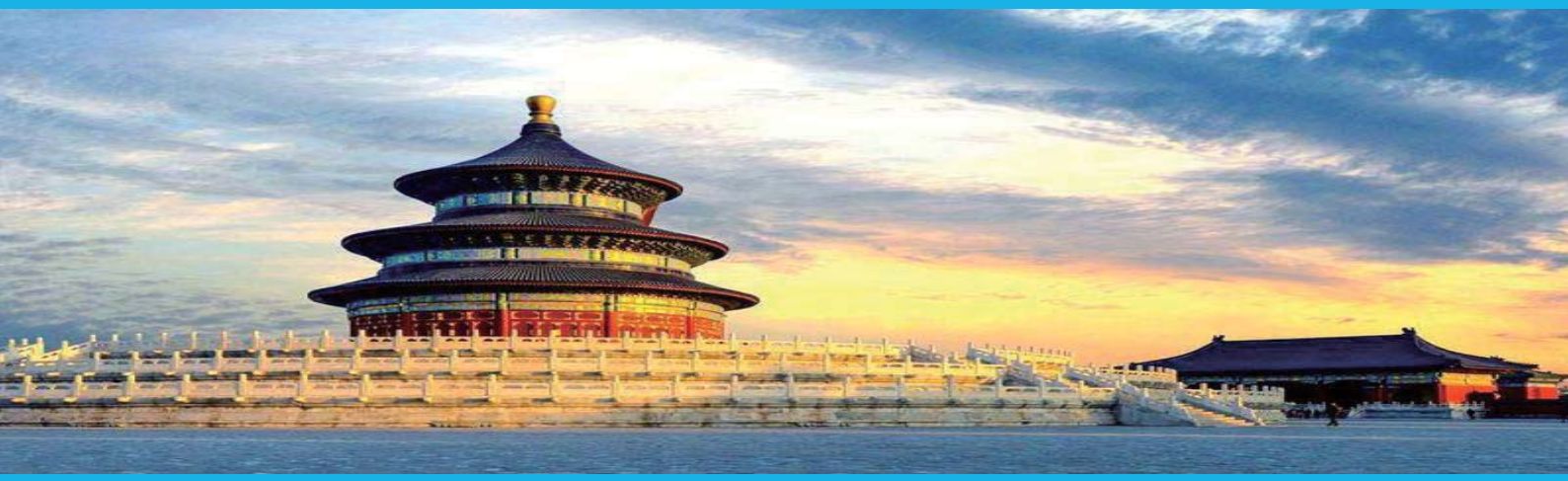
IEEE ICCSS 2021

2021 International Conference on Information, Cybernetics, and Computational Social Systems

December 10–12, 2021

Beijing, China



CONFERENCE DIGEST

Organizer:

Beijing University of Technology

Sponsors:

Beijing University of Technology

South China University of Technology

National Natural Science Foundation of China

IEEE Systems, Man and Cybernetics Society

Conference Digest

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Organized by

Beijing University of Technology, Beijing, China

Technically cosponsored by

Beijing University of Technology, Beijing, China
South China University of Technology, Guangzhou, Guangdong, China
National Natural Science Foundation of China (NSFC), China
IEEE Systems, Man and Cybernetics Society

Foreword

On behalf of the Organizing Committee, we sincerely welcome you to join us at the 2021 International Conference on Information, Cybernetics, and Computational Social Systems (ICCSS 2021) being held in Beijing, China, during December 10-12, 2021. ICCSS 2021 aims to provide an international forum that brings together those actively involved in computational social systems, cybernetics, and information processing, to report on up-to-the-minute innovations and developments, to summarize the state-of-the-art, and to exchange ideas and advances in all aspects of social systems, computation, cybernetics, and information processing.

ICCSS 2021 attracted a total of 191 submissions involving the most advanced development and research coverage with computational social systems, social computing, social networks analysis, data mining and machine learning, data analytics and data visualization, cybernetics and systems science, the intelligent systems, computational intelligence, position and location supported intelligence, signal and image processing, multiresolution and information processing, information security, pattern recognition and computer vision, robotic systems, service systems and organizations, smart sensor networks, system modeling and control, technology assessment, etc. According to the strict peer review of planning committee members and reviewers, 97 papers (acceptance rate 51%) were selected and included in the conference proceedings.

Many organizations and volunteers made great contributions toward the success of this conference. We would like to express our sincere gratitude to Beijing University of Technology, South China University of Technology, National Natural Science Foundation of China (NSFC), IEEE Systems, Man and Cybernetics Society for their sponsorship, and Beijing University of Technology for its Organization. We would also like to sincerely thank all the committee members for their great efforts in organizing the conference. Special thanks to all technical committee members and reviewers for their professional review to ensure the high quality of the meeting process. Finally, we would like to thank all speakers, authors, and participants for their great contribution and support to make ICCSS 2021 a success. We sincerely hope that all participants can gain academic achievements, enhance mutual communication, broaden their horizons and gain friendship in this conference!

Program Chairs

Prof. Qing-Long Han
Prof. Jian Sun
Prof. Wei He
Prof. Honggui Han
Prof. Saeid Nahavandi
Prof. Lu Liu
Prof. Xiao He
Prof. Zhiqiang Geng
Prof. Tong Zhang

Location: Grand Gongda Jianguo Hotel, No.100 Pingleyuan, Chaoyang District, Beijing, China.

Welcome Message

Welcome to the 2021 International Conference on Information, Cybernetics, and Computational Social Systems (ICCSS 2021)!

ICCSS 2021 provides an international forum that brings together those actively involved in computational social systems, cybernetics, and information processing, to report on up-to-the-minute innovations and developments, to summarize the state-of-the-art, and to exchange ideas and advances in all aspects of social systems, computation, cybernetics, and information processing.

We would like to take this opportunity to thank the Technical Program Committee comprising of many Area Chairs and Reviewers from all over the world, who have worked diligently to ensure that high quality papers will be presented and published in the proceedings. We also acknowledge the support of and express our sincere appreciation to the members of the local organizing committee. We are also grateful to the advice and guidance of the Executive Committee of the Beijing University of Technology, South China University of Technology, National Natural Science Foundation of China (NSFC) and IEEE Systems, Man and Cybernetics Society. Lastly and most importantly, we thank all of you, the authors and delegates, for participating in ICCSS 2021, sharing your knowledge and experience and contributing to the advancement of science and technology for the improvement of the quality of our lives.

We wish each and every one a most pleasant experience at ICCSS 2021 in Beijing.

C. L. Philip Chen
General Chair, ICCSS 2021

Junfei Qiao
General Chair, ICCSS 2021

ICCSS 2021 Conference Digest
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Technical Program

Committees

Honorary General Chairs	Tianyou Chai, Northeastern University, China Weihua Gui, Central South University, China Jie Chen, Beijing Institute of Technology, China Zhaotian Zhang, National Natural Science Foundation of China (NSFC), China Guozheng Wu, National Natural Science Foundation of China (NSFC), China Su Song, National Natural Science Foundation of China (NSFC), China Imre J. Rudas, Óbuda University, Budapest Ljiljana Trajkovic, Simon Fraser University, Canada
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Organizing Committee Co-Chairs	Yu Kang, University of science and technology of China, China Badong Chen, Xi'an Jiaotong University, China Hongli Dong, Northeast Petroleum University, China Weimin Zhong, East China University of Science and Technology, China

	Yongfang Xie, Central South University, China Jinliang Ding, Northeastern University, China Changchun Hua, Yanshan University, China Qinglei Hu, Beihang University, China Hongyi Li, Guangdong University of Technology, China Yuanqing Wu, Guangdong University of Technology, China Yi Liu, Zhejiang University of Technology, China Chao Shang, Tsinghua University, China Shengli Du, Beijing University of Technology, China
Award Committee Chairs	Junwei Han, Northwest University of Technology, China Mou Chen, Nanjing University of Aeronautics and Astronautics, China Sabrina Senatore, University of Salerno, Italy Wenwu Yu, Southeast University, China Zhenyu Lu, Nanjing University of Information Science & Technology, China Yanlong Zhao, Chinese Academy of Sciences, China Jun Zhao, Dalian University of Technology, China Long Cheng, Chinese Academy of Sciences, China Zhengguang Wu, Zhejiang University, China
Award Committee Co-Chairs	Binzhao Gao, Tongji University, China Yang Cong, Chinese Academy of Sciences, China Xiwang Dong, Beihang University, China Hujun Yin, University of Manchester, UK Chunyang Zhang, Fuzhou University, China Licheng Liu, Hunan University, China Chen Wang, Tsinghua University, China
Publicity Chairs	Zidong Wang, Brunel University London, United Kingdom Yang Xiao, The University of Alabama, USA Haitao Zhang, Huazhong University of Science and Technology, China Tao Yang, Northeastern University, China
Publicity Co-Chairs	Ke Tang, South University of Science and Technology, China Radu-Emil Precup, Polytechnic University of Timisoara, Swiss Xiaoli Luan, Jiangnan University, China Lu Zhang, Shandong University of Science and Technology, China
Special Session Chairs	Bo Yang, Shanghai Jiaotong University, China Tiantian Xu, Chinese Academy of Sciences, China Ke Gu, Beijing University of Technology, China Yong Xu, Guangdong University of Technology, China
Local Arrangement Chairs	Fang Deng, Beijing Institute of Technology, China Xiangjie Liu, North China Electric Power University, China Ziyang Meng, Tsinghua University, China Deyuan Meng, Beihang University, China Liguo Zhang, Beijing University of Technology, China Ying Hou, Beijing University of Technology, China

Registration Chair	Hongyan Yang, Beijing University of Technology, China Huihui Gao, Beijing University of Technology, China
Publication Chairs	Long Chen, University of Macau, Macau, China Jiwen Lu, Tsinghua University, China Ding Wang, Beijing University of Technology, China
Secretaries	Haoyuan Sun, Beijing University of Technology, China Huayun Han, Beijing University of Technology, China

General Information

The 2021 International Conference on Information, Cybernetics, and Computational Social Systems (ICCSS) will be held at Grand Gongda Jianguo Hotel, No.100 Pingleyuan, Chaoyang District, Beijing, China. There are 2 options for 798 CNY per night: The first option is Guestroom (2 beds) with 30 such rooms, including breakfast; the second option is Guestroom (Double bed) with 30 such rooms, including breakfast. And first come first served.

Transportation Information

Route 1: (about 1 hour and 8 minutes)

Terminal 2 (2 号航站楼) —Capital Airport Express→ SANYUANQIAO(三元桥) —Line 10→ HUJIALOU(呼家楼) —Line 6→ JINTAILU(金台路) —Line 14 East→ BEIGONGDA XIMEN(北工大西门)

Come out from Exit C and walk about 383 meters.

Route 2:(about 40 minutes)

Beijing Railway Station(北京站) —Line 2→ CHONGWENMEN(崇文门) —Line 5→ PUHUANGYU(蒲黄榆) —Line 14 East→ BEIGONGDA XIMEN(北工大西门)

Come out from Exit C and walk about 383 meters.

Route 3:(about 27 minutes)

Beijing South Railway Station(北京南站) —Line 14 East→ BEIGONGDA XIMEN(北工大西门)

Come out from Exit C and walk about 383 meters.

Route 4:(about 40 minutes)

Beijing West Railway Station(北京西站) —Line 7→ Jiu Long Shan(九龙山) —Line 14 East→ BEIGONGDA XIMEN(北工大西门)

Come out from Exit C and walk about 383 meters.

Route 5:(about 49 minutes)

Beijing West Railway Station(北京北站) —Walk→ XIZHIMEN(西直门) —Line 4/DAXING Line→ Beijing South Railway Station (北京南站) —Line 14 East→ BEIGONGDA XIMEN(北工大西门)

Come out from Exit C and walk about 383 meters.

Route 6:(about 1 hour)

Daxing Airport(大兴机场) —Daxing Airport Express→ Cao Qiao(草桥) —Line 10→ SHILIHE(十里河) —Line 14 East→ BEIGONGDA XIMEN(北工大西门)

Come out from Exit C and walk about 383 meters.

Surrounding Information

Beijing is a global city and one of the world's leading centres for culture, diplomacy and politics, business and economics, education, language, and science and technology. A megacity, Beijing is the second largest Chinese city by urban population after Shanghai and is the nation's cultural, educational, and political center. It is home to the headquarters of most of China's largest state-owned companies and houses the largest number of Fortune Global 500 companies in the world, as well as the world's four biggest financial institutions by total assets. Beijing is the "billionaire capital of the world" with the highest number of billionaires living in the city. It is also a major hub for the national highway, expressway, railway, and high-speed rail networks. The Beijing Capital International Airport has been the second busiest in the world by passenger traffic (Asia's busiest) since 2010, and, as of 2016, the city's subway network is the busiest and longest in the world. The Beijing Daxing International Airport, a second international airport in Beijing, is the largest single-structure airport terminal in the world.

Combining both modern and traditional style architectures, Beijing is one of the oldest cities in the world, with a rich history dating back over three millennia. As the last of the Four Great Ancient Capitals of China, Beijing has been the political center of the country for most of the past eight centuries, and was the largest city in the world by population for much of the second millennium AD. With mountains surrounding the inland city on three sides, in addition to the old inner and outer city walls, Beijing was strategically poised and developed to be the residence of the emperor and thus was the perfect location for the imperial capital. The city is renowned for its opulent palaces, temples, parks, gardens, tombs, walls and gates. It has seven UNESCO World Heritage Sites—the Forbidden City, Temple of Heaven, Summer Palace, Ming Tombs, Zhoukoudian, and parts of the Great Wall and the Grand Canal—all of which are popular tourist locations. Siheyuans, the city's traditional housing style, and hutongs, the narrow alleys between siheyuans, are major tourist attractions and are common in urban Beijing.

Here are some places worth visiting in Beijing:

Tiananmen Square(天安门广场)

Tiananmen Square or Tian'anmen Square is a city square in the city center of Beijing, China, located near the city's Central Business District and named after the eponymous Tiananmen ("Gate of Heavenly Peace") located to its north, which separates it from the Forbidden City. The square contains the Monument to the People's Heroes, the Great Hall of the People, the National Museum of China, and the Mausoleum of Mao Zedong. Mao Zedong proclaimed the founding of the People's Republic of China in the square on October 1, 1949; the anniversary of this event is still observed there. The size of Tiananmen Square is 765 x 282 meters (215,730 m2 or 53.31 acres). It has great cultural significance as it was the site of several important events in Chinese history.

Outside China, the square is best known for the 1989 protests and massacre that ended with a military crackdown, which is also known as the Tiananmen Square Massacre or the June Fourth Massacre.

Forbidden City(故宫)

The Forbidden City (Chinese: 紫禁城) is a palace complex in Dongcheng District, Beijing, China, at the center of the Imperial City of Beijing. It is surrounded by numerous opulent imperial gardens and temples including the 22-hectare (54-acre) Zhongshan Park, the sacrificial Imperial Ancestral Temple, the 69-hectare (171-acre) Beihai Park, and the 23-hectare (57-acre) Jingshan Park.

The Forbidden City was constructed from 1406 to 1420, and was the former Chinese imperial palace and winter residence of the Emperor of China from the Ming dynasty (since the Yongle Emperor) to the end of the Qing dynasty, between 1420 and 1924. The Forbidden City served as the home of Chinese emperors and their households and was the ceremonial and political center of the Chinese government for over 500 years. Since 1925, the Forbidden City has been under the charge of the Palace Museum, whose extensive collection of artwork and artifacts were built upon the imperial collections of the Ming and Qing dynasties. The Forbidden City was declared a World Heritage Site in 1987.

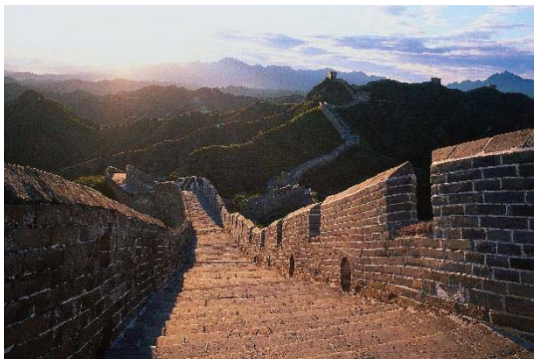
The Forbidden City in Beijing is one of the largest and most well-preserved ancient wooden

structures in the world. It is a national AAAAA-level tourist attraction in China.

Great Wall of China(万里长城)

The Great Wall of China (Chinese: 万里长城) is a series of fortifications that were built across the historical northern borders of ancient Chinese states and Imperial China as protection against various nomadic groups from the Eurasian Steppe. Several walls were built from as early as the 7th century BC, with selective stretches later joined together by Qin Shi Huang (220–206 BC), the first emperor of China. Little of the Qin wall remains. Later on, many successive dynasties built and maintained multiple stretches of border walls. The best-known sections of the wall were built by the Ming dynasty (1368–1644).

The frontier walls built by different dynasties have multiple courses. Collectively, they stretch from Liaodong in the east to Lop Lake in the west, from the present-day Sino–Russian border in the north to Tao River (Taohe) in the south; along an arc that roughly delineates the edge of the Mongolian steppe; spanning over 20,000 km (12,000 mi) in total. Today, the defensive system of the Great Wall is generally recognized as one of the most impressive architectural feats in history.



Summer Palace(颐和园)

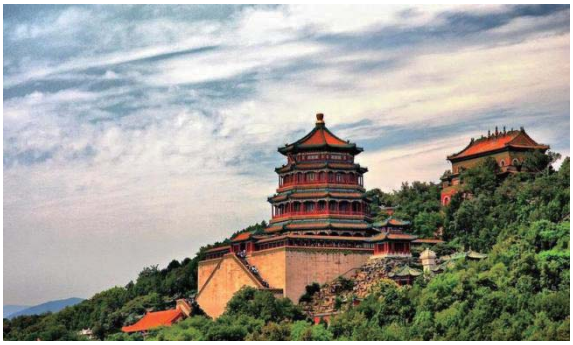
The Summer Palace (Chinese: 颐和园) is a vast ensemble of lakes, gardens and palaces in Beijing.

It was an imperial garden in the Qing dynasty. Inside includes Longevity Hill (万寿山) Kunming Lake and Seventeen Hole Bridge. It covers an expanse of 2.9 square kilometres, three-quarters of which is water.

Longevity Hill is about 60 metres (200 ft) high and has many buildings positioned in sequence. The front hill is rich with splendid halls and pavilions, while the back hill, in sharp contrast, is quiet with natural beauty. The central Kunming Lake, covering 2.2 square kilometres (540 acres), was entirely man-made and the excavated soil was used to build Longevity Hill.

Inspired by the gardens in South China, in the Summer Palace there are over 3,000 various Chinese ancient buildings that house a collection of over 40,000 kinds of valuable historical relics from each dynasty.

In December 1998, UNESCO included the Summer Palace on its World Heritage List. It declared the Summer Palace "a masterpiece of Chinese landscape garden design. The natural landscape of hills and open water is combined with artificial features such as pavilions, halls, palaces, temples and bridges to form a harmonious ensemble of outstanding aesthetic value".



ICCSS 2021

Program at a Glance

December 10-12, 2021

Beijing, China

December 11 (Saturday)	
Keynote Speech and Invited Talk I ID: 464-844-577（腾讯会议） Oral Session I-A and II-A ID: 123-452-758（腾讯会议） Oral Session I-B and II-B ID: 145-705-070（腾讯会议）	
08:30-08:50	Opening Ceremony
08:50-11:40	**08:50—09:50 Keynote 1** by Slamu, Wushour: Discussion on Multilingual Hybrid Intelligent Processing of Silk Road Host: Prof. C. L. Philip Chen **09:50—10:50 Keynote 2** by Tianyou Chai: Development Directions of Industrial Intelligence Host: Prof. Weimin Zhong **10:50—11:50 Keynote 3** by Yaonan Wang: Application and development trend of key technologies in intelligent manufacturing and industrial Internet Host：Prof. Jun Fu
12:00-14:00	Lunch
14:00-16:00	**14:00—14:40 Invited Talk I-1** by Wenwu Yu: Networked Collective Intelligence in Intelligent Transportation System Host：Prof. Dayi Wang **14:40—15:20 Invited Talk I-2** by Yongduan Song: Several Important Issues That Are Overlooked When Designing Controllers Using Neural Networks Host：Prof. Quanbo Ge **15:20—16:00 Invited Talk I-3** by Jiye Liang: Adaptive Graph Construction based Machine Learning Host：Prof. Jing Liang
	Oral Session I-A Chair: Xinrong Gong **Paper ID:** 005,025,027,031, 033,037,051,066 **Oral Session I-B** Chair: Zongyan Zhang **Paper ID:** 046, 048, 054, 056, 062, 064, 073, 067,044
	16:00—16:40 Invited Talk I-4 by Tong Zhou: Structure Identifiability of Networked Dynamic Systems and Beyond Host：Prof. Zhengguang Wu **16:40—17:20 Invited Talk I-5** by Ke Tang: Evolutionary

16：50-17:20	Computation Made Practical Host： Prof. Yang Cong
	Oral Session II-A Chair: Xinrong Gong **Paper ID:** 057, 041, 016, 034, 002, 039, 087 **Oral Session II-B** Chair: Zongyan Zhang **Paper ID:** 068, 072, 075, 077, 078, 081,082, 086

***For oral sessions:** 12 minutes (Speech: 10 minutes, Q&A: 2 minutes) are scheduled for oral presentation including discussions for each paper.

