

IEEE ICUS 2022
Invited Session Summary

Title of Session

Multi-agent Safe Learning in Complex Environments

Name, Salutation and Affiliation of Organizers

1. Assoc. Prof. Chengchao Bai

Harbin Institute of Technology, China

2. Prof. Xiaojie Su

Chongqing University, China

3. Assoc. Prof. Shihui Guo

Xiamen University, China

4. Prof. Huixia Wang

China Academy of Launch Vehicle Technology, China

Biosketches of Organizers



Chengchao Bai, associate professor of the School of Aeronautics and Astronautics of Harbin Institute of Technology, has been selected into the Young Elite Scientists Sponsorship Program by CAST and the Young Talents Selection Program of HIT. His research interests include intelligent unmanned systems, multi-agent safe reinforcement learning, large-scale multi-robot collaboration, intelligent game confrontation and decision-making. He served as a member for the Youth Editorial Board of the Journal Unmanned Systems Technology. He is a committee member of the IEEE RAS Technical Committee on Multi-robot Systems, CICC (Chinese Institute of Command and Control) Technical Committee on Unmanned Systems, CAAI (Chinese Association for Artificial Intelligence) Technical Committee on Cognitive Systems and Information Processing, and CSIG (China Society of Image and Graphing) Technical Committee on Machine Vision. He has published more than 30 academic papers in top journals such as Pattern Recognition, IEEE TITS, and IEEE TAES.



Xiaojie Su received the PhD degree in Control Theory and Control Engineering from Harbin Institute of Technology, China in 2013. He is currently a professor and associate dean with the College of Automation, Chongqing University, Chongqing, China. His current research interests include intelligent control systems, advanced control and system analysis, and application of intelligent robot control. He has published 3 research monographs and more than 80 research papers in international referred journals. Prof. Su is the Founding Chair, IEEE Beijing Section, Systems, Man, and Cybernetics and Robotics and Automation Joint Societies Chapter (CH10994). He is an Steering Committee Member of IEEE Transactions on Big Data, 2022-2023, and currently serves as an Associate Editor for a number of journals, including IEEE Transactions on Artificial Intelligence, IEEE Transactions on Fuzzy Systems, IEEE Transactions on Systems, Man, and Cybernetics: Systems, IEEE Systems Journal, Information Sciences and so on. He is also an Associate Editor for the Conference Editorial Board, IEEE Control Systems Society. He was named to the 2017-2021 Highly Cited Researchers list, Clarivate Analytics.



Shihui Guo is currently an Associate Professor of Xiamen University. He obtained his Bachelor degree from Yuanpei College of Peking University in 2010 and Ph.D. from National Computing Animation Center, Bournemouth University in 2015. In 2019, he received the fellowship of Leaders in Innovation from Chinese Academy of Engineering and Royal Academy of Engineering (UK). He has worked as a postdoctoral researcher in the research group of Professor Nadia Thalmann, a member of Swiss Academy of Engineering. His research interests mainly focus on virtual role motion control based on physical simulation, and other related fields such as graphics, virtual reality and so on. As the principle investigator, he was supported by the National Natural Science Foundation of China, the China Post-doctoral Foundation and ALIBABA DAMO Innovation Research project. More than 40 papers have been published in international journals, such as ACM CHI、ISMAR、CVPR、TIP、TVCG.



Huixia Wang, female, Ph.D., researcher at Beijing Institute of Aerospace Automatic Control. Her research interests are aerospace control system simulation and swarm intelligence. Responsible for several advanced research projects, and made research and exploration on advanced technology verification methods, simulation system construction and war game system of aerospace equipment control system. Focusing on the development of the new generation artificial intelligence technology, combined with the development needs of aerospace equipment, we will carry out technical research on swarm intelligence. Won 1 second prize of the Army Science and Technology Progress Award. More than ten invention patents have been authorized and more than ten papers have been published.

Details of Session

With the rapid development and implementation of AI technology, intelligence has become a keyword in today's society. Whether it is production, life, or national defense construction, almost all walks of life are striving to achieve breakthroughs in intelligence and autonomy to drive the transformation of the entire industry and achieve asymmetric advantages in the new era. With the improvement of the requirements and goals, the task environment gradually presents the characteristics of complex, highly uncertain, and intense confrontation. The traditional single agent cannot complete the work alone most of the time. Therefore, making multi-agents have a resilient and robust ability in any environment is essential. However, limited by the inexplicability of neural networks, there are many challenges in the transferability and generalization of learning strategies. This directly leads to the core bottleneck that the existing learning technology cannot be implemented, that is, how to ensure the security of the learning strategy, especially the security and robustness in different complex environments. Therefore, safe learning is a prerequisite for determining the implementation of intelligence and whether it can be applied in extremely complex environments, and has significant research and engineering value.

The invited session invites original papers of innovative ideas and concepts, new discoveries and improvements, and novel applications relevant to the following selected topics of “Multi-agent Safe Learning in Complex Environments.”

- Multi-agent safe learning theory

- Safe learning interpretability mechanism
- Multi-agent safe learning with resilience guarantee
- Learning-based multi-agent game and cooperation
- Long-term learning security and stability in extremely complex environments
- Explanation and proof of safe interpretability from a new perspective
- Multi-agent safe learning testing and verification