

Dan Qiao

(+86) 17801010541 | qiaodan@buaa.edu.cn | <https://qiaodanbuaa.github.io>

EDUCATION

Master of Science, Automotive Engineering

Beijing University of Aeronautics and Astronautics | GPA: 3.6

Bachelor of Science, Automotive Engineering

Beijing University of Aeronautics and Astronautics | GPA: 3.2

Sep. 2018 – Jul. 2021

Beijing, China

Sep. 2014 – Jul. 2018

Beijing, China

PUBLICATIONS

D. Qiao, J. Zhang*, Y. Zhang, S. Xiao, H. Chen, Privacy-preserved Fully Decentralized Multi-agent Reinforcement Learning for Networked Social Systems, Preprint. 2022.

D. Qiao, G. Wen, Z. Peng*, Novel Saturated Nussbaum-type Function based Adaptive Distributed Consensus Control of Multi-agent Systems with Unknown Arbitrary Control Directions, [Preprint arXiv:2201.09453](#). 2021.

Z. Peng, D. Qiao*, G. Wen, B. Wu, Observer and RBF NN based Sliding-Mode Robust Formation Tracking for Nonholonomic Mobile Robots with Dynamics Model, Preprint. 2021.

S. Yang, Y. Hua, D. Qiao, Y. Lian, Y. Pan*, Y. He, A coupled electrochemical-thermal-mechanical degradation modelling approach for lifetime assessment of lithium-ion batteries, *Electrochimica Acta*, vol. 326, 2020.

RESEARCH EXPERIENCE

Differential Privacy Preserved Decentralized MARL for Social Networked Systems Nov. 2021 – Present

Fully Decentralized MARL, Differential Privacy, Central Bank Monetary Policy

- Introduce the Laplace noise-based Differential Privacy technique into the *QD*-Learning to protect the Q-value which may be associated with the agent's privacy information.
- Prove the mean square convergence and expectation convergence of the Q-value in DP-*QD*-Learning. Provide the theoretical boundary analysis of the variance to demonstrate the statistical law of the convergence value.
- Evaluate the DP-*QD*-Learning on the finite state-action tabular environment, which is capable to represent many social systems such as the center bank monetary policy, evolution of group opinion in elections, etc.

Nussbaum Functions based Formation Control with Unknown Control Directions July 2020 – Apr. 2021

Unknown Actuator Failures and Nonlinearities, Unknown Control Directions (UCDs)

- Proposed a novel lemma of Nussbaum-type functions to overcome the limitation of the identical unknown control directions assumptions and control shock.
- Designed a distributed control algorithm for the consensus problem of multi-agent system by leveraging the novel Nussbaum functions. The simulation results show that the input shock can be reduced by 80% with arbitrary UCDs.
- Designed a distributed formation control algorithm for Multiple WMRs with unknown actuator nonlinearities and UCDs.

Observer-based Distributed Sliding Mode Formation Tracking Control

Jan. 2020 – May 2020

Nonholonomic Wheeled Mobile Robots, Distributed Observer, Leader-Follower Structure

- Designed a distributed observer to estimate the state of the leader robot with limited communication range.
- Developed a novel sliding surface and reference velocity with combined errors to improve the system's robustness.
- Designed a distributed control law for a group of nonholonomic mobile robots with the Euler-Lagrange system.

Other Research: Multi-agent Reinforcement Learning

Group Decision Making

- Decentralized Training Decentralized Execution MARL for networked systems. The active selection of cooperative neighbors which is based on multi consensus theory, NCC, and GCN.
- The transfer of local equilibrium solution in open ad-hoc MARL, which is based on the characteristic that the influence of agent decreases exponentially with the increase of k-hop link in the network.

Extended Interest: Multi-agent & Multi-robot Systems

Distributed Networked System Stability, Complex Networks

- Switching topology, signed networks and cooperative-competitive graph with unknown relationship. Use the Nussbaum function to adaptively approximate the sign of the weights on the edge.
- Complex networks and opinion dynamics, which illustrates the evolution and consensus of individual opinions under the evaluation and interaction of the group.

AWARDS AND COMPETITIONS

Oral Presentation in International Symposium on Automation, Information and Computing (ISAIC), 2020.

Excellent Scholarship for Postgraduate Entrance Examination, Beihang University, 2018.

SKILLS & INTEREST

IELTS 6.5 (Reading 7.5 Listening 6.5 Written 6.0 Speaking 6.0), Latex, Python, and Matlab

Writing popular science blog, Skiing, Science fiction movies, and Editing video.