December 12 (Sunday)	
Invited Talk II and III ID: 464-844-577（腾讯会议） Oral Session III-A, IV-A, V-A and VI-A ID: 123-452-758（腾讯会议） Oral Session III-B, IV- B, V- B and VI- B ID: 145-705-070（腾讯会议）	
08:30-10:30	**08:30—09:10 Invited Talk II-1** by Fuchun Sun: Behavior Intelligence: Model and Cognitive Computation Host：Prof. Xiaoli Luan **09:10—09:50 Invited Talk II-2** by Enhong Chen: Current Status and Prospects of Adaptive Learning Technology in Intelligent Education Host：Prof. Xiao He **09:50—10:30 Invited Talk II-3** by Qinghua Hu: Trusted Multi-modality Learning with Uncertain Information Host：Prof. Tiantian Xu
	Oral Session III-A Chair: Xue Jia **Paper ID:** 088, 089, 090, 091, 092, 096, 038, 013 **Oral Session III-B** Chair: Run Ning **Paper ID:** 055, 059, 060, 061, 063, 065, 069, 070
10:30-11:50	**10:30—11:10 Invited Talk II-4** by Bin Hu: Computational Psychophysiology Based Emotion Analysis for Mental Health Host：Prof. Yanlong Zhao **11:10—11:50 Invited Talk II-5** by Jun Zhao: Data and Knowledge Driven Industrial Energy Prediction and Scheduling Host：Prof. Mou Chen
	Oral Session IV-A Chair: Xue Jia **Paper ID:** 015, 017, 019, 026, 030, 036, 052, 053 **Oral Session IV-B** Chair: Run Ning **Paper ID:** 071, 076, 079, 083, 084, 014, 093, 094
12:00-14:00	Lunch
14:00-15:30	**14:00—14:40 Invited Talk III-1** by Xin Xu: Advances in Autonomy Intelligence and Hybrid Intelligence of Unmanned Systems Host：Prof. Junzhi Yu **14:40—15:20 Invited Talk III-2** by Hongli Dong: Research on Recursive Filtering for Time-Varying Systems in the Sense of Energy-Saving and Secure Transmission Host：Prof. Long Cheng **15:20—16:00 Invited Talk III-3** by Qunxiong Zhu: Research on Virtual Sample Generation for Label Data in Supervised Learning Host：Prof. Wei He

	Oral Session V-A Chair: Jibao Qiu **Paper ID:** 001,004,007,008, 018,022,023,028 **Oral Session V-B** Chair: Qiwei Fan **Paper ID:** 021,080,085,003,009, 010,012,020,024
15:50-17:20	**16:00—16:40 Invited Talk III-4** by Jiwen Lu: Visual Foundation Models and Applications Host：Prof. Jian Sun **16:40—17:20 Invited Talk III-5** by Shaoyuan LI: Operation Optimization and Predictive Control for Distributed Systems Host：Prof. Zhenyu Lu
	Oral Session VI-A Chair: Jibao Qiu **Paper ID:** 029,032,040,042, 045,047,049,058 **Oral Session VI-B** Chair: Qiwei Fan **Paper ID:** 166,043,050,011, 006, 110,126,160

***For oral sessions:** 12 minutes (Speech: 10 minutes, Q&A: 2 minutes) are scheduled for oral presentation including discussions for each paper.

ICCSS 2021 Program at a Glance

December 11, 2021		
08:30-08:50	Opening Ceremony	464-844-577（腾讯会议）
08:50-12:00	Keynote Speech	
12:00-14:00	Lunch	/
14:00-17:20	Invited Talk I	464-844-577（腾讯会议）
	Oral Session I	A：123-452-758（腾讯会议） B：145-705-070（腾讯会议）
	Oral Session II	A：123-452-758（腾讯会议） B：145-705-070（腾讯会议）
December 12, 2021		
08:30-11:50	Invited Talk II	464-844-577（腾讯会议）
	Oral Session III	A：123-452-758（腾讯会议） B：145-705-070（腾讯会议）
	Oral Session IV	A：123-452-758（腾讯会议） B：145-705-070（腾讯会议）
12:00-14:00	Lunch	/
14:00-17:20	Invited Talk III	464-844-577（腾讯会议）
	Oral Session V	A：123-452-758（腾讯会议） B：145-705-070（腾讯会议）
	Oral Session VI	A：123-452-758（腾讯会议） B：145-705-070（腾讯会议）

Technical Program Schedule

Oral Session I

Dec 11, Afternoon

A：123-452-758（腾讯会议）； B：145-705-070（腾讯会议）

Oral Session I-A chair: Xinrong Gong

Oral Session II-A chair: Xinrong Gong

Time	Title	Author
14:00 – 16:00	[#5] Chebyshev Polynomial Broad Learning System	Shuang Feng, Bingshu Wang, C. L. Philip Chen
	[#25] Iteration Graph Network	Wenchuan Zhang, Weihua Ou, Shili Niu, Ruxin Wang, Ziqi Zhu, Shen Ke
	[#27] Privacy-Preserving Average Consensus for Multi-agent Systems with Directed Topologies	Xinyue Qiao, Yuxin Wu, Deyuan Meng
	[#31] A Merge Collision Prediction TDMA-MAC Protocol in Distributed VANET	Changyue Zhang, Shiyuan Han, Jin Zhou, Baozhu Li, Xiaojie Yu, Kang Yao
	[#33] Texture Recognition and Three-Dimensional Force Measurement Using Vision-based Tactile Sensor	Xiaoyue Cao, Chunfang Liu, Xiaoli Li
	[#37] BroadSurv: A Novel Broad Learning System-based Approach for Survival Analysis	Guangheng Wu, Junwei Duan, Jing Wang, Lu Wang, Cheng Dong, Changwei Lv
	[#51] Adaptive Neural Consensus Control of Nonlinear Multi-agent Systems with Actuator Failures	Zhuangbi Lin, Zhi Liu
	[#66] A Reinforcement Learning-Based Detection Method for False Data Injection Attack in Distributed Smart Grid	Kuo Zhang, Zhengguang Wu
16:00 – 17:20	[#57] Deep Graph Network for Process Soft Sensor Development	Mingwei Jia, Yun Dai, Danya Xu, Tao Yang, Yuan Yao and Yi Liu
	[#41] Solution Evaluation-Oriented Multi-objective Differential Evolution Algorithm for MOVRPTW	Ying Hou, Yilin Wu, Honggui Han
	[#16] A Knowledge Transfer-based Fuzzy Broad Learning System for Modeling Nonlinear Systems	Zheng Liu, Honggui Han, Junfei Qiao

	[#34] Dynamic KPCA for Feature Extraction of Wastewater Treatment Process	Xiaoye Fan, Xiaolong Wu, Honggui Han
	[#2] Causality Induced Distributed Spatio-temporal Feature Extraction	Duxin Chen, Wenwu Yu, Qi Shao, Xiaolu Liu
	[#39] Hot Rolling Scheduling of Heavy Plate Production Based on Heuristic and Ant Colony Algorithms	Jiangtao Xu, Jinliang Ding, Qingda Chen, Ling Yi
	[#87] Dual-Grained Clustering with Concurrent Evaluation of Static and Dynamic Slow Features for Instantaneous Product Quality Assessment	Liming Zhu, Xiaping Fan, Wei Wang, Ming Li

Oral Session II:

Dec 11, Afternoon

A：123-452-758（腾讯会议）； B：145-705-070（腾讯会议）

Oral Session I-B chair: Zongyan Zhang

Oral Session II-B chair: Zongyan Zhang

Time	Title	Author
14:00 – 16:00	[#46] Asynchronous Impulsive Bounded Synchronization of Multiplex Networks with Parameter Mismatches and Time-varying Delay	Di Ning , Junhao Hu
	[#48] Deep Autoencoder for Non-destructive Testing of Defects in Polymer Composites	Mingkai Zheng, Kaixin Liu, Nanxin Li, Yuan Yao, Yi Liu
	[#54] Nonlinear Control with Energy Shaping for Unmanned Helicopter Slung-load System Based on Disturbance Observer	Wei Liu, Mou Chen
	[#56] Trend similarity MWPCA based fault monitoring for xylenol tail gas treatment process	Feihong Xu, Xiaoli Luan
	[#62] Kernel-based Class-specific Broad Learning System for software defect prediction	Wuxing Chen, Kaixiang Yang, Yifan Shi, Qiying Feng, Zhiwen Yu
	[#64] Obstacle avoidance control of the unmanned bicycle based on variable universe fuzzy exponential rate reaching law sliding mode control	Zipeng Xu, Longlong Fan, Yongli Zhang, Hongxing Li
	[#73] Finite-time consensus tracking for large-scale multi-motor system based on second-order communication topology	Hui Li, Dengxiu Yu, Zhen Wang, Hao Xu, Shengjin Li, Jia Long
	[#67] Real-time Reachable Set Estimation of Discrete-time Singular Systems	Yuning Cao, Zhiguang Feng, Yanmin Liu
	[#44] Exponential synchronization for fuzzy inertial neural networks with mixed time delays	Jing Han, Guici Chen, Guodong Zhang, Junhao Hu
16:00 – 17:20	[#68] A Prediction Model for Remaining Useful Life of Turbofan Engines by Fusing Broad Learning System and Temporal Convolutional Network	Kai Yu, Degang Wang, Hongxing Li
	[#72] Design of Robust Fuzzy Neural Network with α- Divergence	Jiaqian Wang, Zheng Liu, Honggui Han
	[#75] EGCN: Ensemble Graph Convolutional Network for Neural Architecture Performance Prediction	Xin Liu, Zixiang Ding, Nannan Li, Yaran Chen, and Dongbin Zhao
	[#77] Cooperative Control of Intersection Connected Vehicles under Constrained Communication Resource	Wanxing Xiao, Bo Yang
	[#78] Spatial-temporal Traffic Flow Prediction	Qiang Zhao, Qiwei Sun,

	Model Based on Dynamic Graph Structure	Shiyuan Han, Jin Zhou, Yuehui, Xiaofang Zhong
	[#81] Research on Underwater Object Detection Based on Improved YOLOv4	Wang Hao, Nangfeng Xiao
	[#82] A Dual-Robot Welding Path Planning Method Based on Kmeans and Ant Colony Algorithms	Jingjing Wang, Hongli Deng, Cun Wang, Xinliang Cao
	[#86] Parallel Temporal and Spatial Modeling for Interpretable Fault Detection and Isolation of Industrial Processes	Pengyu Song, Chunhui Zhao, Jinliang Ding, Youxian Sun, Xuanxuan Jin

Oral Session III:

Dec 12, Morning

A：123-452-758（腾讯会议）； B：145-705-070（腾讯会议）

Oral Session III-A chair: Xue Jia

Oral Session IV-A chair: Xue Jia

Time	Title	Author
8:30 – 10:30	[#88] Adaptive Control for A Class of Nonlinear MIMO Systems	Chen Zhao, Xin Wang
	[#89] Moving Target Shooting Control Policy Based on Deep Reinforcement Learning	Boyu Li, Tao Jin, Yuanheng Zhu, Haoran Li, Yingnian Wu and Dongbin Zhao
	[#90] An evaluation management mechanism based on node trust	Jing Huang, Zhe-Yuan Sun, Hui-Juan Zhang, jia Chen, Shen He
	[#91] Lidar-millimeter wave radar information fusion multi-target detection based on unscented Kalman filter and covariance intersection algorithm	Fan Le, Hong Mo, Yinghui Meng
	[#92] Sliding mode control of a 2-DOF helicopter system with adaptive input compensation	Xuejing Lan, Weijie Yang, Jianing Zhang, Zhijia Zhao, Ge Ma, Zhifu Li
	[#96] Multi-Loss Function for Collision-to-distance Estimation	Xiangzhu Zhang, Lijia Zhang, Ding Xu, Hailong Pei
	[#38] Singularity-Free Robust Adaptive Controller for Miniature Helicopters	Yao Zou, Liangyin Zhong, Xiuyu He, Wei He
	[#13] NN-based Fixed-Time Tracking Control for Multi-Agent Systems With Input Delays	Xiaohong Zheng, Xiaomeng Li, Wenbin Xiao, Qi Zhou and Renquan Lu
10:30 – 11:50	[#15] A Multidimensional System Architecture Oriented to the Data Space of Manufacturing Enterprises	Kuan Lu, Zhijian Cheng, Hongru Ren, Renquan Lu
	[#17] An Improved UAV Path Optimization Algorithm forTarget Accurately and Quickly Localization	Rui Liang, Kai Wu, Sheng Xu, Tiantian Xu, Xiaoyi Ma, Lianyu Fu
	[#19] Fixed-/Preassigned-Time Anti-Synchronization of Chaotic Neural Networks	Haoyu Li, Leimin Wang, Xingyu Tian
	[#26] Interactive Segmentation Using Prior Knowledge-Based Distance Map	Youdam Chung, Wenkai Lu
	[#30] Channel Prediction for Real-Time Wireless Communication with MmWave SC-FDE in IIoT Systems	Changwei Lv, Ming Liu, Junwei Duan
	[#36] Observer-based feedback control for linear parabolic PDEs with quantized input	Xuena Zhao, Junwen Gu, Zhijie Liu, Wei He

	[#52]Parameter estimation for nonlinear functions related to LTI system responses	Ling Xu1, Feng Ding
	[#53] Load Margin Assessment of Electricity-heat System Based on the Improved CPF	Hongxin Dong, Zhongyang Han, Jun Zhao, Wei Wang

Oral Session IV:

Dec 12, Morning

A：123-452-758（腾讯会议）； B：145-705-070（腾讯会议）

Oral Session III-B chair: Run Ning

Oral Session IV-B chair: Run Ning

Time	Title	Author
8:30 – 10:30	[#55] Face Rotation and Recognition Based on Attention Mechanism and Generative Adversarial Networks	Hong Li, Nanfeng Xiao
	[#59] A modified Bayesian neural network integrating stochastic configuration network and ensemble learning strategy	Hao Zheng, Degang Wang, Wei Zhou
	[#60] Imported Appliance Risk Level Identification Based on Support Vector Machine Algorithm	Cheng Cheng, Jiejun Zhao, Xiaoli Luan, Li Mao, Feng Guo
	[#61] A Review on Simulation Platforms for Complex Industrial Process	Tianzheng Wang, Jian Tang, Heng Xia, Xiaotong Pan
	[#63] DNN Speech Separation Algorithm Based on Improved Segmented Masking Target	Meng Gao, Ying Gao, Feng Pei
	[#65] Recognition of aluminum electrolysis overheat trend based on DA-LSTM Neural Network	Ye Zhu, Shiwen Xie, Yongfang Xie, Xiaofang Chen
	[#69] Prediction of ship fuel consumption based on Elastic network regression model	Shanshan Li, Xinyu Li, Yi Zuo, Tieshan Li
	[#70] Underwater Sludge Detection System Based on Multi-Data Fusion	Yunchao Jiang, Shunyi Zhao, Songjie Guo
10:30 – 11:50	[#71] Residual Channel Attention Connection Network for Reference-based Image Super-resolution	Ruirong Lin, Nangfeng Xiao
	[#76] Attitude Control of Quadrotor UAVs Using Adaptive Terminal Sliding Mode Control	Haiming Du, Jian Sun, Gang Wang
	[#79] Research on Shift Matching to Enhance DAM	Kai Hu, Nanfeng Xiao
	[#83] End-to-End Supervised Zero-Shot Learning with Meta-Learning Strategy	Xiaofeng Xu, Xianglin Bao, Ruiheng Zhang, Xingyu Lu
	[#84] ISSPM: A stock prediction model incorporating investor sentiment calculations based on fusedmax	Yuer Yang, Siting Chen, Zeguang Chen, Shaobo Chen, Ruolanxin Li, Zhiye Cai, Haotian Gu, Hongyi Yin, Yujuan Quan

	[#14] Command-Filter-Based Finite-Time Control for Human-in-the-Loop UAVs With Dead-Zone Inputs	Guohuai Lin, Zhijian Cheng, Hongru Ren, Hongyi Li, Renquan Lu
	[#93] Adaptive Neural Network-Based Fault-Tolerant Control of 2-DOF Helicopter With Output Constraints	Zhijia Zhao, Jian Zhang, Jianing Zhang, Tao Zou
	[#94] Time-varying state constraints-based neural network control of a 2-DOF helicopter system	Tao Zou, Huiyuan Wu, Zhijia Zhao, Jianing Zhang

Oral Session V:

December 12, Afternoon； A: 123-452-758（腾讯会议）；B: 145-705-070（腾讯会议）

Oral Session V-A chair: Jibao Qiu

Oral Session VI-A chair: Jibao Qiu

Time	Title	Author
14:00 – 16:00	[#001] Anti-windup neural network-sliding mode control for dynamic positioning vessels	Ting Sun, Cheng Liu, Xuegang Wang
	[#004] Weakly Supervised Fine-Grained Visual Classification Through Spatial Information Mining and Attention-guided Regularization	Lequan Wang, Jin Duan, Guangqiu Chen, Gaotian Liu, Ziqiang Chen
	[#007] Distributed Incremental Quasi-Newton Algorithm for Power System State Estimation	Yu Bai, Wenling Li, Bin Zhang
	[#008] Multi-agent coverage control based on improved community discovery algorithm	Hongyan Li, Shengjin Li, Zhen Wang, Chong Li, Shan Gao, Dengxiu Yu,
	[#018] Research on the Prediction Model of Key Personnel's Food Crime Based on Stacking Model Fusion	Yupeng Zhai, Xiaoli Li
	[#022] STDP and Competition Learning in Spiking Neural Networks and its application to Image Classification	Min Deng, Chuandong Li
	[#023] A Hierarchical Motion Retrieval Algorithm for Complex Manipulation Tasks Planning with An Encoded Knowledge Base	Ailin Xue, Xiaoli Li, Chunfang Liu
	[#028] A Reference-Vector-Based Strength Pareto Evolutionary Algorithm 2	Lu Zhang, Qinchao Meng
16:00 – 17:20	[#029] Veracity: A Fake News Detection Architecture for MANET Messaging	Amit Neil Ramkissoon, Wayne Goodridge
	[#032] LBP index for evaluation of disk degaussing achievement based on AFM image	Ziying Zhang, Zhe Xu, Xiaoge Liu, Jian Tang
	[#040] Optimal design of soft sensors and bias updating scheme based on rank-constrained optimizationrank-constrained optimization	Yibo Wang, Chao Shang, Dexian Huang
	[#042] Adaptive Intra Refresh For Low-Latency Video Coding	Xi Huang, Luheng Jia, Han Wang, Kebin Jia
	[#045] Research on Traffic Load Balancing of Data Center Based on SDN in Campus Networkchallenges, and methods	Shan Jing, Lei Guo, Chuan Zhao
	[#047] Optimal sampling control of nonlinear systems based on adaptive dynamic programming	Heping Gu, Jun Mei, Chuan Zhao,
	[#049] Enhanced Soft Sensor with Qualified Augmented Data Using Centroid Measurement Criterion	Yun Dai, Qing Yu, Yi Liu, Yuan Yao, Tao Yang
	[#058] Visualization analysis of rocket fault detection technology based on Citespace	Zhiguo Zhou, Lijing Huang, Ruliang Lin,

Oral Session VI:

December 12, Afternoon

A: 123-452-758（腾讯会议）；B: 145-705-070（腾讯会议）

Oral Session V-B chair: Qiwei Fan

Oral Session VI-B chair: Qiwei Fan

Time	Title	Author
14:00 – 16:00	[#021] A Supervised Learning Algorithm to Binary Classification Problem for Spiking Neural Networks	Shuyuan Wang, Chuandong Li
	[#080] Safety Analysis of Automatic Crane Trolley Running System Based on STAMP/STPA	Wenbo Zhang, Xiangkun Meng, Qihe Shan, Jianyuan Wang, Fei Teng, Tieshan Li,
	[#085] Stealthy False Data Injection Attacks against Extended Kalman Filter Detection in Power Grids	Yifa Liu, Long Cheng, Wenchao Xue, Shuping He
	[#003] Robust Multivariable Control for Municipal Wastewater Denitrification Process	Tong Wang, Honggui Han, Haoyuan Sun, Hongyan Yang, Xiaolong Wu
	[#009] Event-triggered intermittent control for finite time synchronization of delayed chaotic neural networks	Zeyu Ruan, Junhao Hu, Jun Mei
	[#010] Stabilization of Fuzzy Inertial Neural Networks with Infinite Delays	Changqing Long, Guodong Zhang, Junhao Hu
	[#012] Improved Sliding Mode-based Load Frequency Control in Multi-Area Power Systems	Jia Chen, Xinxin Liu, Xiaojie Su
	[#020] A Parallel Combination of Facilitating Synapse Based on Temporal Correlation in SpikeProp Algorithm	Shushi Liu, Chuandong Li
	[#024] An Image Recognizing Method Based on Precise Moment of Spikes	Wenlin Li, Chuandong Li
16:00 – 17:20	[#166] Parameters identification of photovoltaic cell models using the gradient iterative	Yan Ji, Jinde Cao
	[#043] Edge Detection of Microstructure Images of Magnetic Multilayer Materials via a Richer Convolutional Features Network	Shimin Zhang, Jiangsheng Gui, Zhihui Cai
	[#050] Event-triggered intermittent control for finite time synchronization of delayed chaotic neural networks	Yong Liu, Yingying Chi, Zhe Zheng, Rui Liu, Wenpeng Cui, Xiaoguang Jia
	[#11] IGBT Open Circuit Fault Diagnosis Based on Improved Support Vector Machine	Zhiqiang Geng, Qi Wang, Yongming Han

	[#006] Robust convergence of uncertain fuzzy BAM neural networks with time-varying delays	Liangliang Li, Wenlin Jiang
	[#110] Semi-Supervised Deep Clustering with Soft Membership Affinity	Haixiao Zhao, Rongrong Wang, Jin Zhou, Shiyuan Han, Tao Du, Ke Ji, Ya-ou Zhao, Kun Zhang, Yuehui Chen,
	[#126] Globally exponential attractivity of delayed neural networks evoked by periodic external inputs	Yan Ji, Jinde Cao
	[#160] Semi-Supervised Deep Clustering with Soft Membership Affinity	Haixiao Zhao, Rongrong Wang, Jin Zhou, Shiyuan Han, Tao Du, Ke Ji, Ya-ou Zhao, Kun Zhang, Yuehui Chen,

Keynote Speech 1

Title: Discussion on Multilingual Hybrid Intelligent Processing of Silk Road

Prof. WUSHOUR SLAMU

Xinjiang University

Abstract: Introducing the new development of hybrid intelligent processing such as big data-driven knowledge learning, cross-media collaborative processing, human-machine collaboration enhanced intelligence, group integrated intelligence, autonomous intelligent system, etc. Introducing a new generation of artificial intelligence hybrid intelligent processing based on deep learning and information perception, including big data-driven knowledge learning, knowledge computing engine, cross-media analysis and reasoning, intelligent recognition, natural language intelligent understanding and automatic generation and other key common technology systems, and its perception in the intelligent system, comprehensive analysis, timely processing, and self-adjustment functions; Introducing the application of hybrid intelligent processing in promoting the intelligentization of social governance, building an intelligent monitoring with early warning and comprehensive application platform, and the construction of the Silk Road Multilingual translation platform. Emphatically introducing the belt and Road natural language intelligent mutual evaluation platform and its large-scale corpus construction based on hybrid intelligent processing such as deep neural network, advanced machine learning and big data intelligence.

WUSHOUR SLAMU is currently a Professor and a Ph.D. Supervisor with Xinjiang University. He is an also an Academician of the Chinese Academy of Engineering. He is also an Executive Director of the Chinese Association for Artificial Intelligence. He has published more than 200 articles and presided over 65 key projects, including seven national 863 projects and one national 973 project. He has presided over the formulation of five international standards and more than 14 national standards. His research interest includes multilingual natural language processing. He received three National Science and Technology Progress Award.

Keynote Speech 2

Title: Development Directions of Industrial Intelligence

Prof. Tianyou Chai

Northeastern University

Abstract: In this talk, the role of industrial automation and information technology in the industrial revolutions is analyzed, as well as the current status and main problems in automation and information for manufacturing enterprise. The connotation of industrial intelligence and the challenges in realizing industrial intelligence are put forward. Based on the analysis and application cases of industrial internet and industrial artificial intelligence, the technical basis of industrial intelligence is presented. Then, the research directions, ideas and methods of industrial intelligence are proposed.

Tianyou Chai received the Ph.D. degree in control theory and engineering in 1985 from Northeastern University, Shenyang, China, where he became a Professor in 1988. He is the founder and Director of the Center of Automation, which became a National Engineering and Technology Research Center and a State Key Laboratory. He is a member of Chinese Academy of Engineering, IFAC Fellow and IEEE Fellow. He has served as director of Department of Information Science of National Natural Science Foundation of China from 2010 to 2018.

His current research interests include modeling, control, optimization and integrated automation of complex industrial processes.

He has published 260 peer reviewed international journal papers. His paper titled Hybrid intelligent control for optimal operation of shaft furnace roasting process was selected as one of three best papers for the Control Engineering Practice Paper Prize for 2011-2013. He has developed control technologies with applications to various industrial processes. For his contributions, he has won 5 prestigious awards of National Natural Science, National Science and Technology Progress and National Technological Innovation, the 2007 Industry Award for Excellence in Transitional Control Research from IEEE Multiple-conference on Systems and Control, and the 2017 Wook Hyun Kwon Education Award from Asian Control Association.

Keynote Speech 3

Title: Application and development trend of key technologies in intelligent manufacturing and industrial Internet

Prof. Yaonan Wang

Hunan University

Abstract: Industrial Internet is an industrial and application ecology formed by the all-round deep integration of new generation information technology and manufacturing industry, and is a key integrated infrastructure to promote the high-quality development of manufacturing industry, which involves many disciplines such as computer, control, communication, robotics, artificial intelligence and cognitive science. In the past decade, industrial Internet technology has developed rapidly, and the new generation of intelligent manufacturing systems resulting from the integration with artificial intelligence technology have been more and more widely used in many advanced manufacturing fields such as aerospace, marine engineering, rail transportation, and new energy vehicles, which play a crucial role in promoting China's scientific and technological innovation, economic development, major needs, and people's health.

This report first reviews the history, background and current development status of smart manufacturing at home and abroad, and points out the new connotation of contemporary smart manufacturing. Then, it clarifies the important position of industrial Internet in smart manufacturing, outlines the latest development status of industrial Internet at home and abroad, and points out the core content of industrial Internet and current challenges. Then, the system structure of industrial Internet, the technology of Cloud-Edge collaborative computing, the technology of Cloud-Edge convergent robot and its typical application cases in the smart manufacturing industry such as medicine, electronics, automobile and ship are introduced in detail. Finally, the future development trend of industrial Internet in smart manufacturing is prospected.

Yaonan Wang is an Academician of the Chinese Academy of Engineering, expert in robotics and intelligent control, professor and doctoral supervisor of Hunan University, is the director of National Engineering Laboratory of Robot Vision Perception and Control Technology. He is currently a member of the Chinese Society of Automation, the Chinese Society of Computer Science, the Chinese Society of Artificial Intelligence, the Chinese Society of Graphics, the Vice President of the National Intelligent Robotics Innovation Alliance,

the Executive Director of the Chinese Society of Automation, the Supervisor of the Chinese Society of Artificial Intelligence, a member of the Technical Committee of Artificial Intelligence and Blockchain of the Science and Technology Commission of the Ministry of Education, and the President of the Hunan Provincial Society of Automation. He was the subject matter expert in the field of intelligent robotics of the National 863 Program, and the chief scientist of the EU Fifth Framework International Cooperation Major Project.

He has long been engaged in research and teaching scientific research on robot sensing and control technology and engineering applications, and has won one National Technical Invention Second Prize, three National Science and Technology Progress Second Prizes, and 11 Provincial and Ministerial First Prizes as the first completer. He has published more than 200 SCI papers such as IEEE, 15 books and more than 80 national invention patents. He was selected as a Humboldt Scholar in Germany. He has trained more than 70 PhDs and won the honorary titles of National Outstanding Backbone Teacher in Higher Education, National May Day Labor Medal, National Advanced Worker, National Innovation and Competition Award, and Advanced Individual in Hunan Province against the New Crown Epidemic.

Invited Talk I-1

Title： Networked Collective Intelligence in Intelligent Transportation System

Prof. Wenwu Yu

Abstract: In this talk, the multi-agent collective behaviors and some of their potential applications are briefly reviewed. In particular, intelligent transportation system is studied based on networked collective intelligence. We first introduced the 5G technology about networked automatic drive. Then, we discussed several critical problems about network construction, prediction of network traffic, and traffic signal control, which forms the cooperative intelligent system. We also provided some future studies in this topic. 。

Wenwu Yu received the B.Sc. degree in information and computing science and M.Sc. degree in applied mathematics from the Department of Mathematics, Southeast University, Nanjing, China, in 2004 and 2007, respectively, and the Ph.D. degree from the Department of Electronic Engineering, City University of Hong Kong, Hong Kong, China, in 2010. Currently, he is the Founding Director of Laboratory of Cooperative Control of Complex Systems and the Deputy Associate Director of Jiangsu Provincial Key Laboratory of Networked Collective Intelligence, an Associate Dean in the School of Mathematics, and a Full Professor with the Endowed Chair Honor in Southeast University, China. Dr. Yu held several visiting positions in Australia, China, Germany, Italy, the Netherlands, and the USA. His research interests include multi-agent systems, complex networks and systems, disturbance control, distributed optimization, neural networks, game theory, cyberspace security, smart grids, intelligent transportation systems, big-data analysis, etc. Dr. Yu severs as an Editorial Board Member of several flag journals, including IEEE Transactions on Circuits and Systems II, IEEE Transactions on Industrial Informatics, IEEE Transactions on Systems, Man, and Cybernetics: Systems, Science China Information Sciences, Science China Technological Sciences, ACTA AUTOMATICA SINICA, etc. He was listed by Clarivate Analytics/Thomson Reuters Highly Cited Researchers in Engineering in 2014 -2021. He publishes about 100 IEEE Trans. journal papers with more than 20,000 citations. Moreover, he was awarded a National Natural Science Fund for Excellent Young Scholars in 2013, the National Ten Thousand Talent Program for Young Top-notch Talents in 2014, and the Cheung Kong Scholars Programme of China for Young Scholars in 2016 and for Scholars in 2020. Dr. Yu is also the recipient of the Second Prize of State Natural Science Award of China in 2016.

Invited Talk I-2

Title：Several Important Issues That Are Overlooked When Designing Controllers Using Neural Networks

Prof. Yongduan Song

Chongqing University

Abstract: The “universal” approximation/learning characteristics of neural networks have been widely used in control design. In theory, several critical conditions need to be met at the same time, whether this important feature is established or not. Failure to meet any of these conditions may result in the loss of this characteristic. This report makes a preliminary discussion on this issue and points out that these conditions are often ignored unconsciously or deliberately in most existing NN based control designs in practical applications. At the same time, we come up with a solution to face this problem, by establishing a strategy to make the neural network unit play a full role in the entire process of system operation, to ensure its reliability and effectiveness in the control loop

Yongduan Song, Fellow of IEEE, Fellow of International Eurasian Academy of Sciences, Fellow of Chinese Automation Association. He is currently the Dean of School of Automation, Chongqing University, and the Founding Director of the Institute of Smart Engineering, Chongqing University. He was one of the six Langley Distinguished Professors with the National Institute of Aerospace (NIA), Founding Director of Cooperative Systems at NIA. He has served/been serving as an Associate Editor/Guest Editor for several prestigious scientific journals, including IEEE Transactions on Automatic Control, IEEE Transactions on Neural Networks and Learning Systems, IEEE Transactions on Intelligent Transportation Systems, etc. He is the Editor-in-Chief Elect for IEEE Transactions on Neural Networks and Learning Systems, assuming his EiC responsibilities starting January 1, 2022. His research interests extend to intelligent systems, guidance navigation and control, bio-inspired adaptive and cooperative systems.

Invited Talk I-3

Title：Adaptive Graph Construction based Machine Learning

Prof. Jiye Liang

Shanxi University

Abstract: In graph machine learning, the association information in the data is modeled by graphs and considered as an substantial factor, which breaks the basic assumption of traditional machine learning, i.e. the Independent and Identical Distribution. Therefore, it is expected to trigger a new learning paradigm. High-quality graphs are crucial to graph machine learning. However the graph construction faces dual challenges: (1) the data distribution is unknown and complex, and (2) the requirements of learning tasks are varied. In response to it, an adaptive graph construction method is proposed, which can cope with the above two challenges simultaneously. As two specific application scenarios, the graph based semi-supervised learning and the graph embedding based unsupervised dimensionality reduction are used for illustrating the working mechanism and advantages of the proposed method. As a general solution, the adaptive graph construction method is expected to play a greater role in other graph machine learning problems.

Jiye Liang, Professor of Shanxi University, CCF Fellow, Director of the Key Laboratory of Computational Intelligence and Chinese Information Processing of the Ministry of Education, Member of the Special Committee on Artificial Intelligence and Blockchain Technique, Science and Technology Commission of the Ministry of Education, Deputy Director of Committee on Artificial Intelligence and Pattern Recognition, CCF. His research interests mainly include data mining, machine learning and artificial intelligence. And he has published more than 200 papers in important journals and conferences such as AI, JMLR, IEEE TPAMI, IEEE TKDE, ML, ICML, AAAI, etc.

Invited Talk I-4

Title：Structure Identifiability of Networked Dynamic Systems and Beyond

Prof. Tong Zhou

Tsinghua University

Abstract: Networked dynamic systems (NDS) have been attracting research attentions for a long time. With technology developments, especially those in communications and computers, the scale of an NDS becomes larger and larger. Moreover, some new issues also arise, such as attack prevention, random communication delay/failure, etc. In addition, recent marvelous success in artificial intelligence greatly stimulates constructions of artificial NDSs with a huge number of nodes. On the other hand, some classic problems including revealing the structure of an NDS from measurements, computationally efficient conditions for NDS controllability/ observability verifications, etc., still remain challenging.

In this talk, a model is introduced for a large scale NDS in which subsystems are connected through their internal outputs in an arbitrary way, and subsystems may have distinctive dynamics. A matrix rank based necessary and sufficient condition is given for the global identifiability of subsystem interactions, which leads to several conclusions about NDS structure identifiability when there is some a priori information. This matrix also leads to an explicit description for the set of subsystem interactions that can not be distinguished from experiment data only. Importance of "structure identifiability degree" is also revealed through numerical simulations, with a discussion on its influences on model prediction capabilities and system performances.

Tong Zhou received the B.S. and M.S. degrees from the University of Electronic Science and Technology of China, China, in 1984 and 1989, respectively, another M.S. degree from Kanazawa University, Japan, in 1991, and the Ph.D. degree from Osaka University, Japan, in 1994. After visiting several universities in The Netherlands, Japan and China, he joined Tsinghua University, Beijing, China, in 1999, where he is currently a Professor of control theory and control engineering. His current research interests include networked dynamic systems, distributed/robust estimation and control, system identification and their applications to real-world problems in molecular cell biology and communication systems. Dr. Zhou was a recipient of the First-Class Natural Science Prize in 2020 from the Chinese Association of Automation (CAA), a recipient of the

First-Class Natural Science Prize in 2003 from the Ministry of Education, China, and a recipient of the National Outstanding Youth Foundation of China in 2006. He has served as an Associate Editor of the IEEE TRANSACTIONS ON AUTOMATIC CONTROL, and is now on the editorial board of AUTOMATICA. He is an IEEE Fellow and a CAA Fellow.

Invited Talk I-5

Title： Evolutionary Computation Made Practical

Prof. Ke Tang

Southern University of Science and Technology

Abstract: Over the past 50 years, Evolutionary Computation (EC) has gradually developed as a powerful tool for complex real-world problems. However, the trial-and-error nature of EC has also led to several drawbacks, particularly in the sense of the efficiency and trustworthyness, which prevent even wider applications of EC. In this talk, recent approaches for improving EAs in these aspects will be presented.

Ke Tang is a Professor at the Department of Computer Science and Engineering, Southern University of Science and Technology (SUSTech). Before joining SUSTech in January 2018, he was with the School of Computer Science and Technology, University of Science and Technology of China (USTC), first as an Associate Professor (2007-2011) and then as a Professor (2011-2017). His major research interests include evolutionary computation and machine learning, as well as their applications. He has published more than 180 papers, which have received over 10000 Google Scholar citations. He is a recipient of the IEEE Computational Intelligence Society Outstanding Early Career Award and the Natural Science Award of Ministry of Education (MOE) of China, and was awarded the Newton Advanced Fellowship (Royal Society) and the Changjiang Professorship (MOE of China). He is an Associate Editor of the IEEE TRANSACTIONS ON EVOLUTIONARY COMPUTATION and served as a member of Editorial Boards for a few other journals.

Invited Talk II-1

Title： Behavior Intelligence: Model and Cognitive Computation

Prof. Fuchun Sun

Tsinghua University

Abstract: Behavior AI based behaviorism paradigm，emphasizes that perception serves behavior and how behavior enhances the closed-loop process of perception. It is a dynamic mapping and closed-loop AI while symbolism and connectionism AI are open one. To deal with behavior AI, a new cognitive model“Bcent”, short for Brain body co-development, is proposed to regard perception and behavior as two physical processes，dubbed as Perception Body and Behavior Body, respectively; meanwhile, the reasoning part connecting Perception Body and Behavior Body is called Cognition Body, which mainly accomplishes knowledge inference and cognitive development. In a nutshell, Perception Body and Behavior Body are physically structured and coordinate with each other under the command of Cognition Body. Bcent is a unity of learning, cooperation and promotion towards sensing, cognitive learning and action. In this talk, we will first introduce the theoretical methods and functional realization of the three core bodies in Bcent. Then the main research results of the multimodal perception, behavior-based active perception and imitation learning are presented as well. Next, the applications of these theoretical methods in UAVs, mobile robots and oropharyngeal-swab robot are reported. Finally, the development trend of Bcent-based behavior AI is prospected.

Dr. Fuchun Sun is professor of Department of Computer Science and Technology, Tsinghua University, and deputy director of State Key Lab. of Intelligent Technology & Systems, Beijing, China. He serves as Vice Chairman of Chinese Association for Artificial Intelligence and Executive Director of Chinese Association for Automation. His research interests include robotic perception and skill learning，Cross-modal Learning and intelligent control. He has won the Champion of Autonomous Grasp Challenges in IROS2016 and IROS 2019. He is elected as IEEE Fellow and CAAI Fellow in 2019, CAA Fellow in 2020.

Sun is the recipient of the excellent Doctoral Dissertation Prize of China in 2000 by MOE of China and the Choon-Gang Academic Award by Korea in 2003, and was recognized as a Distinguished Young Scholar in 2006 by the Natural Science Foundation of China. He served as the EIC of the Journal of Cognitive Computation and Systems, and associated editors of IEEE Trans. on Neural Networks and Learning Systems during 2006-2010, IEEE Trans. On Fuzzy Systems since 2011, IEEE Trans. on

Cognitive and Development Systems since 2018 and IEEE Trans. on Systems, Man and Cybernetics: Systems since 2015.

Invited Talk II-2

Title：Current Status and Prospects of Adaptive Learning Technology in Intelligent Education

Prof. Enhong Chen

University of Science and Technology of China (USTC)

Abstract: In recent years, the intelligent education system has developed rapidly, more and more learners have participated in online autonomous learning activities, and accumulated a large amount of educational learning data. How to make use of these data to develop intelligent education integrating big data, artificial intelligence technology and provide effective intelligent services for learners is an important task at present. As a key application of intelligent education, adaptive learning aims to provide each student with personalized learning activities through big data analysis technology, adjust learning content and improve learning efficiency. This report will focus on adaptive learning technologies and applications, the effective representation of educational resources, assessment of students' cognitive state, and the current situation of adaptive learning strategies. In addition, sharing application cases of typical adaptive intelligent education systems and looking forward to possible future development directions.

Professor En-Hong Chen, executive dean of School of Data Science and vice dean of School of Computer Science of University of Science and Technology of China(USTC), CCF Fellow, IEEE Senior Member, winner of the National Science Fund for Distinguished Young Scholars (in 2013), scientific and technological innovation leading talent of 'Ten Thousand Talent Program', the leader of the "Big data Analysis and Application" team, winner of Natural Science of the Ministry of Education and winner of Wu Wenjun's Artificial Intelligence Science and Technology Progress Award. His research interests are data mining, intelligent education, especially social network analysis and recommender systems. He is the chair of several important academic conferences in the field of data mining and knowledge discovery, including ICKG2020 and CNCC2015, and the editorial board of many important journals at home and abroad, including IEEE TKDE and ACM Artist. He has published more than 100 papers on high-level academic journals (such as TKDE, TOIS, etc.) and international important academic conferences (such as KDD, SIGIR, etc.) in related fields. Representative papers were selected as ESI highly cited papers. Winner of ACM KDD 2018 Best Student Paper

Award, IEEE ICDM 2011 Best Research Paper Award and ACM KDD 2008 Best Application Paper Award "and so on.

Invited Talk II-3

Title：Trusted Multi-modality Learning with Uncertain Information

Prof. Qinghua Hu

Tianjin University

Abstract: Multimodal learning has been widely used in many applications. However, there are usually various uncertainties underlying multimodal data, including (attribute/label) noise, (modality) incompleteness, and (correlation) dynamicity, challenging current multimodal learning models. It is critical to address these challenges for real-world applications. In this talk, we will briefly review our proposed techniques for these uncertainties to provide trustworthy multimodal learning techniques, and also introduce several typical applications using these techniques.

Dr. Qinghua Hu is the Beiyang Chair Professor of Tianjin University, the Deputy Director of the Department of Intelligence and Computing and the Director of the School of Artificial Intelligence, and the National Outstanding Youth. He is mainly engaged in research on uncertainty AI, autonomous machine learning and cross-modal learning. He has received support from the National Merit Youth Program, the National Natural Science Foundation of China, the National Outstanding Youth Science Foundation of China, and the National Key Research and Development Program of China. He has achieved a series of results in uncertainty modeling of big data, uncertainty-sensitive machine learning algorithms, and intelligent unmanned system environment perception considering uncertainty, and has published more than 200 academic papers in IEEE TPAMI, IJCV, TKDE, TFS, ICCV, CVPR, NeurIPS, IJCAI, etc, and has been granted more than 20 patents. He currently serves as an editorial board member of IEEE Trans. on Fuzzy Systems, Journal of Automation, Journal of Electronics, Journal of Intelligent Systems, Chinese Journal of Graphics, and Control and Decision Making.

Invited Talk II-4

Title：Computational Psychophysiology Based Emotion Analysis for Mental Health

Prof.Bin Hu

Beijing Institute of Technology

Abstract: Computational psychophysiology is a new direction that broadens the field of psychophysiology by allowing for the identification and integration of multimodal signals to test specific models of mental states and psychological processes. Additionally, such approaches allows for the extraction of multiple signals from large-scale multidimensional data, with a greater ability to differentiate signals embedded in background noise. Further, these approaches allows for a better understanding of the complex psychophysiological processes underlying brain disorders such as autism spectrum disorder, depression, and anxiety. Given the widely acknowledged limitations of psychiatric nosology and the limited treatment options available, new computational models may provide the basis for a multidimensional diagnostic system and potentially new treatment approaches

Bin Hu is a Professor of Beijing Institute of Technology，a Director of Gansu Provincial Key Laboratory of Wearable Computing and Adjunct Professor of Computing Department at Open University. His research areas focus on affective computing and computational psychophysiology. He is currently an Institution of Engineering and Technology (IET) fellow, and a State Specially Recruited Experts of China. He is Chair of TC Computational Psychophysiology at IEEE SMC and Vice-Chair on the China Committee of International Society for Social Neuroscience. He is also currently serving as a member of the Steering Committee of Computer Science and Technology at the Chinese Ministry of Education. He was a recipient of many research awards, including the 2014 China Overseas Innovation Talent Award, the 2016 Chinese Ministry of Education Technology Invention Award, the 2018 Chinese National Technology Invention Award, and the 2019 Chinese National Invention Patent Gold Award. He was Chair or Steering Committee Member of many international conferences. He was the Guest Editor of Science supplement “Advances in Computational Psychophysiology” by the American Association for the Advancement of Science. He is currently Editor-in-Chief of IEEE Transaction on Computational Social Systems and Associate Editor of IEEE Transaction on Affective Computing.

Invited Talk II-5

Title： Data and Knowledge Driven Industrial Energy Prediction and Scheduling

Prof. Jun Zhao

Dalian University of Technology

Abstract: Industrial energy resource saving is capable of not only improving the enterprise profits, but also carrying out the significant strategy meaning for our country. Given the fixed technical process and equipment, its optimization scheduling is the most important approach for such a goal. A class of data-driven predictive scheduling methodology is proposed, and the quantitative uncertainty, and the semantic characteristics of the energy data, the short-term prediction model, the prediction interval one and the long-term model are respectively reported, and a rolling optimization technique with the procedures of prediction-cheduling-alidation is proposed. The mentioned approaches have been successfully applied to a number of industrial enterprises in our country.

Prof. Zhao is now with the School of Control Science and Engineering, Dalian University of Technology. His research interests include data-driven modeling and optimization for industry system. He was the recipient of Distinguished Young Scholar funding supported by NSFC, and the recipient of Young Scholar of Yangtze River from Ministry of Education of China. He has authored or co-authored over 100 technical publications in refereed journals and conference proceedings. He serves as associate editors for several top tier journals including *Control Engineering Practice, IEEE TNNLS, Information Sciences,* etc.

Invited Talk III-1

Title：Advances in Autonomy Intelligence and Hybrid Intelligence of Unmanned Systems

Prof. Xin Xu

National University of Defense Technology

Abstract: With the increasing demand for various unmanned system applications in industry, medical treatment, national defense and other fields, it is necessary to study and explore the theories and methods to improve the autonomous ability and man-machine cooperation ability of unmanned systems in complex and uncertain environments. Based on the analysis of relevant technical requirements, the report introduces the research progress in autonomous intelligence of unmanned system, especially intelligent perception based on bionic principle, online reinforcement learning and transfer reinforcement learning, as well as the man-machine cooperation mechanism based on machine learning. It provides some research progress of autonomous perception of intelligent unmanned vehicle and man-machine cooperative driving. Finally, the further work is analyzed and prospected.

Dr. Xin Xu is a full professor with the College of Intelligence Science and Technology, National University of Defense Technology. He received the Distinguished Young Scholars' Funds of National Natural Science Foundation of China in 2018. His main research fields include machine learning and autonomous control of robots and intelligent unmanned systems. He was a recipient of the second-class National Natural Science Award of China and 2 first-class Natural Science Awards of Hunan Province. He has published 2 monographs and more than 170 papers. His representative papers have been published in IEEE TNNLS, IEEE TSMC: Systems, IEEE TPAMI, J. AI research, Information Sciences, J of Filed Robotics, IEEE TCST, IEEE TITS, IEEE TIE, IEEE / ASME T-Mechatronics and other journals. He is associate editor of IEEE Transactions on SMC: Systems, Information Sciences, International Journal of Robotics and Automation, associate Editor-in-Chief of CAAI transactions on Intelligence Technology, and an Editorial Board Member of the Journal of Control Theory and Applications.

Invited Talk III-2

Title： Research on Recursive Filtering for Time-Varying Systems in the Sense of Energy-Saving and Secure Transmission

Prof. Hongli Dong

Northeast Petroleum University

Abstract: Improving quality and efficiency is a long-term strategic measure for China's oil industry to achieve high-quality development, and the intellectualized transformation of oilfields is imperative. With the development of information technology and the continuous advancement of smart oilfields construction, the application of wireless communication networks is becoming more and more extensive. Sensors rely on the networks to transmit production data in real time, which plays an important role in ensuring the smooth operation of oilfields. As the oilfield networks continue growing, the problems of energy saving and safety during information transmission are becoming increasingly prominent. In order to ensure the sustainable development of China’s petroleum industry, energy saving and security are always the basic requirements for the smart oilfield construction. How to ensure the accuracy of production data under the energy-saving wireless transmission mechanism, and how to ensure the reliability of production data in the case of network being attacked are extremely challenging issues. The recursive filtering method is used as the key technology to study the above problems, and the corresponding filters are designed for cases including 1) the recursive filtering for linear time-varying systems under the duty cycle transmission mechanism based on collaborative prediction; 2) the recursive filtering for complex networks with random coupling strengths under the event-triggered transmission mechanism; 3) the security filtering for complex networks with uncertain coupling strengths subject to deception attacks; 4) the security filtering for nonlinear time-varying systems under deception attacks and the duty cycle transmission mechanism; and 5) the recursive filtering for the natural gas pipeline flow system in the sense of energy-saving and secure transmission. Then, the purpose is achieved of ensuring the accuracy and reliability of production data on the premise of energy saving and security wireless transmission.

Prof. Hongli Dong received the Ph.D. degree in control science and engineering from the Harbin Institute of Technology, Harbin, China, in 2012. From 2009 to 2010, she was a Research Assistant with the Department of Applied Mathematics, City University of Hong Kong, Hong Kong. From 2010 to 2011, she was a Research Assistant with

the Department of Mechanical Engineering, The University of Hong Kong, Hong Kong. From 2011 to 2012, she was a Visiting Scholar with the Department of Information Systems and Computing, Brunel University London, London, U.K. From 2012 to 2014, she was an Alexander von Humboldt Research Fellow with the University of Duisburg--Essen, Duisburg, Germany. She is currently a Professor with the Artificial Intelligence Energy Research Institute, Northeast Petroleum University, Daqing, China. She is also the Director of the Heilongjiang Provincial Key Laboratory of Networking and Intelligent Control, Daqing. Her current research interests include robust control and networked control systems.

Invited Talk III-3

Title： Research on Virtual Sample Generation for Label Data in Supervised Learning

Prof. Qunxiong Zhu

Beijing University of Chemical Technology

Abstract: Now the data-driven method becomes a promising alternative and one of the research hotspots. It is well known that even in big data era, small sample problems cannot be ignored. From the perspective of data processing, studying how to enlarge data samples effectively is not only a key research direction in the field of artificial intelligence, but also entitling very theoretical significance and practical values. Virtual sample generation (VSG) is a promising technology which generates plenty of new virtual samples by the information acquired from small sample sets, improving the accuracy of the forecasting model. To overcome the problem of insufficient label data used in data-driven modeling algorithms of supervised learning, This report will focus on the VSG methods based on the improved CGAN, input-training neural network, autoencoder neural network and Kriging interpolation. Process industry case studies are carried out and the simulation results are given and analyzed.

Dr. Qunxiong Zhu is now a Professor of the College of Information Science and Technology at the Beijing University of Chemical Technology, China. He is also the director of the Engineering Research Center of Intelligent Process System Engineering, Ministry of Education of China. He has been the President of the Beijing Association of Automation, an executive member of Chinese Association of Automation (CAA), CAA Fellow, the Vice-Chairman of Technical Committee on Process Control of CAA, a member of Chemical Industry and Engineering Society of China (CIESC), the Vice-Chairman of Technical Committee on IT application of CIESC. His research interests include computational intelligence and industrial applications, process modeling and system optimization, fault diagnosis and alarm management, virtual reality and digital twin.

Invited Talk III-4

Title： Visual Foundation Models and Applications

Prof. Jiwen Lu

Tsinghua University

Abstract: This talk will first overview the research and development tread of visual foundation models from two aspects: network architecture and learning principles. Then, some research progress made by the intelligent vision group at the Department of Automation of Tsinghua University will be introduced, such as object detection and segmentation, object classification and recognition, image and video retrieval, and 3D reconstruction and recognition

Jiwen Lu is currently an Associate Professor with the Department of Automation, Tsinghua University. His current research interests include computer vision and pattern recognition. He has co-authored more than 100 research papers in PAMI/IJCV/VPR/ CCV/ECCV. He serves as the General Co-Chair for the International Conference on Multimedia and Expo (ICME) 2022, the Program Co-Chair for the International Conference on Multimedia and Expo 2020, the International Conference on Automatic Face and Gesture Recognition (FG) 2023, and the International Conference on Visual Communication and Image Processing (VCIP) 2022. He serves as the Co-Editor-of-Chief for Pattern Recognition Letters, an Associate Editor for the IEEE Transactions on Image Processing, the IEEE Transactions on Circuits and Systems for Video Technology, and the IEEE Transactions on Biometrics, Behavior, and Identity Sciences. He was a recipient of the National Natural Science Funds for Distinguished Young Scholar. He is a Fellow of IAPR.

Invited Talk III-5

Title： Operation Optimization and Predictive Control for Distributed Systems

Prof. Shaoyuan Li

Shanghai Jiao Tong University

Abstract: There is a class of complex plant-wide systems which are composed of many physically or geographically divided subsystems. Each subsystem interacts with some so called neighboring subsystems by their states and inputs. The technical target is to achieve a specific global performance of the entire system.

The distributed (or decentralized) framework, where each subsystem is controlled by an independent controller, has the advantages of error-tolerance, less computational effort, and being flexible to system structure. Thus the distributed control framework is usually adopted in this class of system, in spite of the fact that the dynamic performance of centralized framework is better than it. Thus, how to improve global performance under distributed control framework is a valuable problem.

This talk systematically will introduce the different distributed predictive control for the plant-wide system, including the system decomposition, classification of distributed predictive control, unconstraint distributed predictive control and the stabilized distributed predictive control with different coordinating strategies for different purposes, as well as the implementation examples of distributed predictive control. The major new contribution of this book is to show how the distributed MPCs can be coordinated efficiently for different control requirements, namely the network connectivity, error tolerance, performance of entire closed-loop system, calculation speed, etc., and how to design distributed MPC.

Shaoyuan Li received his PhD degree in Automatic Control and Applications from Nankai University of China in 1997 and he was a Post Doctor in the Department of Automation in Shanghai Jiao Tong University from March 1998 to March 2000. He is Chair Professor at School of Electronic Information and Electrical Engineering, and the Chinese Dean of SJTU Paris Elite Institute of Technology, Shanghai Jiao Tong University. He is Vice president of Chinese Association of Automation, Deputy Director of Automation Teaching Steering Committee, the Ministry of Education, and Member of the State Council Discipline Evaluation Committee (Control Science and Engineering). His research areas include model-predictive control, adaptive control, intelligent control and industrial

applications. He has published more than 200 papers in leading journals both at home and abroad. He is the PI of over 20 projects supported by the National Nature Science Foundation of China (NSFC), the High Technology Research and Development Program of China and Shanghai Science and Technology Commission. His main achievements won the First Prize of the 2006 Shanghai Natural Science Award (ranking the first), the Second Prize of the first Yang Jiache Science and Technology Award in 2010, the First Prize of the Natural Science Award of CAA in 2016 (ranking the first), the Second Prize of the 2017 National Natural Science Award (ranking the second), the Outstanding Prize of Shanghai Teaching Achievement Award in 2017 (ranking the first), and the First Prize of National Teaching Award by Ministry of Education in 2018 (ranking the first). In 2008, he was awarded with the National Outstanding Youth Fund by NSFC. Moreover, he was entitled Shanghai Elite Teacher and nominated for Baogang Outstanding Teacher Award. He was also enlisted National Bai-Qian-Wan Talent Plan.

Abstract

Saturday, Dec 11, 2021

Session SaO I: 14:00-17:20

Address: 123-452-758（腾讯会议）

Session SaO I-A: 14:00-16:00

[#5] Chebyshev Polynomial Broad Learning System

Shuang Feng, School of Applied Mathematics, Beijing Normal University, Zhuhai, China

Bingshu Wang, 2School of Software, Northwestern Polytechnical University, Taicang Campus, Suzhou, China

C. L. Philip Chen, School of Computer Science and Engineering, South China University of Technology, Guangzhou, China

The broad learning system (BLS) has been attract- ing more and more attention due to its excellent property in the field of machine learning. A great deal of variants and hybrid structures of BLS have also been designed and developed for better performance in some specialized tasks. In this paper, the Chebyshev polynomials are introduced into the BLS to take advantage of their powerful approximation capability, where the feature windows are replaced by a set of Chebyshev poly- nomials. This new variant, named Chebyshev polynomial BLS (CPBLS), has a light structure with a reduction in computational complexity since the sparse autoencoder is removed. Instead, the dimension of each input sample is expended by n + 1 Chebyshev polynomials, mapping the original feature into a new feature space with higher dimension, which helps to classify the patterns in training. The proposed CPBLS is evaluated by some popular datasets from UCI and KEEL repositories, and it outperforms some representative neural networks and neuro- fuzzy models in terms of classification accuracy. The CPBLS also show some advantages over the recent developed compact fuzzy BLS (CFBLS) which indicates its great potential in future research and real-world applications.

[#25] Iteration Graph Network

Wenchuan Zhang, School of Big Data and Computer Science, Guizhou Normal University

Weihua Ou, School of Big Data and Computer Science, Guizhou Normal University

Shili Niu, School of Big Data and Computer Science, Guizhou Normal University

Ruxin Wang, National Pilot School of software, Yunnan University

Ziqi Zhu, School of Computer Science and Technology, Wuhan University of Science and Technology

Shen Ke, School of Big Data and Computer Science, Guizhou Normal University

Graph neural networks have been widely used in graph data processing and analysis. Recent methods either reduce the spatial receptive field for low algorithm complexity, or greatly lose efficiency in order to realize attention mechanism. To address this problem, we present Iteration Graph Network (IGN), which uses an iterative inversion method to aggregate the k-localized neighbor information of nodes. In the graph-based semi-supervised node classification task, our method surpasses the state-of-the-art method in the benchmark datasets and experiment results show that our method outperforms graph attention networks (GAT) and is more than 3 times faster than graph attention networks, consumes more than 6 times less memory than GAT. Our code will be make publicly available.

[#27] Privacy-Preserving Average Consensus for Multi-agent Systems with Directed Topologies

Xinyue Qiao, Yuxin Wu, Deyuan Meng, The Seventh Research Division, Beihang University (BUAA), The School of Automation Science and Electrical Engineering, Beihang University (BUAA)

In the process of forming average consen- sus, the privacy that the agents do not want to disclose may be maliciously speculated and used by others. To avoid breaches of privacy for multi-agent systems subject to directed topologies, we propose a novel privacy-preserving average consensus algorithm that employs an improved Laplacian-type control protocol. It is shown that all agents can achieve accurate average consensus without the weight-balance condition despite directed topologies. To ward off internal malicious agents, we add edge-based zero-sum interference sig- nals in the process of transferring information. Thus, by introducing a private parameter, all agents can be pro- tected against malicious eavesdroppers who know the entire topology and can intercept communication links. Two simulation examples are presented to demonstrate the validity of our algorithms for realizing the average consensus under the impacts of malicious adversaries.

[#31] A Merge Collision Prediction TDMA-MAC Protocol in Distributed VANET

Changyue Zhang, Shiyuan Han, Jin Zhou, Shandong Provincial Key Laboratory of Network Based Intelligent Computing, University of Jinan Jinan, 250022, China

Baozhu Li, Internet of Things and Smart City Innovation Platform,Zhuhai Fudan Innovation Institute Zhuhai, 518057, China

Xiaojie Yu, Shandong Provincial Key Laboratory of Network Based Intelligent Computing, University of Jinan Jinan, 250022, China

Kang Yao, Shandong Provincial Network Security and Infomationization Technology Center, Jinan, 250002, China

The communication between vehicles has attracted more and more attention in intelligent transportation sys- tem(ITS). Due to the rapid movement of vehicles, the topology of network nodes changes rapidly, resulting in collisions between vehicles. Therefore, the design of efficient and reliable media access control protocol is very necessary to solve the communi- cation problem between vehicles. In this paper, a merge collision prediction TDMA-MAC in distributed VANET(MCPMAC) is proposed to solve the merging collision problem. In MCPMAC, when multiple vehicles occupying the same time slot meet within the two hop communication range, one vehicle continues to use the time slot by comparing the time stamp of the vehicle access time slot, and the other vehicles sequentially select the idle time slot to reduce the probability of merging collision between vehicles. Simulation results show MCPMAC protocol has higher reliability and lower number of collisions than the existing MAC protocols.

[#33] Texture Recognition and Three-Dimensional Force Measurement Using Vision-based Tactile Sensor

Xiaoyue Cao, Chunfang Liu, Xiaoli Li, Faculty of Information Technology, Beijing University of Technology, Beijing, China

Although robotic grippers have been extensively used in industry nowadays, most of them still are lack of tactile perception to achieve some dexterous manipulation like grasping an unknown object using appropriate force. Hence, to make the grippers gain multiple types of tactile information, we combine the gripper with the dual-modal vision-based tactile sensor in our experiment. Different from existed texture recognition experiments, we build own texture dataset included 12 kinds of samples using the novel tactile transducer. At the same time, we compare K-Nearest Neighbor (KNN) with Residual Network (ResNet), the experiment results showcase that the accuracy of KNN, is only 66.11%, while the accuracy of ResNet based on deep convolution neural network is as high as 100.00%. In addition, to detect the contact force, we employ the nonlinear characteristic of BP neural network to establish the mapping relation between the two-dimensional displacement image of markers and the three- dimensional (3D) force vector. Experiments are implemented to demonstrate the sensor's performance of predicting the force within 4% margin of error.

[#37] BroadSurv: A Novel Broad Learning System-based Approach for Survival Analysis

Guangheng Wu, Junwei Duan, College of Information Science and Technology Jinan University, Guangzhou, China

Jing Wang, School of Computer Science Guangdong polytechnic Normal University Guangzhou, China

Lu Wang, Academic Affairs Office, Jinan University, Guangzhou, China

Cheng Dong, School of Intelligent System Science and Engineering Jinan University, Zhuhai, China

Changwei Lv, Shenzhen Institute of Information Technology, Shenzhen, China

Survival analysis (time-to-event analysis) is a set of statistic methods for time-to-event data analysis and is widely used in many areas including medicine, economics and finance. One of the fundamental problems in survival analysis is to explore the relationship between the covariates and the survival time. Recently, with the development of deep learning-based techniques, various approaches have been proposed for survival analysis. To better handle the censoring, special cost functions or sophisticated network structures are usually designed for these methods. In this paper, a novel two-stage method is proposed to model the survival data. In the first stage, pseudo conditional probabilities are computed, which can act as the quantitative response variables in regression problems. In the second stage, with these pseudo values, a complicated survival analysis problem is transformed into a regression problem that can be effectively solved by broad learning system. The experimental results show that, with a flexible structure and a simple cost function, our proposed method has a better performance in handling the censored problems.

[#51] Adaptive Neural Consensus Control of Nonlinear Multi-agent Systems with Actuator Failures

Zhuangbi Lin, Zhi Liu, School of Automation, Guangdong University of Technology, Guangzhou, China

The adaptive consensus control for multi-agent sys- tems (MASs) with actuator failures is considered in this article. By combining the neural networks (NNs) technique to develop the control scheme, the unknown nonlinear function are allowed to exist in the system dynamics. Moreover, the disturbance is also compensated by adaptive estimated parameter. The controller is totally distributed and only two unknown parameters needed to be updated. The presented control method not only ensures that every agent of MAS can track the leader with a predetermined error, but improves the transient performance. At last, a physical example is provided to demonstrate the effectiveness of the proposed method.

[#66] A Reinforcement Learning-Based Detection Method for False Data Injection Attack in Distributed Smart Grid

Kuo Zhang, Institute of Cyber-Systems and Control Zhejiang University Hangzhou China

Zhengguang Wu, the State Key Laboratory of Industrial Control Technology Zhejiang University, Hangzhou China

False data injection attack(FDIA) is a traditional attack for the smart grid. There are many methods for the detection of the FDIA, but few of them can send the attack alarm successfully without an attack model. In this paper, we propose a reinforcement learning-based FDIA detection method for the distributed smart grid. The detection problem is formulated as a partially observable Markov decision process(POMDP) problem, and the observation of the POMDP can be obtained from the estimation of state and attack which come from the Kalman filter. By using the Sarsa algorithm, we can get a Q-table through online training. Finally, we use the IEEE-118 bus power system to evaluate the performance of our detector, and numerical results show the accurate response for the FDIA.

Session SaO II-A: 16:00-17:20

[#057] Deep Graph Network for Process Soft Sensor Development

Mingwei Jia, Yun Dai, Yi Liu, Institute of Process Equipment and Control Engineering, Zhejiang University of Technology
Danya Xu, Tao Yang, State Key Laboratory of Synthetical Automation for Process Industries, Northeastern University
Yuan Yao, Department of Chemical Engineering, National Tsing Hua University

In the (bio)chemical processes, traditional hardware sensors are difficult to directly measure the quality of critical products due to their time-varying, non-linear, and dynamic characteristics. This makes process soft sensor modeling methods important. Since the process variables can be regarded as natural graph data, this work introduces graphs in the soft sensor modeling area. A soft sensor model based on the graph neural network (GNN) is proposed. The model can learn the topological structure of graph data between each unit variable. Moreover, it characterizes variable relationships from the spatial and temporal dimensions to the output prediction by introducing the spatial-temporal convolutional layer. The effectiveness and advantages of the GNN-based soft sensor model are verified using a simulated fermentation process.

[#41] Solution Evaluation-Oriented Multi-objective Differential Evolution Algorithm for MOVRPTW

Ying Hou, Yilin Wu, Honggui Han, Faculty of Information Technology Beijing University of Technology

Multi-objective vehicle routing problem with time windows (MOVRPTW) is a canonical logistics problem widely existing in supply chain. It is challenging to obtain the feasible solutions with fast convergence and well diversity due to the constraint of time windows. To address this issue, a solution evaluation-oriented multi-objective differential evolution (SE-MODE) algorithm is presented in this paper. First, a solution evaluation mechanism based on constraint dominance principle is developed to evaluate the dominance degree of feasible solutions and infeasible solutions quantitatively. Second, infeasible solutions with less dominance degree are utilized to generate solutions in the early stage of evolution adopting a memetic algorithm framework. Third, a feasible solution-oriented differential mutation strategy is developed to increase the probability of generating feasible solutions and improve the convergence of the population. Finally, the proposed SE-MODE algorithm is evaluated on the RC instances from Solomon, experimental results show that SE-MODE algorithm is promising in solving MOVRPTW.

[#16] A Knowledge Transfer-based Fuzzy Broad Learning System for Modeling Nonlinear Systems

Zheng Liu, Honggui Han, Junfei Qiao, Faculty of Information Technology Beijing University of Technology Beijing, China

Fuzzy broad learning system has been regarded as an effective algorithm to utilize the measured data to model nonlinear systems. However, due to the possible existence of data inadequate or data loss, it is a challenge to design a suitable fuzzy broad learning system with the data shortage issue for modeling. Therefore, to solve this problem, a knowledge transfer-based fuzzy broad learning system was developed and analyzed in this paper. First, the knowledge extracted from the operation process was used to construct the initial condition of fuzzy broad learning system. Then, the fuzzy broad learning system can obtain the accurate parameters and structure in the initialization phase. Second, a knowledge evaluation mechanism was developed to rebuild the knowledge of the source scene by judging the correlation and discrepancy. Then, the knowledge of the source scene can be preferably integrated in the target scene. Third, a transfer gradient algorithm was employed to adjust the parameters of fuzzy broad learning system. Then, the modeling performance of knowledge transfer-based fuzzy broad learning system can be improved. Finally, a benchmark problem and a practical application were used to test the merits of knowledge transfer-based fuzzy broad learning system. The experimental results indicated that the proposed method can achieve superior modeling performance.

[#34] Dynamic KPCA for Feature Extraction of Wastewater Treatment Process

Xiaoye Fan, Xiaolong Wu, Honggui Han, Faculty of Information Technology Beijing University of Technology

High-speed Railway has become an essential part of society, with an increasing demand for safety. Overhead contact system is an important part of the power supply system with wide variety of fasteners. Affected by the natural environment and vibration during train operation, these parts may loosen or fall off. For safety reasons, automatic machine defect detection is required to replace inefficient manual inspection. Due to the complexity of defects and difficulties in data acquisition, defect detection in overhead contact system faces many problems. The lack of defect samples is the most challenging one. With the development of computer vision and popularization of intelligent image processing technology, new algorithms and models provide effective solutions for those problems, which deserve further study.

[#2] Causality Induced Distributed Spatio-temporal Feature Extraction

Duxin Chen, Wenwu Yu, Qi Shao, Xiaolu Liu, School of Mathematics Southeast UniversityQihe Shan, School of Navigation, Dalian Maritime University

Various real world data contains complex coupling spatio-temporal information, which brings a huge challenge for prediction, especially long-term prediction. Therefore, in this study, we propose a causality induced spatiotemporal feature extraction method and a novel deep learning framework for long-term strongly coupling data prediction tasks, which can effectively extract long-term spatio-temporal dependence of the time series data through causal network, geographic network and multiple time extraction mechanism. The proposed algorithm has achieved outstanding prediction performance in the widely-used test data set of traffic flow, where the long-term prediction accuracy of is nearly 30% better than other state-of-the-art currently-used spatio-temporal prediction models.

[#39] Hot Rolling Scheduling of Heavy Plate Production Based on Heuristic and Ant Colony Algorithms

Jiangtao Xu, Jinliang Ding, Qingda Chen, Ling Yi, State Key Laboratory of Synthetical Automation for Process Industries, Northeastern University Shenyang, China

Slab scheduling of hot rolling plays an important role in smart manufactory of heavy plate production. It faces the

challenges of multiple specifications, small batch and characteristic mode of production. The wide-range fluctuation of product specifications leads the existing approaches difficult to used. To solve this problem, a novel slab scheduling approach based on heuristic and ant colony algorithms is proposed. The schedule problem is formulated in two stages, namely slab allocation and slab rolling sequence optimization. In the slab allocation stage, the strategy of selecting appropriate slabs from forward delivery is used. Then, an ant colony algorithm combined with a constraints handling strategy based on specification jump penalties is designed to solve the slab rolling sequence optimization problem. The computational experiments are carried out and the results demonstrate the effectiveness by the actual production data.

[#87] Dual-Grained Clustering with Concurrent Evaluation of Static and Dynamic Slow Features for Instantaneous Product Quality Assessment

Liming Zhu, Xiaping Fan, Wei Wang, Ming Li, Hangzhou Cigarette Factory of China Tobacco Zhejiang Industrial Company Limited, Hangzhou, China

Product quality assessment (PQA) aims to detect the quality of products through real-time physical measurement statistics. This problem is essentially a multivariate statistical analysis problem, which is prevalent in complex industrial process. However, there are few researches focusing on this problem. Besides, most existing PQA methods depend on the sense organs of evaluation experts or consumers, which is too subjective and the accuracy of evaluation results is often difficult to guarantee. In this article, we propose an instantaneous PQA method which performs two-step evaluation on dual grains with the concurrent static and dynamic slow features of quality data obtained by slow feature analysis. First step is the coarse-grained evaluation step, which is the analysis with static slow features and then four quality levels can be achieved. For each quality level, to perform finer evaluation, the second step, which is fine-grained evaluation step, analyzes dynamic slow features to get the range of normal fluctuation characteristics. Finally, the online evaluation procedure and judging rules are designed for new products. To evaluate the feasibility of the proposed method, a case which is to assess the quality of a batch of cigarettes produced by an actual cigarette factory is studied and the result conforms to the experience of cigarette experts and demonstrates that the proposed method realizes instantaneous quality assessment.

Saturday, Dec 11, 2021

Session SaO II: 14:00-17:20

Address: 145-705-070（腾讯会议）

Session SaO I-B: 14:00-16:00

[#46] Asynchronous Impulsive Bounded Synchronization of Multiplex Networks with Parameter Mismatches and Time-varying Delay

Di Ning , Junhao Hu, School of Mathematics and Statistics, South-Central University for Nationalities, Wuhan 430074, China

This paper mainly deals with bounded synchro- nization of multiplex networks with time-varying delay via asynchronous impulsive control, where the system structure is the same but the system parameters are mismatched within each layer. Firstly, a novel multiplex network in which the interlayer interactions cross different layers only exist at discrete impulsive instants is put forward. Secondly, in view of different impulse sequences within each layer, based on the average impulse in- terval and extended comparison principle for impulsive systems, some sufficient criteria for reaching bounded synchronization of heterogenous multiplex networks are addressed. Finally, a numerical example explicates the feasibility of the theoretical results.

[#48] Deep Autoencoder for Non-destructive Testing of Defects in Polymer Composites

Mingkai Zheng, Kaixin Liu, Institute of Process Equipment and Control Engineering Zhejiang University of Technology Hangzhou 310023, China

Nanxin Li, China E-port Information Data Center Shanghai Branch, Shanghai 200120, China

Yuan Yao, Department of Chemical Engineering National Tsing Hua University Hsinchu 30013, Taiwan

Yi Liu, Institute of Process Equipment and Control Engineering Zhejiang University of Technology Hangzhou 310023, China

As an important non-destructive testing technique, infrared thermography (IRT) has been widely used to detect the internal defects of composite materials. However, the nonlinear nature of the thermographic data and the adverse effects of noise and inhomogeneous background prevent IRT from delivering satisfactory results. In this work, a novel deep autoencoder thermography (DAT) method is proposed for defect detection of composite materials. The multi-layer structure of the deep autoencoder is used to extract the features layer by layer. Then, the output of the middle-hidden layer is visualized to show the effects of removing noise and uneven background. As a result, the defect is highlighted in the visualized images. The test results on a carbon fiber reinforced polymer specimen show the effectiveness of the proposed DAT method.

[#54] Nonlinear Control with Energy Shaping for Unmanned Helicopter Slung-load System Based on Disturbance Observer

Wei Liu, Mou Chen, College of Automation Engineering Nanjing University of Aeronautics and Astronautics, China, Nanjing 210016

In this study, a nonlinear anti-swing control based on energy shaping and disturbance observer is designed for the longitudinal system model of unmanned helicopter slung-load with the external disturbance. A finite time sliding mode disturbance observer (FTSMDO) is employed to estimate the external disturbance force, and the anti-swing controller is devised by combining the energy shaping and Lyapunov analysis. The Lyapunov principle and LaSalle invariance theorem are used to prove the stable asymptotic stability of all errors in the closed- loop system, and the effectiveness of the proposed method is verified by comparative simulations.

[#56] Trend similarity MWPCA based fault monitoring for xylenol tail gas treatment process

Feihong Xu, Xiaoli Luan, Key Laboratory of Advanced Process Control for Light Industry of the Ministry of Education, Jiangnan University, Wuxi, China

In the process of preparing xylenol, a large amount of tail gas will be generated. When using industrial boilers to treat the xylenol tail gas, the high-pressure steam in the furnace may lead to an explosion accident; on the other hand, the toxic tail gas of incomplete combustion in the furnace may also leak, endangering the lives of staff. So it is necessary to monitor the fault of the industrial boiler which used to treat xylenol tail gas. However, due to the non-stationary characteristics of the tail gas treatment process, the conventional fault monitoring methods have the problem of low accuracy. In order to solve these problems, this paper proposes a fault monitoring method based on trend similarity feature. This method cuts the time series by sliding time window, and calculates the trend similarity between data in each time window. Then uses the sliding time window to update the monitoring model in real-time. So it can change the threshold value of the monitoring model with the change of samples, to improve the monitoring accuracy. Finally, the practical data collected from a xylenol producer are used for validation. The results show that the fault detection based on the trend similarity feature has higher accuracy than the conventional method, and the detection accuracy increases with the non-stationary of the process.

[#62] Kernel-based Class-specific Broad Learning System for software defect prediction

Wuxing Chen, Guangdong University of Technology School of Computer Science Guangzhou, China

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Yifan Shi, Huaqiao University School of Engineering Institute Quanzhou, China

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With the continuous expansion of the software industry, the problem of software defects is receiving more and more attention. There has been a series of machine learning methods applied to the field of software defect prediction (SDP) as a way to ensure the stability of software. However, SDP suffers from the imbalance problem. To solve this problem, we first propose a class-specific broad learning system (CSBLS), which assigns a specific penalty factor to each class in accordance with the data distribution. Then we design a class-specific kernel-based broad learning system (CSKBLS), which adopts kernel mapping instead of random projection. This additive kernel scheme takes into account both outliers and noise in the data set. Extensive experiments on the real-world NASA datasets show that CSKBLS outperforms the comparison methods on the tasks of software defect prediction.

[#64] Obstacle avoidance control of the unmanned bicycle based on variable universe fuzzy exponential rate reaching law sliding mode control

Zipeng Xu, Longlong Fan, Yongli Zhang, Hongxing Li, School of Control Science and Engineering Dalian University of Technology Dalian, China

In this paper, a variable universe fuzzy exponential rate reaching law sliding mode controller (VFSMC) is designed for obstacle avoidance and stabilization of the unmanned bicycle. First, a variable universe fuzzy controller is used to adjust the parameter of the sliding mode controller. Then, a fuzzy controller is considered to realize the error correction of the sliding mode controller to improve the accuracy of the controller. Further, the artificial potential field method is adopted to achieve obstacle avoidance control of the unmanned bicycle. Some numerical simulations are provided to illustrate the validity of the proposed controller.

[#73] Finite-time consensus tracking for large-scale multi-motor system based on second-order communication topology

Hui Li, School of Mechanical Engineering Northwestern Polytechnical University AVIC Qingan Group Co.,Ltd Xi'an, China

Dengxiu Yu, The Unmanned System Research Institution Northwestern Polytechnical University Xi'an, China

Zhen Wang, The Center for Optical Imagery Analysis and Learning Northwestern Polytechnical University Xi'an, China

Hao Xu, The Unmanned System Research Institution, Northwestern Polytechnical University, Xi'an, China

Shengjin Li, School of Mechanical Engineering, Northwestern Polytechnical University, Xi'an, China

Jia Long, The Unmanned System Research Institution, Northwestern Polytechnical University, Xi'an, China

This paper proposes a finite-time consensus tracking algorithm for a large-scale multi-motor system (LSMMS), which is extremely meaningful for modern automatic product lines to run continuously with high precision and efficiency. A second- order communication topology inspired by the social structure is proposed to reduce the computational complexity of the system and make it more suitable for product lines with a vast amount of motors that need to be controlled. Then, the finite-time consensus controller based on second-order communication topology for LSMMS is designed using the backstepping method, making the time costs in the tracking errors of position and velocity converging to zero finite. Simulation is given to illustrate the effectiveness of the proposed approach

[#67] Real-time Reachable Set Estimation of Discrete-time Singular Systems

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Yanmin Liu,Shandong Gretech Water-Treatment Co., Ltd

Shandong, China

The inquiry into real-time reachable set estimation for singular systems is conducted in this paper. By applying Lyapunov stability principle, the method mentioned underneath can estimate the reachable set in real time, A competent condition is set up in the form of linear matrix inequality (LMI) to ensure that the reachable set of singular system is confined in real-time by an array of ellipsoids. The authority of the results presented in this paper is illuminated by a numerical example.

[#44] Exponential synchronization for fuzzy inertial neural networks with mixed time delays

Jing Han, Guici Chen, College of Science, Wuhan University of Science and Technology Wuhan, China

Guodong Zhang and Junhao Hu, School of Mathematics and Statistics South-Central University For Nationalities Wuhan, China

In this paper, a class of inertial neural net- works(INNs) with fuzzy templates and mixed time delays is con- sidered. By building a novel Lyapunov functional and designing an effective adaptive control law, several new results are derived to get exponential synchronization of the investigated fuzzy inertial neural networks(FINNs). We construct the exponential synchronization results of the FINNs with mixed delays by using nonreduced-order method for the first time. At last, numerical simulations are given to show the correctness of the results.

Session SaO II-B: 16:00-17:20

[#68] A Prediction Model for Remaining Useful Life of Turbofan Engines by Fusing Broad Learning System and Temporal Convolutional Network

Kai Yu, Degang Wang, Hongxing Li, School of Control Science and Engineering, Dalian University of Technology Dalian, China

In this paper, a prediction model based on a broad learning system (BLS) and temporal convolutional network (TCN) is proposed to measure the remaining useful life (RUL) of turbofan engines. Firstly, a variational autoencoder (VAE) is used to extract important low-dimensional features from the engine sensor data. Then, the degradation information is extracted from the time and feature dimensions of fragment data using TCN. Further, the BLS combined with residual

connection is used to enhance the nonlinear representation of the model. The proposed method is validated on the commercial modular aero propulsion system simulation (C-MAPSS) dataset and compared with some state-of-the-art methods. The experimental results show that the proposed method is effective in RUL prediction.

[#72] Design of Robust Fuzzy Neural Network with α-Divergence

Jiaqian Wang, Zheng Liu, Honggui Han, Faculty of Information Technology Beijing University of Technology Beijing, China

Fuzzy neural network has been considered as an effective model to apply in many applications. However, due to the training mode based on minimizing the mean squared error, the typical fuzzy neural network suffers from poor robustness for disturbances. To overcome this problem, a robust fuzzy neural network with α-divergence is designed and analyzed in this paper. First, a cost function based on α-divergence is developed to describe the discrepancy between the real output and fuzzy neural network output. Then, a training mode, which minimizes the above function, can reduce the sensibility of disturbances to improve the robustness of fuzzy neural network. Second, an adaptive learning algorithm is employed to adjust the parameter of fuzzy neural network. Then, the proposed fuzzy neural network is able to obtain fast convergence in the learning process. Finally, some benchmarks are used to test the merits of fuzzy neural network. The simulation results illustrate that the proposed fuzzy neural network can achieve good robustness.

[#75] EGCN: Ensemble Graph Convolutional Network for Neural Architecture Performance Prediction

Xin Liu, Zixiang Ding, Nannan Li, Yaran Chen, and Dongbin Zhao Fellow, IEEE State Key Laboratory of Management and Control for Complex Systems, Institute of Automation, Chinese Academy of Sciences, Beijing 100190, China, School of Artificial Intelligence, University of Chinese Academy of Sciences, Beijing 101408, China

Neural Architecture Search (NAS) is proposed to automatically search novel neural networks. Currently, one typical problem of NAS is that its computation requirements are too high to stand for most researchers. In fact, it consumes a lot of resources to train subnetworks for architecture search. If the performance of each subnetwork can be predicted accurately without training, the computational burden will be alleviated. Graph Convolutional Network (GCN) is proven to have powerful capabilities for topological information perception and extraction. It is suitable to use GCN for predicting neural architecture performance which is related to its topology.

In this paper, we treat GCN as the performance predictor with two improvements. First, a novel neural architecture data processing method named DATAPRO2 is designed to improve GCN's performance. Then, we propose EGCN, a model-based performance predictor which employs ensemble technique on GCN with DATAPRO2 to alleviate the overfitting issue caused by the imbalanced dataset for neural architecture performance prediction. Experimental results on CVPR-2021-NAS-TRACK2 dataset show that EGCN contributes to obtaining better predic- tive performance than vanilla GCN and other popular predictors.

[#77] Cooperative Control of Intersection Connected Vehicles under Constrained Communication Resource

Wanxing Xiao, Bo Yang, Department of Automation Shanghai Jiao Tong University Shanghai 200240, China

The development of automation and vehicle com- munication has enabled the cooperative control of vehicles at an intersection. In practice, in order to realize coordinated decisions and cooperative actions, information exchange among vehicles via a wireless network is susceptible to be affected by limited communication resources. In this paper, we consider a vehicle coordination and communication resource-aware problem under limited communication resources. Firstly, to address this issue, we propose a distributed model predictive control (DMPC) method with priority for each vehicle, which will reduce the impact of prediction consistency loss caused by communication delay. In addition, a prediction-based trigger mechanism is constructed for the proposed DMPC method, which predicts the usage of communication in advance and facilitates resource scheduling. Finally, we evaluated our scheme by the simulation of multi- vehicles, which demonstrates the effectiveness of communication saving while avoiding collisions and stop-deadlock.

[#78] Spatial-temporal Traffic Flow Prediction Model Based on Dynamic Graph Structure

Qiang Zhao, Qiwei Sun, Shiyuan Han, Jin Zhou, Yuehui, Shandong Provincial Key Laboratory of Network Based Intelligent Computing, University of Jinan Jinan, 250022, China

Xiaofang Zhong, School of Data and Computer Science, Shandong Women's University Jinan, 250022, China

Traffic flow has the characteristics of complex spa- tial dependence and temporal dependence. Deep learning as a traffic flow prediction method can make full use of the temporal and spatial characteristics of traffic flow. In this paper, the road network is abstracted into a graph structure, the size of the graph structure is dynamically changed, and the graph convolutional neural network (GCN) and the long short term memory network (LSTM) are used to capture the temporal and spatial characteristics of traffic flow to solve the traffic flow prediction problem. Based on the data of vehicle speed in California bay area, the experiment is divided into three prediction scales. The effectiveness of the traffic flow prediction model is verified by experimental comparison.

[#81] Research on Underwater Object Detection Based on Improved YOLOv4

Wang Hao, Nangfeng Xiao, School of Computer Science and Engineering South China University of Technology Guangzhou, China

The complex underwater environment and lighting conditions make underwater images suffer from texture distor- tion and color variations. In this paper, we propose an improved YOLOv4 detection method to detect four underwater organisms: holothurian, echinus, scallop, starfish and waterweeds. Firstly, we modified the network structure, added a deep separable convolution to the backbone network, and added a 152 × 152 feature map, which is conducive to the detection of small targets. Secondly, k-means clustering

algorithm is used to cluster the bounding box in the data set, and the size of the bounding box is improved according to the clustering results. Thirdly, we propose a new module (EASPP, Spatial Pyramid Pooling), which increases slightly the model complexity, but the improvement effect is significant. Finally, when training the model, we use multi-scale training to better train targets with different scales. The experimental results show that on our test set, the improved method in the underwater object detection method is 4.8% higher than the original YOLOv4 model in accuracy (AP), the F1-score is 5.1% higher than that of the original method, and for mAP@0.5 it reaches 81.5%, which is 5.6% higher than that of the original method, which can be concluded that our method is effective.

[#82] A Dual-Robot Welding Path Planning Method Based on Kmeans and Ant Colony Algorithms

Jingjing Wang, College of Vocational and Technical Education Guangxi Science&Technology of Normal, University Laibin, China
Hongli Deng, School of Culture and Communication Guangxi Science&Technology of Normal University, Laibin, China
Cun Wang, Xinliang Cao, College of Vocational and Technical Education Guangxi Science&Technology of Normal, University Laibin, China

For the problem of double robots working together in the welding process, this project proposes a path planning method based on Kmeans algorithm and ant colony algorithm. The Kmeans algorithm is used to classify all weld joint tasks and reasonably assign them to individual robots. The ant colony algorithm is used to sort the weld joints assigned to individual robots and also to plan the work route for each robot. The simulation results show that the task assignment to this method is more scientific and reasonable than the existing methods, and the path planning results are shorter than the existing ones.

[#86] Parallel Temporal and Spatial Modeling for Interpretable Fault Detection and Isolation of Industrial Processes

Pengyu Song, Chunhui Zhao, Jinliang Ding, Youxian Sun, State Key Laboratory of Industrial Control Technology (College of Control Science and Engineering), Zhejiang University, Hangzhou, China
Xuanxuan Jin, Zhejiang Zheneng Jiahua Power Generator Co.,Ltd. Hangzhou, China

The structure of modern industrial processes has been gradually complicated to adapt to diversified production requirements. Process variables generally have temporal characteristics. Meanwhile, complex spatial interactions between variables also pose challenges for process modeling. In this study, a parallel temporal and spatial feature extraction framework is proposed and applied to fault detection and isolation in industrial processes. On the one hand, unlike the existing methods with mixed spatiotemporal information, we design independent temporal and spatial modeling structures. The temporal characteristics of each process variable are simultaneously extracted in the designed temporal submodule. Furthermore, the spatial connections between variables are captured through sparse adjacency network extraction and information fusion. In this way, the temporal and spatial information can be individually observed to provide interpretable monitoring results. On the other hand, considering the different spatiotemporal anomalies caused by various fault types, we establish a targeted isolation strategy to provide reliable fault analysis. For temporal faults, the reconstruction error indicators are designed to quantify the abnormality of the variable. Moreover, a network reconstruction model is developed to measure the spatial structure deviation and locate the fault source. The performance of the proposed method is verified through a real industrial example.

Sunday, Dec 12, 2021

Session SuO III: 8:30-11:50

Address: 123-452-758（腾讯会议）

Session SuO III-A: 8:30-10:30

[#88] Adaptive Control for A Class of Nonlinear MIMO Systems

Chen Zhao, College of Electronic and Information Engineering, Southwest university

Xin Wang, College of Electronic and Information Engineering, Southwest university

In this paper, a command-filter-based adaptive fuzzy control strategy is proposed for a class of nonlinear multiple input and multiple output(MIMO) systems with full state constraints. The appropriate barrier Lyapunov function is employed to prevent the constraints violation, and the command-filtered backstepping control method is proposed to remove the explosion of differentiation and lessen the computational burden. In addition, fuzzy logic system is employed to approximate the unknown nonlinear function, and the proposed compensating signals can make up for the error caused by the command filters. The proposed control strategy guarantees that all signals in the closed-loop system are semiglobal uniformly ultimately bounded by adjusting those designed system parameters. The simulation result is introduced to verify the effectiveness of the proposed control strategy.

[#89] Moving Target Shooting Control Policy Based on

Boyu Li, Yuanheng Zhu, Dongbin Zhao and Haoran Li， State Key Laboratory of Management and Control for Complex Systems, Institute of Automation, Chinese Academy of Sciences

Tao Jin and Yingnian Wu is， School of Automation, Information Science and Technology University

Robots are playing a more and more important role in people’s production and life, recently. However, robot control in dynamic environment is still a difficulty. With the great breakthrough of deep reinforcement learning in the field of video games, this method is also extended to the field of robots. Due to the gap between the simulation environment and the real environment, the deep reinforcement learning algorithm trained in the simulation environment is difficult to be applied to the real environment. Aiming at the gimbal control with two degrees of freedom (DOF), a pipline combining system identification and deep reinforcement learning is proposed. On the one hand, the shooting accuracy of the gimbal to moving objects is improved through deep reinforcement learning algorithm. On the other hand, the gap between simulation and reality is reduced through system identification. The method is verified in the RoboMaster University AI Challenge (RMUA) shooting system. The results show that the shooting accuracy is better than the classical control method.

[#90] An evaluation management mechanism based on node trust

Jing Huang, Zhe-Yuan Sun, Hui-Juan Zhang, jia Chen, Shen He, Research Institute of China Mobile Communications Corporation, Research Institute of Safety Technology

Tens of billions of nodes in the Internet of Things work together, making the boundary between virtual and reality more and more blurred. However, while the Internet age has brought subversive changes to people's lives, it has also brought huge security risks. Therefore, in order to effectively identify malicious nodes and realize the security and credibility of each node in the Internet of Things, this paper proposes an evaluation and management mechanism based on node trust. First, perform direct trust measurement of nodes based on node satisfaction and reliability stored locally; Secondly, the indirect trustworthiness measurement of the node is realized by combining the direct recommendation trust degree and the indirect recommendation trust degree; Finally, according to the comprehensive trust value, it dynamically analyzes the risk and threat of the environment where the node is located, and identifies and eliminates malicious nodes in time. The simulation results show that the evaluation management mechanism proposed in this paper can effectively identify malicious nodes, thereby ensuring the security of the Internet of Things.

[#91] Lidar-millimeter wave radar information fusion multi-target detection based on unscented Kalman filter and covariance intersection algorithm

Fan Le, Hong Mo, Yinghui Meng,College of Electric and Information Engineering Changsha University of Science and Technology Changsha,

Lidar-based object detection is an important method of environment perception for autonomous driving. Due to the limitation of the inherent properties of lidar, the detection accuracy of obscured vehicles and distant objects is inferior, which causes the problem of missed detection. To address this problem, a lidar-millimeter wave radar infor-mation fusion multi-target detection method based on the unscented Kalman filter (UKF) and the covariance intersection (CI) algorithm was proposed in this article. Firstly, the UKF algorithm was applied to generate state estimations on the data collected by the sensor. Subsequently, the CI algorithm was introduced to form state fusion estimates. Finally, a simulation experiment platform was built based on MATLAB, and a comparison experiment with Joint Probabilistic Data Asso-ciation (JPDA) and Gaussian mixture probability hypothesis density (GMPHD) algorithms were designed. The Generalized optimal sub-pattern assignment (GOSPA) indi-cators were adopted to evaluate the detection accuracy of each algorithm, and the effectiveness of the method was verified. The experimental results showed that UKF-CI had higher detection accuracy and provided accurate infor-mation for the decision-making part of the autonomous driving system, which guaranteed the stable operation of the autonomous driving system.

[#92] Sliding mode control of a 2-DOF helicopter system with adaptive input compensation

Xuejing Lan, Weijie Yang, Jianing Zhang, Zhijia Zhao, Ge Ma, Zhifu Li, School of Mechanical and Electrical Engineering, Guangzhou University

This paper considers the decoupling control problem of a two-degree-of-freedom (2-DOF) helicopter system with uncertainties and disturbances. The unknown input bias caused by the dynamical coupling is approximated by fuzzy neural networks. An adaptive sliding mode control (SMC) strategy is proposed to deal with the uncertainties and unknown dis-turbances on the system. By appropriately constructing the Lyapunov function, the stability of the controlled system is proved. Finally, the effectiveness and availability of the strategy are verified by numerical simulation.

[#96] Multi-Loss Function for Collision-to-distance Estimationl

Xiangzhu Zhang, Key Laboratory of Autonomous Systems and Networked Control, Ministry of Education, Unmanned Aerial Vehicle Systems Engineering Technology Research Center of Guangdong, South China University of Technology

Lijia Zhang, School of Computer Science and Technology, Guangdong University of Technology

Ding Xu, Hailong Pei, Key Laboratory of Autonomous Systems and Networked Control, Ministry of Education, Unmanned Aerial Vehicle Systems Engineering Technology Research Center of Guangdong, South China University of Technology

Estimation of the nearest obstacle distance is the key to the indoor autonomous obstacle avoidance and navigation of monocular UAVs. At present, the distance estimation model of the most immediate obstacle in UAV indoor autonomous navigation primarily uses regression loss or the ordinal regression loss to train. The continuity of regression loss utilizes distance and the orderliness of ordinal regression loss utilization distance. This paper proposes a multi-loss training deep learning model based on ordinal regression loss and regression loss. We add a distance decoder after the ordinal regression as the regression estimation. Finally, we test the model performance in public datasets and obtain good results.

[#38] Singularity-Free Robust Adaptive Controller for Miniature Helicopters

Yao Zou, Liangyin Zhong, Xiuyu He, Wei He, University of Science and Technology Beijing

A singularity-free robust adaptive trajectory track- ing controller is designed for miniature helicopters with uncertain inertial parameters. Firstly, a position loop controller is developed with the saturation control scheme. Then, a novel attitude loop controller with initial condition constraint proposed for the attitude tracking to the command one. Further, adaptive laws with the projection algorithm are proposed to estimate the uncertain inertial parameters. It is demonstrated that, with the developed controller, the bounded trajectory tracking objective is accomplished.

[#13] NN-based Fixed-Time Tracking Control for Multi-Agent Systems With Input Delays

Xiaohong Zheng, Xiaomeng Li, Wenbin Xiao, Qi Zhou and Renquan Lu

This article discusses a fixed-time consensus tracking control problem for multi-agent systems (MASs) suffering from input delays. First, the Pade approximation technique is employed to deal with input delays. Second, unknown nonlinearities in MASs are reconstructed by command filtering technique and neural network (NN). Convex optimization technique is used to design NN weight update law. To guarantee the transient performance of MASs, fixed-time control is utilized, while the resulting singularity problem is solved by curve fitting method. Under the fixed-time stability criterion and Lyapunov stability theorem, it is shown that all signals of the closed-loop system are bounded in fixed time. Finally, the validity of the presented algorithm is checked by simulation.

Session SuO IV-A: 10:30-11:50

[#15] A Multidimensional System Architecture Oriented to the Data Space of Manufacturing Enterprises

Kuan Lu, Zhijian Cheng, Hongru Ren, Renquan Lu, School of Automation and Guangdong , Province Key Laboratory of Intelligent Decision and Cooperative Control, Guangdong University of Technology.

The concept and characteristics of the data space model of manufacturing enterprises in various countries are expounded, and a multi-dimensional data system architecture oriented to the data space of manufacturing enterprises is proposed. The effective analysis and processing of big data in manufacturing enterprises can provide them with more effective model building, integrated retrieval and intelligent management strategies, so as to reduce costs and increase efficiency. A systematic overview of the data space of the entire system and the entire value chain of the manufacturing enterprises is carried out. First, the three dimensions of the business domain, the processing domain and the modal domain are clarified; secondly, the methods of applying data processing at each stage in each domain are explained; finally, the advantages and importance of the data model are summarized.

[#17] An Improved UAV Path Optimization Algorithm for Target Accurately and Quickly Localization

Rui Liang, Kai Wu, Xiaoyi Ma, Lianyu Fu, City West Power Supply Branch State, Grid Tianjin Electric Power Company

Sheng Xu, Tiantian Xu, Guangdong-Hong Kong-Macao Joint Laboratory of Human-Machine Intelligence-Synergy Systems, Shenzhen Institute of Advanced Technology

Angle-of-arrival (AOA) target localization using the unmanned aerial vehicle (UAV) has been widely applied in many practical applications. To localize an invasive target quickly and accurately, both the estimation and UAV path optimization algorithms are required. This paper focuses on developing a path optimization method to improve the target estimation performance. Firstly, the problem formulation of AOA target localization is introduced. Secondly, the classical pseudolinear Kalman filter (PLKF) and the gradient-based path optimization are presented. Thirdly, we analyze the problems that existed in the previous methods and propose an improved gradient-descent path optimization algorithm combined with a simple grid search method. Finally, the

simulation examples verify the effectiveness of the proposed methods.

[#19] Fixed-/Preassigned-Time Anti-Synchronization of Chaotic Neural Networks

Haoyu Li and Leimin Wang, School of Automation, China University of Geosciences, Hubei Key Laboratory of Advanced Control and Intelligent Automation for Complex Systems

This paper investigates a unified controller to solve the fixed-time anti-synchronization (FTAS) and preassigned-time anti-synchronization (PTAS) problems for chaotic neural networks. Under our controller, chaotic neural network can realize anti-synchronization within the fixed or preassigned time which greatly expands the practical application range of the anti-synchronization. In addition, sufficient conditions and time estimation on FTAS and PTAS are derived. Finally, the feasibility of the control scheme is proved via a numerical simulation.

[#26] Interactive Segmentation Using Prior Knowledge-Based Distance Map

Youdam, Wenkai Lu, Xingyu Tian, Department of Automation, Tsinghua University

In this paper, we aim to solve problems in interactive segmentation, a technique which is widely used for data labeling tasks. It requires the user to provide clicks for the objects of interest. The user-provided clicks are transformed into the distance map, which plays an important role in the interactive segmentation. Therefore, we propose a novel distance map that is obtained by combining the automatic segmentation result with the user-provided clicks. Since we have validated that better auto-matic segmentation result leads to better interactive segmentation result, we concatenate the original image with its LOG (Laplacian of Gaussian) filter image to improve the automatic segmentation results. Besides, given that its successful implementation requires correct labels so as to enable the computer to simulate the user interaction, a data cleansing technique is applied to filter out samples with inaccurate labels also known as noisy labels. The effectiveness of our proposed method is assessed using the Kaggle’s TGS Salt Identification Challenge dataset. The obtained results indicate that when using the proposed algorithm, the average IoU reaches 91.81% for only one user-provided click.

[#30] Channel Prediction for Real-Time Wireless Communication with MmWave SC-FDE in IIoT Systems

Changwei Lv, Ming Liu, Shenzhen Institute of Information Technology, Shenzhen, China

Junwei Duan, Jinan University, Guangzhou, China

With the application of wireless sensor-actuator networks in the Industrial Internet of Things (IIoT), it is crucially important to ensure the real-timing of data transmission. The millimeter wave (mmWave) communicating at the extremely high frequency band is a promising solution for the rapidly expanding data throughput in IIoT, due to the wide usable frequency band. In extremely high frequency band, the channel coherent time will be obviously reduced and becomes shorter than the frame duration. In this case, the channel state information (CSI) acquisition based on channel estimation will provide outdated information for coherent signal detection. Therefore, forecasting the channel variation for real-time data transmission is necessary. In this paper, we investigate the channel prediction methods in both the frequency and time domains for mmWave single- carrier frequency-domain-equalization (SC-FDE) systems. In the frequency domain, the channel prediction is conducted on each subcarrier, while the time domain predictor on each channel tap. As a number of the channel taps in the time domain are mainly composed of estimation noise, we separate these channel taps composed of estimation noise from the significant taps before building the prediction model. In this paper, the autoregressive (AR) model is employed to perform the channel prediction in the both domains. The simulation results show that the time domain predictor increases the prediction accuracy while reducing the computation complexity.

[#36] Observer-based feedback control for linear parabolic PDEs with quantized input

Xuena Zhao, Zhijie Liu, Wei He, School of Automation and Electrical Engineering University of Science and Technology Beijing

Junwen Gu, School of Advanced Engineering, University of Science and Technology Beijing

This study focuses on the input quantization control for the linear parabolic PDEs with local piecewise controllers and pointwise measurements. To estimate the unmeasured state for controller design, we construct a PDE observer based on feedback signals. And then a quantization feedback compensator is proposed to exponentially stabilize the linear parabolic PDE systems. The closed-loop system stability is proven by Lyapunov direct method. Further, simulation results are presented to demonstrate the correctness of the theoretical proof.

[#52] Parameter estimation for nonlinear functions related to LTI system responses

Ling Xu and Feng Ding, School of Internet of Things Engineering, Jiangnan University

This paper considers the parameter estimation prob-lem of nonlinear models, which are related to the impulse or step response functions of linear time-invariant (LTI) dynamical systems, based on the response data. In terms of the nonlinear characteristic of the models, the nonlinear dynamical optimiza-tion scheme is adopted for obtaining the system parameter estimates. By constructing a gradient criterion function, a gra-dient recursion algorithm is derived. In order to overcome the difficulty of determining the step-size in the gradient recursion algorithm, a trying method and a numerical approach are proposed to achieve the step-size. On this basis, a stochastic gradient estimation method is presented by using a recursive step-size. Furthermore, a multi-innovation stochastic gradient method is deduced for enhancing the estimation accuracy by using the dynamical window data. Finally, a dynamical length stochastic gradient estimation technique is offered to obtain more accurate parameter estimates by using dynamical length measured data from the step response. The examples are provided to examine the algorithm performance and the simulation results indicate that the presented approaches are effective.

[#53] Load Margin Assessment of Electricity-heat System Based on the Improved CPF

Hongxin Dong, Zhongyang Han, Jun Zhao, Wei Wang, Key Laboratory of Intelligent Control and Optimization for Industrial Equipment of Ministry of Education, Dalian University of Technology

Energy supply security is the basis to ensure a stable operation of integrated energy system (IES). The selection of appropriate indicators and calculation methods play a pivotal role in the field of security assessment. Considering the strong coupling of multi-energy flows, large system scale and complex structure, the traditional methods which only consider single energy flow and a fixed load mode are not accurate enough to evaluate the energy supply security. To solve the above problems, a load margin assessment method based on the improved continuation power flow (CPF) is proposed in this study. Firstly, according to the steady state of electricity-heat system, a general mechanism-based model related to load increase is developed as the basic algorithm for the CPF process. Next, the CPF method is extended to the IES, where the directions of the load increase are set by the first-order difference to describe the states of the system in real-time. Considering that the load increase should be restricted in a practical range for real-world application, this paper proposes a non-negative lower load limit setting method based on empirical probability distribution. Finally, experiments on both a typical IES and an IES of an industrial park in China are performed, which validates the effectiveness and practicability of the proposed method for quantitative security assessment of electricity-heat system.

Sunday, Dec 12, 2021

Session SuO IV: 8:30-11:50

Address: 145-705-070（腾讯会议）

Session SuO III-B: 8:30-10:30

[#55] Face Rotation and Recognition Based on Attention Mechanism and Generative Adversarial Networks

Hong Li, Nanfeng Xiao, South China University of Technology Guangzhou, China

Face rotation can enrich imbalanced data and improve face recognition performance. However most of the previous methods focus on identity information. Therefore, this paper firstly proposes a novel attended pose-guided generative adversarial network (APGAN) to synthesize an arbitrary target posed photorealistic human face from the original one, while maintaining the identity and the expression information. The proposed model is mainly composed of heatmap-based generator with attention and dual discriminators with attention. Adaptive attention mechanism is proposed to concentrate on critical facial organs and maintain local structure during face rotation, for achieving more precise information preservation. Integrated expression learning exploits the shared low-level features and the inherited correlation between the two tasks, furtherly improves the expression recognition capability. Attribute purification, dynamic loss weights and alternative dataset training strengthen the performance and alienate the overfitting problem together. APGAN model is trained on small-scale dataset KDEF, challenging the robustness of the networks. The extensive experimental results on the qualitative analysis and the quantitative comparison, demonstrate that the proposed model outperformances the previous face rotation methods and expression recognition methods.

[#59] A modified Bayesian neural network integrating stochastic configuration network and ensemble learning strategy s

Hao Zheng, Degang Wang, Wei Zhou, School of Control Science and Engineering, Dalian University of Technology

In this paper, a stochastic configured Bayesian neural network (SCBNN) is proposed for solving regression and classification problems. Firstly, stochastic configuration network (SCN) is applied to extract feature. Then, the stochastic configured scheme is applied to Bayesian neural network (BNN) for obtaining the appropriate structure. The extracted features are combined with the original features to compute the output of the network. Further, an integration strategy of the Bayesian model average (BMA) is considered to improve the performance of the network. Some experimental results demonstrate the validity of the proposed method.

[#60] Imported Appliance Risk Level Identification Based on Support Vector Machine Algorithm

Cheng Cheng, Xiaoli Luan, College of IOT Engineering,JiangNan University

Jiejun Zhao, Li Mao, Feng Guo, Mechanical & Electrical Products and Vehicle Testing Center WuXi Customs House of P.R.

Since 2009, China has promulgated several laws and regulations to regulate the import of solid waste, but there has been a lack of supporting identification criteria. To provide detailed and feasible risk level identification criteria for imported appliances to guide the Customs identification of e-waste. This paper establishes a three-tier identification criterion which has 42 indicators covering: appearance, value of use, electrical safety risk, mechanical safety risk, toxic and hazardous substances risk. Using these indicators as input, an intelligent identification method constructed by support vector machine (SVM) algorithm could identify the risk level of imported appliances as low risk, medium risk, and high risk. To verify the effectiveness and practicality of this method, this paper uses the identification cases provided by Wuxi Customs. The results show that the identifi-cation method has high self-learning capability and accuracy.

[#61] A Review on Simulation Platforms for Complex Industrial Process

Tianzheng Wang, Jian Tang, Heng Xia, Xiaotong Pan, Faculty of Information Technology, Beijing University of Technology

The complex industrial process is consisted of multiple loops with coupling relation. They have the characteristics of strong nonlinearity and non-stationary. So it is difficult to describe them with precise mathematical models. Thus, the design of control systems about complex industrial process mainly relies on repeated experiments and debugging on the actual system. Moreover, the novel operational optimization control algorithms cannot directly applied to the operation of industrial processes in terms of factors like safety requirement and economic cost. Therefore, it is necessary to build simulation platforms of complex industrial process to solve these issues. In order to construct an effective simulation platform, a review on different simulation platforms is made in this paper. The existing simulation platforms for industrial process are divided into four categories. They are real control system and real controlled object, real control system and virtual controlled object, virtual control system and real controlled object and virtual control system and virtual controlled object. Then, their structure and application background are analyzed in detail. The existing problems are also summarized. Finally, the conclusion and prospect of simulation platforms for industrial process are given out..

[#63] DNN Speech Separation Algorithm Based on

Meng Gao, Ying Gao, Feng Pei , School of Opto-Electronic Information Science and Technology

To further improve the speech separation effect of deep neural networks (DNN), a DNN speech separation algorithm is proposed in this paper based on segmented masking target. The algorithm combines the advantages of IBM and IRM in different signal-to-noise ratio (SNR) regions to construct a segmented masking target that can adapt to changes in SNR as the training target of DNN. In addition, to improve the accuracy of IRM estimation, a two-step prior SNR is used for the effective calculation to further improve the speech

separation performance of the DNN model. Finally, the simulation experiments show that the improved target in this paper has a better speech separation effect than IBM and IRM.

[#65] Recognition of aluminum electrolysis overheat trend based on DA-LSTM Neural Network

Ye Zhu, Shiwen Xie, Yongfang Xie, Xiaofang Chen, School of Automation Central South University

Superheat is the difference between the temperature of electrolyte and the temperature of primary crystal in aluminum electrolysis production, which is related to the physical field, current efficiency and electrolytic cell life and other important indicators in production. Therefore, by monitoring and identifying the degree of superheat, various parameters and blanking in the aluminum electrolysis process can be reasonably adjusted to keep the degree of superheat within a reasonable and stable range, which is of great significance to the efficient operation of the entire aluminum electrolysis cell. At present, many scholars have studied the identification of superheat and achieved a certain accuracy, but there are still few studies on the identification of the trend of superheat change. Therefore, in this paper, by mining the time sequence information of various data in the production process of aluminum electrolysis, the Long Short Term Memory (LSTM) algorithm with dual-stage attention mechanism (DA-LSTM) is used to classify and identify the superheat trend. The first stage of DA-LSTM introduces input feature attention to increase the weight of more relevant features. In the second stage, time step attention is introduced, and different time steps are weighted. Finally, the effectiveness of this method is verified by comparing with other methods, and it has higher accuracy.

[#69] Prediction of ship fuel consumption based on Elastic network regression model

Shanshan Li Xinyu Li, Yi Zuo, Tieshan Li, Dalian Maritime University Navigation College ,Collaborative Innovation Center of Maritime Big Data & Marine Artificial General Intelligence

Tieshan Li, University of Electronic Science and Technology of China, College of Automation Engineering

Predicting the fuel consumption of ships sailing under different navigation conditions and improving the operation efficiency of shipping industry has become an important topic. There are many characteristic variables affecting ship fuel consumption during navigation, such as trim, draft, wind speed, wind direction and so on. And some variables are highly correlated, which is easy to produce multicollinearity problems. It makes the fuel consumption prediction complex. The study established an Elastic network regression model by combining the least absolute contraction and selection operator (LASSO) and Ridge regression algorithm. The model reduces the complexity and improves the interpretability and accuracy by selecting the characteristic variables affecting ship fuel consumption. The study is verified by the navigation data of a ferry within two months. The results show that compared with long short term memory (LSTM) and back-propagation neural network (BPNN), the Elastic network regression model can not only explain the relationship between fuel consumption and variables, but also predict fuel consumption more accurately and effectively.

[#70] Underwater Sludge Detection System Based on Multi-Data Fusion

Yunchao Jiang, Shunyi Zhao, Key Laboratory of Advanced Process Control for Light Industry (Ministry of Education), Jiangnan University

Songjie Guo, Information Center,Hangzhou Yuhang Water Co. Ltd

Underwater sludge greatly affects water quality, and it is an important task of urban maintenance to clean up the sludge in the urban rivers. To remove sludge, a critical step is to measure the location and depth of sludge accurately, which leads to a refined calculation of maintenance fee. A traditional method of measuring sludge is based on human experience, which is costly, and more importantly, calculation errors and low efficiency. In this paper, we introduce an intelligent and automatic underwater sludge detection system. Two sonars equipped on an unmanned ship provide the measurements of depth, which are fused using the Kalman-like method to obtain accurate measures of sludge depth. Our experiment shows that the system can detect sludge depth conveniently.

Session SuO IV-B: 10:30-11:50

[#71] Residual Channel Attention Connection Network for Reference-based Image Super-resolution

Ruirong Lin, Nangfeng Xiao, School of Computer Science and Engineering South China University of Technology

Compared with single image super-resolution (SISR), reference-based image super-resolution (RefSR) utilizes additional references (Ref) to recover more realistic texture details, achieving better reconstruction performance. Most recent works focus on transferring relevant texture features from Ref to low-resolution (LR) images. However, those works ignore the high-frequency information existing in the LR space, leading to performance degradation when irrelevant Ref images are given. To address this issue, we propose a residual channel attention connection network for reference-based image super-resolution (RCACSR), which fuses valuable high-frequency information in LR space with high-resolution (HR) texture details of Ref. Specifically, the proposed residual channel attention connection network (RCACN) can extract more complex features from the LR space. Moreover, an enhanced texture transformer is presented, which can search and transfer texture features more accurately from Ref. Extensive experiments have demonstrated that the proposed RCACSR is superior to the state-of-the-art approaches in the aspects of both quantitative and qualitative measurements.

[#76] Attitude Control of Quadrotor UAVs Using Adaptive Terminal Sliding Mode Control

Haiming Du, Jian Sun, Gang Wang, School of Automation, Beijing Institude of Technology

To handle the strongly coupled, nonlinear and un-modeled disturbance in UAVs, an adaptive terminal sliding mode control strategy based on characteristic modeling is presented, which achieves improved attitude control accuracy and robust-ness. Specifically, a characteristic model of quadrotor attitude control is first established. Then, using sliding mode control theory, a characteristic model-based adaptive terminal sliding mode control law is designed and utilized to improve

control effects. Finally, simulation and real flight experimental results demonstrate that the proposed method enjoys effectiveness and superiority.

[#79] Research on Shift Matching to Enhance DAM
Kai Hu, Nanfeng Xiao,School of Computer Science and Engineering,South China University of Technology

Human's responses in communication depend on the context. Specifically, they are the feedback to a sentence or a word in the context. Further, external knowledge needs to be added to provide appropriate information for the human's answer. DAM (Deep Attention Matching Network), uses the attention mechanism of transformer to expand utterance and response into multi-level granularity representations, and then calculate the granularity similarity at the same level, which has better effects than using traditional RNN (recurrent neural network). Inspired by DAM, we propose to calculate the similarity between granularities at different levels which can explore more useful information for training and learning in this paper. We call this new matching method "shift matching", which is not limited to enhancing DAM, but can be generalized to other models. Our experiments include two parts: the first part compares the improved model with the base, and then compares the classic model to solve multi-round dialogue problem. The second part is to compare the experimental results of the different shift distances. The results are better than that of the state-of-the-art model.

[#83] End-to-End Supervised Zero-Shot Learning with Meta-Learning Strategy
Xiaofeng Xu, Xianglin Bao, School of Computer and Information Anhui Polytechnic University

Ruiheng Zhang, School of Mechatronical Engineering Beijing Institute of Technology

Xingyu Lu, School of Electronic and Optical Engineering Nanjing University of Science and Technology

Zero-shot learning (ZSL) is a challenging but prac-tical task in the computer vision field. ZSL aims to recognize new unseen objects using disjoint seen objects. Recently, the ZSL problem can be solved in a supervised learning way by using deep generative models to synthesize data as the training data for unseen objects. In this paper, we design an end-to-end supervised ZSL model in which the data generation network and the object classification network are trained jointly. To improve the generalization ability of the supervised ZSL model, the meta learning strategy is introduced to alleviate the domain shift problem between the synthesized data and the real data of unseen objects. Extensive experiments on four ZSL standard datasets demonstrate the significant superiority of the end-to-end strategy and the meta learning strategy for the proposed model in ZSL tasks.

[#84] ISSPM: A stock prediction model incorporating investor sentiment calculations based on fusedmax
Yuer Yang, Zeguang Chen, College of Cyber Security, Jinan University

Siting Chen, Shaobo Chem, Yujuan Quan, College of Information Science and Technology Jinan University

Ruolanxin Li, Zhiye Cai, Haotian Gu, Hongyi Yin, School of Economics,Jinan University

In this paper, a stock trend forecasting model is constructed based on Bert's text sentiment analysis and the forecasting method of LSTM. In order to improve the traditional forecasting model, which does not take into account the influence of market sentiment on stock prices, we use Bert's model to ex-tract textual information features from social media information, market news, and stockholders' comments after using historical stock trading data as features in the model for forecasting and carry out text sentiment analysis. The text features are then combined with historical stock data, and the fusedmax function is used to filter out the most likely outcomes to predict stock trends.

[#14] Command-Filter-Based Finite-Time Control for Human-in-the-Loop UAVs With Dead-Zone Inputs
Guohuai Lin, Zhijian Cheng, Hongru Ren, Hongyi Li, Renquan Lu, School of Automation and Guangdong Province Key Laboratory of Intelligent Decision and Cooperative Control, Guangdong University of Technology, Guangzhou 510006, China.

This paper studies the adaptive neural finite-time attitude control problem for six-rotor unmanned aerial vehicles (UAVs) with dead-zone inputs. Under the assumption that control inputs of leader are provided by a human operator, the command- filter-based finite-time attitude control protocol is proposed to achieve leader-follower consensus in finite time. In the control design, the command filter technique and radial basis function neural networks (RBF NNs) are adopted to solve the problems of explosion of complexity and uncertain nonlinear dynamics, respectively. In addition, dead-zone nonlinearities of control inputs are compensated by the boundedness of dead-zone slopes. Based on the presented control scheme, the finite-time stability of UAVs is obtained via the Lyapunov stability theory. Finally, simulation results validate the control property of the proposed strategy.

[#93] Adaptive Neural Network-Based Fault-Tolerant Control of 2-DOF Helicopter With Output Constraints
Zhijia Zhao, Jian Zhang, Jianing Zhang, Tao zou, School of Mechanical and Electrical Engineering Guangzhou University

In this paper, we propose an adaptive neural network-based fault-tolerant control for the two-degree of free-dom (DOF) helicopter system with actuator fault and output constraints. First, the radial basis function neural network is used to estimate the uncertainty of the system. Moreover, adaptive auxiliary parameters are used to compensate the actuator failure. And then, the barrier Lyapunov function is adopted to deal with the output constraints in the system. By analyzing the stability of Lyapunov function, it is strictly proved that the closed-loop system is semi-globally uniform and bounded, and under the combined action of actuator fault and output constraints, accurate tracking control performance is achieved. Finally, the simulation results in the 2-DOF helicopter system show the effectiveness of the control strategy.

[#94] Time-varying state constraints-based neural network control of a 2-DOF helicopter system

Tao Zou, Huiyuan Wu, Zhijia Zhao, Jianging Zhang, School of Mechanical and Electrical Engineering Guangzhou University

This paper proposes a neural network (NN) control method for a nonlinear 2-DOF helicopter system with time-varying state constraints. By constructing the time-varying bar-rier Lyapunov technology and the controller designed based on the backstepping method, the system's states are guaranteed within a predetermined region. The NN is adopted to approxi-mate the unknown function of the system to ensure its tracking performance and stability. Finally, the effectiveness of the derived control is validated by numerical simulation.

Sunday, December 12, 2021

Session SuO V: 14:00-17:20

Address: 123-452-758（腾讯会议）

Session SuO V-A: 14:00-16:00

[#001] Anti-windup neural network-sliding mode control for dynamic positioning vessels

Ting Sun, Cheng Liu, Navigation College, Dalian Maritime University
Xuegang Wang, CCCC Fourth Harbor Engineering Institute Co., Ltd.

In this paper, a control strategy based on sliding mode control and radial basis function neural network is proposed for dynamic positioning vessels with nonlinearity, model uncertainty, time-varying disturbances, and input saturation. Sliding mode control is employed in the design of a novel nonlinear controller for dynamic positioning vessels to enhance the robustness. Radial basis function neural network is introduced to approximate model uncertainty and time-varying disturbances, which can mitigate the chattering problem of sliding mode control. Moreover, an auxiliary design system is applied to mitigate the effectiveness of input saturation, which is widely existed in the marine control actuators. The closed-loop signals are proved to be stable by Lyapunov theory. In conclusion, the multiple simulations illustrate the feasibility and advantages of the presented anti-windup neural network-sliding mode controller.

[#004] Weakly Supervised Fine-Grained Visual Classification Through Spatial Information Mining and Attention-guided Regularization

Lequan Wang, Jin Duan, Guangqiu Chen, Gaotian Liu, School of Electronic and information Engineering, Changchun University of Science and Technology
Ziqiang Chen, Anhui canshi Information Technology Co., Ltd

Over-fitting is a severe problem when we adopt deep neural networks with a large number parameters in fine-grained visual classification. Many data augmentation methods are proposed through weakly supervised learning to alleviate over-fitting issue. Different from those methods, we propose a weakly supervised attention-guided regularization by object parts' attention maps to fine-tune the Fully Connected (FC) layer and relieve over-fitting issue during training in this paper. On the other hand, the neural units in the last convolutional layer contain the same receptive fields that limit recognition performance due to involving lots of background noises. To alleviate this issue, we devise a spatial information mining module with an auxiliary penalty loss to aggregate multi-scale receptive fields feature maps with the selected precedent layer. Comprehensive experiments are conducted to show our method achieves or surpasses state-of-the-art results on common fine-grained classification datasets.

[#007] Distributed Incremental Quasi-Newton Algorithm for Power System State Estimation

Yu Bai, Wenling Li, School of Automation Science and Electrical Engineering
Bin Zhang, School of Artificial Intelligence, Beijing University of Posts and Telecommunications.

In this paper, we propose a distributed incremental quais-Newton (D-IQN) algorithm for multi-area power system state estimation (MASE). Maximum correntropy criterion (MCC) is used in objective function in order to address non-Gaussian noise. Incremental quais-Newton (IQN) is applied to solve state estimation in each area. In the inter-area communication networks, consensus+innovation strategy is adopted to form a distributed pattern. In this way, each area carries out a local state estimation with limited information exchange with its neighboring areas. As a fully distributed algorithm, no central coordinator is needed here. Based on this peer-to-peer communication paradigm, accurate estimation results are obtained and the privacy of each area remains well-preserved. Numerical experiments are carried out on 118-bus systems. The results show that the algorithm is effective for non-Gaussian noise and outperforms other methods such as distributed Broyden-Fletcher-Goldfarb-Shanno (BFGS), Gauss-Newton and WLS method.

[#008] Multi-agent coverage control based on improved community discovery algorithm

Hongyan Li, Shengjin Li, School of Mechatronics Northwestern Polytechnical University
Zhen Wang, School of Artificial Intelligence, Optics and ElectroNics, Northwestern Polytechnical University
Chong Li, Honors College Northwestern Polytechnical University
Shan Gao, Unmanned System Research Institute Northwestern Polytechnical University Xi'an
Dengxiu Yu, Unmanned System Research Institute Northwestern Polytechnical University Xi'an

In this paper, we propose a coverage control method based on the community discovery algorithm. In the traditional coverage control, the Voronoi partition method is used to divide the target region. However, it cannot be applied in the concave area of the plane or the high-dimensional space. Hence, we propose a coverage control method based on the community discovery algorithm, which can be applied in discrete, concave, and high-dimensional areas. In addition, we introduce the method of Delaunay triangulation to generate the topological relationship between different agents. As a result, the coverage control method of a set of points with internal connections is solved. And the coverage control method is proved to be effective by two examples in simulation.

[#018] Research on the Prediction Model of Key Personnel's Food Crime Based on Stacking Model Fusion

Yupeng Zhai, Kang Wang, Faculty of Information Technology Beijing University of Technology
Xiaoli Li, Faculty of Information Technology, Beijing Key Laboratory of Computational Intelligence and Intelligent System, Engineering Research Center of Digital Community, Ministry of Education Beijing University of Technology

Crime prediction is of great significance to the food safety defense work of major events. The traditional crime prediction depends on the experience of police officers, which is highly subjective and cannot be predicted in advance. This paper analyzes and processes food safety police data, combines the characteristics of food crimes, uses stacking model fusion method to predict the food crime tendency of key personnel, and verifies the model through the Recall Rate. The results show that the integrated learning model has high accuracy and can effectively predict the food crime tendency of key personnel.

[#022] STDP and Competition Learning in Spiking Neural Networks and its application to Image Classification

Min Deng, Chuandong Li, College of Electronic and Information Engineering Southwest University

Spiking neural networks (SNNs), regarded as the third generation artificial neural networks (ANNs), can well explain the behavior of biological neurons. Recently, the research on the application of spiking neural networks has attracted much attention, especially in the image recognition field. To solve the problem of ANNs' lack of biological rationality, this paper combines Spike Timing Dependent Plasticity (STDP) with competitive learning to realize the MNIST dataset classification. A simple two-layer network structure, which includes an input layer and a processing layer is adopted. With the MNIST dataset as input, spike trains are generated based on frequency coding. A competitive learning mechanism is adopted in the processing layer to train the network, while during the learning and training process, we adopted the STDP power-law learning rule to update weights to achieve unsupervised learning image classification, and the classification accuracy reaches 83.179%. The results show that the network proposed in this paper achieves good performance, fast training speed and more biological rationality.

[#023] A Hierarchical Motion Retrieval Algorithm for Complex Manipulation Tasks Planning with An Encoded Knowledge Base

Ailin Xue, Xiaoli Li, Chunfang Liu, Department of Information Beijing University of Technology

In human-robot cooperation, it is a challenge thing that the robot should perform to convert humans' natural languages to continuous action sequences, which is necessary for completing complex collaborative tasks. In this paper, firstly, a new knowledge base is built for encoding different features of movements, objects and relations; then, a hierarchical motion sequences retrieval algorithm is presented by combining our knowledge base with Deep Q-learning. Finally, the experiments verify that the developed reasoning system is effective and accomplishes to manipulate the objects to reach target statuses.

[#028] A Reference-Vector-Based Strength Pareto Evolutionary Algorithm 2

Lu Zhang, Qinchao Meng, College of Electrical Engineering and Automation, Shandong University of Science and Technology

In this paper, a reference-vector-based strength Pareto evolutionary algorithm 2 (RVSPEA2) is proposed to solve the multiobjective continuous optimization problems. In this proposed RVSPEA2, a reference vectors generation strategy is introduced into solutions selection mechanism of SPEA2, and an objective normalization technique is developed for dealing with the disparately scaled objectives. To verify the effectiveness of the proposed RVSPEA2, some benchmark test problems are applied. The results show that the proposed algorithm outperforms other compared optimization algorithms in terms of convergence and diversity.

Session SuO VI-A: 16:00-17:20

[#029] Veracity: A Fake News Detection Architecture for MANET Messaging

Amit Neil Ramkissoon, Wayne Goodridge, Department of Computing & Information Technology, The University of the West Indies at St Augustine

Mobile Ad Hoc Network Messaging has become an integral part of today's social communication landscape. They are used in a variety of applications. One major problem that these networks face is the spread of fake news. This problem can have serious deleterious effects on our social data driven society. Detecting fake news has proven to be challenging even for modern day algorithms. This research presents, Veracity, a unique computational social system to accomplish the task of Fake News Detection in MANET Messaging. The Veracity architecture attempts to model social behaviour and human reactions to news spread over a MANET. Veracity introduces five new algorithms namely, VerifyNews, CompareText, PredictCred, CredScore and EyeTruth for the capture, computation and analysis of the credibility and content data features. The Veracity architecture works in a fully distributed and infrastructureless environment. This study validates Veracity using a generated dataset with features relating to the credibility of news publishers and the content of the message to predict fake news. These features are analysed using a machine learning prediction model. The results of these experiments are analysed using four evaluation methodologies. The analysis reveals positive performance with the use of the fake news detection architecture.

[#032] LBP index for evaluation of disk degaussing achievement based on AFM image

Ziying Zhang, Zhe Xu, Xiaoge Liu, Beijing University of Technology Faculty of Information Technology
Jian Tang, Beijing University of Technology, Faculty of Information Technology, Beijing Key Laboratory of Computational Intelligence and Intelligent System
Yaxuan Yao, National Institute of Metrology Center for Advanced Measurement Science

In the field of information security, it is very important to judge whether the information on a magnetic storage medium is completely destroyed. But so far, domestic research on the degaussing effect of magnetic storage media is still lacking. Previous studies have shown that the magnetic images before and after degaussing can reflect the amount of meaningful information left on the disk, which is closely related to the degaussing effect. Therefore, this paper proposes a new method to study the magnetic images before and after degaussing. This paper introduces the LBP texture feature extraction algorithm to process the magnetic images before and after degaussing, and evaluates the degaussing effect of

the magnetic storage medium through the extracted texture feature values. A new LBP degaussing evaluation index is proposed, and the parameters of the index are optimized to achieve the best evaluation performance.

[#040] Optimal design of soft sensors and bias updating scheme based on rank-constrained optimization rank-constrained optimization

Yibo Wang, Chao Shang, Dexian Huang, Department of Automation, Tsinghua University

Soft sensors have been widely applied in many different industrial fields to predict the values of quality variables, which cannot be measured online. However, it is likely that most of processes are affected greatly by time-varying changes. Thus, the bias updating mechanism is frequently introduced into the maintenance of soft sensors in industrial processed. However, the soft sensors models are developed in a static sense, and it is questionable that their performance is optimal under bias update. To address this issue, we propose an optimal design of soft sensors and bias updating scheme based on rank-constrained optimization. To efficiently solve the optimization problem, an algorithm based on the difference-of-convex programming is proposed. Compared with classi-cal static least squares equipped with bias update, the new approach turns out to more accurate and robust, which is demonstrated by a simulation study.

[#042] Adaptive Intra Refresh For Low-Latency Video Coding

Xi Huang, Luheng Jia, Han Wang, Kebin Jia, Faculty of Information Technology, Beijing University of Technology

Low-latency video applications are widely used in video communication, video surveillance and other real time scenarios, of which the low-latency video coding technique is the key component to reduce the coding complexity and transmission delay. The fixed-period intra refresh in video coding are capable of reducing inter-frame bit rate fluctuation and recover delivering error. In this work, we propose a novel fixed-period intra refresh method to further improve the coding efficiency and error resilience of encoded bitstream by rearranging the refreshing order according to the blocks importance-ranking joint consid-ering reference importance using motion statistics and coding complexity leveraging rate-distortion cost of the encoding frame. Experimental results demonstrate that our proposed method obtains smoother bitrate and higher coding efficiency of up to 4.6% BD-rate reduction compared with previous method.

[#045] Research on Traffic Load Balancing of Data Center Based on SDN in Campus Network

Shan Jing, Lei Guo, Chuan Zhao, School of Information Science and Engineering, University of Jinan

With the rapid development of the Internet, the amount of university network data is increasing, and the scale of data centers in campus network is becoming larger and larger. Accordingly, higher requirements are put forward for the reliability of data center network and network transmission rate. When the network traffic becomes very large, how to achieve load balancing, improve bandwidth utilization and ensure network performance has become a difficult problem that the data center network must break through. The effect of OSPF traffic load balancing strategy and ECMP mechanism in traditional networks to solve this problem is not obvious. Under the idea of SDN, control and forwarding are completely separated. The method to solve this problem becomes more flexible and is no longer limited by fixed protocols. All switches have no independent brain and only forwarding function, The controller is responsible for all path calculations and strategies, and the switch forwards them according to the flow table issued by the controller. After analyzing the defects of traditional network processing traffic load balancing, this paper studies the data center load balancing strategy under the idea of SDN, and uses mininet to test the actual effect.

[#047] Optimal sampling control of nonlinear systems based on adaptive dynamic programming

Heping Gu, Jun Mei, Chuan Zhao, School of Mathematics and statistics, South-Central University for Nationalities

For the optimal control problem of continuous time nonlinear systems, a sampling control method based on adaptive dynamic programming is proposed in this paper. The general form and cost function of nonlinear systems are given, the famous Hamilton-Jacobi-Bellman (HJB) equation is derived, and the sampling controller is designed based on the optimal control input. The neural network control is used to approximate the optimal cost function, and it is proved that the closed-loop system is uniformly ultimately bounded. Finally, numerical simulation is presented to show the feasibility of the proposed method.

[#049] Enhanced Soft Sensor with Qualified Augmented Data Using Centroid Measurement Criterion

Yun Dai, Qing Yu, Yi Liu, Institute of Process Equipment and Control Engineering, Zhejiang University of Technology
Yuan Yao, Department of Chemical Engineering National Tsing Hua University
Tao Yang, State Key Laboratory of Synthetical Automation for Process Industries Northeastern University

Development of reliable soft sensors using limited labeled samples is not an easy task in industrial processes. A selective generative adversarial network (SGAN)-based support vector regression (SGAN-SVR) soft sensor is proposed for quality prediction using limited labeled training data. Specifically, SVR is considered as a base prediction model. The Wasserstein GAN (WGAN) is adopted to capture the distribution of available labeled data and generate virtual candidates. Subsequently, using a proposed similarity measurement strategy, those synthetic data with more information are selected and introduced into the training set. Using the designed data augmentation approach, the SGAN-SVR model can achieve better prediction performance compared with the SVR soft sensor. The quality prediction results on an industrial polyethylene process demonstrate the effectiveness and advantages of the proposed method.

[#058] Visualization analysis of rocket fault detection technology based on Citespace

Zhiguo Zhou, Lijing Huang, Fengqi Yan, School of Information and Electronics Beijing Institute of Technology
Ruliang Lin, School of Information and Electronics, Beijing Institute of Technology, Beijing Aerospace Wanyuan Science & Technology Co., Ltd

As the main vehicle for entering space and deploying space equipment, launch vehicles have high energy density and complex electrical structures. Once mission fail, It will suffer serious losses. Fault detection technology aims to reduce the failures of launch vehicles and provide effective criteria for fault-tolerant processing. It has become the research focus of the aerospace departments of various countries. Based on the scientific metrology software Citespace, the fault detection technology of launch vehicle is analyzed scientifically in this paper, including co-occurrence of keywords, emergence of keywords, citation clustering and so on. Systematically summarizes relevant research in the WOS and CNKI databases, and predicts the development trend of this field. At the same time, this paper summarizes the development of the field of launch vehicle fault detection technology and the advantages and disadvantages of classic algorithms. Finally looks forward to the research development and engineering realization of fault detection algorithms.

Sunday, December 12, 2021

Session SuO VI: 14:00-17:20

Address: 145-705-070（腾讯会议）

Session SuO V-B: 14:00-16:00

[#021] A Supervised Learning Algorithm to Binary Classification Problem for Spiking Neural Networks

Shuyuan Wang, Chuandong Li, College of Electronic and Information Engineering Southwest University

Spiking neural networks (SNN) are known as the third generation neural network, which can simulate biological neural networks signals and has stronger computing power. In contrast to the model classification tasks previously mentioned in machine learning, the Tempotron algorithm is a biologically rational and temporal coding supervised synaptic learning rule that enables neurons to efficiently learn a wide range of decision rules. Embedding information in the space-time structure of spikes rather than simply the average spike emission frequency. In this paper, we adopt Tempotron algorithm to perform binary classification task on the imported Fashion MNIST dataset and adopt gradient descent algorithm to update the synaptic weight during the training process. The two conditions of sending spikes and no sending spikes are taken as the classification standard. The experimental results show that this method has high learning accuracy and efficiency can classify the dataset accurately, and solve complex and real-time problems better.

[#080] Safety Analysis of Automatic Crane Trolley Running System Based on STAMP/STPA

Wenbo Zhang, Xiangkun Meng, Qihe Shan, College of Navigation, Dalian Maritime University
Jianyuan Wang, Fei Teng, Marine Electrical Engineering College, Dalian Maritime University
Tieshan Li, College of Automation Engineering, University of Electronic Science and Technology, College of Navigation, Dalian Maritime University

Automatic crane is a complex system affected by the external environment and the internal components of the system, information fusion, software and hardware combination, and man-machine integration. The improvement of its automation and informatization proposes various challenges in the accident model construction and safety analysis. However, the safety analysis methods based on fault types consider that the occurrence of accidents is linear and ignore the correlation among components of the system. This paper adopts the system-theoretic accident model and process (STAMP) and system-theoretic process analysis (STPA) mode is to implement safety analysis of the automatic crane trolley running system (ACTRs). The paper starts from the identification of system-level losses and hazards, clarifies the function and internal logical control relationships of the system's components, and then finds potential unsafe control actions (UCAs) and loss scenarios during the trolley running. The results show that the control requirements for the regular operation of the trolley running system can be analyzed in detail. Therefore, the STAMP/STPA can apply to the safety investigation of automatic cranes.

[#085] Stealthy False Data Injection Attacks against Extended Kalman Filter Detection in Power Grids

Yifa Liu, Long Cheng, State Key Laboratory of Management and Control for Complex Systems, Institute of Automation, Chinese Academy of Sciences, School of Artificial Intelligence, University of Chinese Academy of Sciences
Wenchao Xue, Key Laboratory of System and Control, Academy of Mathematics and System Science, Chinese Academy of Sciences
Shuping He, School of Electrical Engineering and Automation, Anhui University

The power grid is a kind of national critical infrastructure directly affiliated to human daily life. Because of the vital functions and potentially significant losses, the power grid becomes an excellent target for many malicious attacks. Due to the special nonlinear measurements, many detection methods do not match the grid very well. The extended Kalman filter based detection is one of the few methods suitable for nonlinear system detection, and therefore can be used in power system to spot malicious attacks. However, the reliability and effectiveness of the extended Kalman filter based detection have not been fully studied and adequately guaranteed. By proposing a two-step false data injection attack strategy, this paper gives a stealthy way to inject false data of increasing magnitude into the power grid, which can eventually cause a certain degree of deviation of the grid state without being detected. In the simulation, the method proposed in this paper caused a voltage deviation of more than 25% before being discovered in the power system.

[#003] Robust Multivariable Control for Municipal Wastewater Denitrification Process

Tong Wang, Honggui Han, Haoyuan Sun, Hongyan Yang, Xiaolong Wu, Beijing Artificial Intelligence Institute and Beijing Laboratory for Intelligent environmental protection, Faculty of Information Technology, Beijing University of Technology

The control of internal flow and external carbon is crucial for the municipal wastewater denitrification process. However, due to the disturbance and interactions in the process, it is difficult to achieve suitable control performance. To solve this problem, a robust multivariable control (RMC) scheme is proposed to improve the process control efficiency. First, a mechanism-based control method is designed to provide an explicit control signal that mitigates the effect of load changes. Second, a robust control method, using a fuzzy neural network sliding mode controller, is developed to improve the tracking accuracy. Third, an adaptive learning algorithm is proposed to tune the parameters of RMC so that the closed-loop system is stable in the term of Lyapunov stability theory. Finally, the benchmark simulations of municipal wastewater denitrification process demonstrate that, compared with other control strategies, the proposed method yields a stable control performance with an obvious energy saving effect.

[#009] Event-triggered intermittent control for finite time synchronization of delayed chaotic neural networks

Zeyu Ruan, Junhao Hu, Jun Mei, School of Mathematics and statistics, South-Central University for Nationalities

The event-triggered intermittent control is proposed for finite time synchronization of delayed chaotic neural networks in this paper. The event-triggered intermittent controller, in which intermittent instants are not predesigned, is explored to achieve finite time synchronization for delayed chaotic neural networks. Some sufficient conditions for finite time synchronization are derived by using Lyapunov stability theory and Zeno behavior is excluded. It is noted that the finite time synchronization criterion in this paper is different from previous work. Numerical simulation is presented to show their good agreements with the theoretical analysis.

[#010] Stabilization of Fuzzy Inertial Neural Networks with Infinite Delays

Changqing Long, Guodong Zhang, Junhao Hu, School of Mathematics and statistics, South-Central University for Nationalities

This paper addresses the global asymptotic stabilization problem for a class of fuzzy inertial neural networks (FINNs) with infinite delays and handles with the FINNs directly by a non-reduced order strategy. Based on the Lyapunov theory and some analytical techniques, several new criteria are obtained to ensure the global asymptotic stabilization of the considered FINNs under the designed controller. Compared with the common neural networks, we introduce the fuzzy logics, inertial terms, time-varying coefficients and infinite delays into the considered model, which supplements and improves some previously published literature results. At last, give numerical simulations to illustrate the validity of the theoretical outcomes.

[#012] Improved Sliding Mode-based Load Frequency Control in Multi-Area Power Systems

Jia Chen, State Key Lab Power Transmiss Equipment Syst. Se, Chongqing University
Xinxin Liu, Xiaojie Su, College of Automation, Chongqing University

This paper investigates the nonlinear sliding mode observer-based load frequency control design of multi-area power systems subject to quantization output measurement. Firstly, the multi-area power systems are modeled. Then, a nonlinear sliding surface is developed. Finally, a nonlinear control law is synthesized to guaran-tee the reachability of the sliding surface.

[#020] A Parallel Combination of Facilitating Synapse Based on Temporal Correlation in SpikeProp Algorithm

Shushi Liu, Chuandong Li, College of Electronic and Information Engineering Southwest University

This paper presents a new method to minimize the error function between the expected spike time and the actual spike time, which is a parallel combination of facilitating synapses consisting of an excitatory and an inhibitory synapse. The SpikeProp algorithm is designed to solve the error optimization problem between the expected spike time and the actual spike time of the current from the presynaptic neuron passing through the synapse to the postsynaptic neuron. The SpikeProp algorithm merges the Bienenstock–Cooper–Munro (BCM) rule with Spike Timing Dependent Plasticity (STDP) before calculating errors. The idea of filtration based on value in Synaptic Weight Association Training (SWAT) is utilized in the hidden layer. Thus, a time selector is used in the synapse between the input layer and the hidden layer, which is achieved through parallel combination of excitatory and inhibitory synapses. The neuron models used in these two processes are Leaky Integrate and Fired (LIF) and Spike Response Model (SRM), respectively. The algorithm is benchmarked against the nonlinear exclusive OR (XOR) problem. The simulation results has illustrated the diagram of the time selector in the hidden layer and the error measured in the output layer.

[#024] An Image Recognizing Method Based on Precise Moment of Spikes

Wenlin Li, Chuandong Li, College of Electronic and Information Engineering, Southwest University

Inspired by neural computing science, Spiking Neural Networks (SNNs), as the third generation of Artificial Neural Networks (ANNs), with its high biological interpretability, powerful time-space information processing ability and diverse spike coding method, has shown a great potential in pattern recognition, object detecting and data predicting. It has received extensive attention in the field of brain-inspired computing and machine learning. Utilizing spike trains as communication signals within the network is one of the advantages of spiking neural networks, which is the main way of information transmission between neurons in the brain. How to encode input information into spike signals for transmission in the network determines the working efficiency. In this paper, a spiking neural network based on the spike firing rate and temporal coding is proposed in the training and testing process respectively, and applied to the recognition of MNIST handwritten digital dataset, with an accuracy of 78.74%.

Session SuO VI-B: 16:00-17:20

[#166] Parameters identification of photovoltaic cell models using the gradient iterative

Yan Ji, School of Mathematics, Southeast University, College of Automation and Electronic Engineering, Qingdao University of Science and Technology
Jinde Cao, School of Mathematics, Southeast University

This paper considers the parameter estimation of photovoltaic cell models. A gradient-based iterative algorithm is presented to determine the parameters of photovoltaic cell models by using the negative gradient search method. The proposed algorithm improved each parameter of the single-diode equivalent circuit of the photovoltaic cell models. Furthermore, the model transformation-based iterative method is proposed in order to enhance computational efficiencies. Finally, the simulation test results show that the proposed algorithm is effective.

[#043] Edge Detection of Microstructure Images of Magnetic Multilayer Materials via a Richer Convolutional Features Network

Shimin Zhang, Jiangsheng Gui, School of Informantion Science and Technology Zhejiang Sci-Tech University

Zhihui Cai, College of Sciences, China Jiliang University

Magnetic multilayer materials are extensively used in micro-devices and nanoelectronics areas. It is significant to implement edge detection and extraction for the microstructure images of the multilayer materials. This research deals with the edge detection and extraction of microstructures images of the magnetic multilayer material based on a richer convolutional features (RCF) network. First, an RCF network model on a 20-fold expanded Berkeley Segmentation Data Set and benchmark 500 (BSDS500) dataset is retrained. Then, such model is applied to the edge detection test on the given microstructure images of the magnetic multilayer material, and the edge probability maps containing coarse and obvious boundaries between the layers of magnetic materials are obtained. Third, the non-maximum suppression (NMS) algorithm is introduced to further refine the thick edges of the microstructure images. The results demonstrate that the RCF-based edge detection method is capable of detecting light and unclear boundaries of the magnetic multilayer material from their images, and outperforms the existing other edge detection algorithms includes Canny operator and HED network. In addition, under the expanded RCF model combining with the NMS algorithm, the edge probability map of the microstructure images of the magnetic multilayer material are almost the same as the ground truth.

[#050] Event-triggered intermittent control for finite time synchronization of delayed chaotic neural networks

Liu Yong, Yingying Chi, Zheng Zhe, Liu Rui, Cui Wenpeng, Jia Xiaoguang, R&D Center, Beijing Smart-Chip Microelectronics Technology Co., Ltd.

Based on summary of the main international standards of Ethernet physical layer chip and its working principle, this paper analyzed the requirements of the Ethernet physical layer chip in different Internet of energy terminals of Smart Substation, Distribution communication, Smart power plant, such as the communication bandwidth, electromagnetic compatibility, operating temperature. Technical requirements such as time-synchronization and energy saving also are summarized. The Ethernet physical layer core supporting IEEE1588 timestamp function can improve the sampling synchronization accuracy, and the physical layer chip supporting IEEE802.3az high efficiency and energy saving Ethernet standard can significantly reduce the energy consumption and cost of the device for power distribution devices powered by off-line power supply.

[#11] IGBT Open Circuit Fault Diagnosis Based on Improved Support Vector Machine

Zhiqiang Geng, Qi Wang, Yongming Han, information Science and Technology Beijing University of Chemical Technology,Beijing, China

Modular multilevel converter (MMC) is a new type of the voltage source converter, which is widely used in the flexible DC transmission and motor drive. However, the MMC is composed of a large number of sub-modules, which poses a huge difficulty for accurately locating the specific sub-module that has a fault. Therefore, this paper proposes an improved support vector machine (SVM) based on the overlapped wavelet packet transform (MODWPT) to diagnose the open circuit fault of the insulated gate bipolar transistor (IGBT) of the MMC sub-module. The MODWPT is used for the feature extraction, then the k-fold cross-validation can group fault feature data sets to evaluate the performance of SVM classifiers, which can effectively reduce the generalization error of the fault diagnosis model. Based on the MMC fault simulation model of the PSCAD platform, the experimental results show that the average fault diagnosis accuracy of the improved SVM based on the MODWPT is 99.78%, which has better classification accuracy and reliability than the traditional SVM, the back propagation neural network and Bayesian.

[#006] Robust convergence of uncertain fuzzy BAM neural networks with time-varying delays

Liangliang Li, Wenlin Jiang, School of Mathematical Sciences, Huaibei Normal University

This paper focuses on the robust exponential con-vergence of uncertain Takagi-Sugeno (T-S) fuzzy bidirectional associative memory (BAM) neural networks with time-varying delays. By employing Lyapunov method and delay inequality technique, several easily verifiable sufficient criteria are derived to guarantee the T-S fuzzy BAM neural networks with time-varying delays to converge robustly exponentially to a ball in the state space with a pre-specified rate. Finally, a numerical example with simulations is given to illustrate the effectiveness of our theoretical results.

[#110] Semi-Supervised Deep Clustering with Soft Membership Affinity

Haixiao Zhao, Rongrong Wang, Jin Zhou, Shiyuan Han, Tao Du, Ke Ji, Ya-ou Zhao, Kun Zhang, Yuehui Chen, Shandong Provincial Key Laboratory of Network based Intelligent Computing, University of Jinan

As an effective deep clustering method, improved deep embedding clustering can process large-scale high-dimensional data. However, the method only focuses on the global data and does not consider the local graph structure between data points. In this paper, a semi-supervised deep clustering algorithm with soft membership affinity is proposed to cluster high-dimensional datasets. The proposed algorithm is composed of three parts: the reconstruction loss is adopted to recover data and extract important features on latent space, the KL divergence between the soft assignment and the target distribution is utilized to make samples in each cluster distribute more densely, and the novel soft membership affinity, which is regarded as the semi-supervised information, is introduced to the IDEC model to constrain the relationship between data points and their neighbors, so as to further enhance the clustering performance. Experiments on datasets show that the algorithm is effective compared with other deep clustering algorithms.

[#126] Globally exponential attractivity of delayed neural networks evoked by periodic external inputs

Yan Ji, School of Mathematics, Southeast University, College of Automation and Electronic Engineering, Qingdao University of Science and Technology
Jinde Cao, School of Mathematics, Southeast University

This paper investigates the globally exponential attractivity of an n-neuron cellular neural network with mixed delay. It can have 2n periodic orbits located in saturation regions and these periodic orbits are globally exponentially attractive. Meanwhile, conditions are established to ensure the existence

of 2n globally exponential stable periodic solutions when external inputs are periodic. Finally, simulation results show that the proposed results are effective.

[#160] Semi-Supervised Deep Clustering with Soft Membership Affinity

Haixiao Zhao, Rongrong Wang, Jin Zhou, Shiyuan Han, Tao Du, Ke Ji, Ya-ou Zhao, Kun Zhang, Yuehui Chen, Shandong Provincial Key Laboratory of Network based Intelligent Computing, University of Jinan

As an effective deep clustering method, improved deep embedding clustering can process large-scale high-dimensional data. However, the method only focuses on the global data and does not consider the local graph structure between data points. In this paper, a semi-supervised deep clustering algorithm with soft membership affinity is proposed to cluster high-dimensional datasets. The proposed algorithm is composed of three parts: the reconstruction loss is adopted to recover data and extract important features on latent space, the KL divergence between the soft assignment and the target distribution is utilized to make samples in each cluster distribute more densely, and the novel soft membership affinity, which is regarded as the semi-supervised information, is introduced to the IDEC model to constrain the relationship between data points and their neighbors, so as to further enhance the clustering performance. Experiments on datasets show that the algorithm is effective compared with other deep clustering algorithms.

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