SONGYANG HAN

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EDUCATION

University of Connecticut (UCONN) **Storrs, USA**
PhD in *Computer Science and Engineering* Supervisor: Prof. Fei Miao ***Aug. 2018-May 2023***

- GPA: **4.0/4.0**
- Core courses: *Algorithms, Formal Methods, Machine Learning, Advanced Computer Network, Optimal & Model Predictive Control, Deep Reinforcement Learning, Cryptography*

Shanghai Jiao Tong University (SJTU) **Shanghai, China**
(*University of Michigan-SJTU Joint Institute*) ***Sep. 2015-Mar. 2018***
M.S. in *Electrical and Computer Engineering* Supervisor: Prof. Chengbin Ma

- GPA: **3.96/4.0 Ranking: 1/20**
- Core courses: *Game Theory, Data Mining, Engineering Optimization, Methods of Applied Mathematics I, Probability and Random Process, Mechatronic Systems Design, New Energy System*

Nanjing University (NJU) **Nanjing, China**
B.Eng. in *Automation* ***Sep. 2011-Jun. 2015***

- GPA: **4.44/5.0 Ranking: 1/34**
- Core courses: *Principles of Automatic Control, Modern Cybernetics, Operations Research, C++, Data Structure, Database, Computer Vision, Computer Network, Signals and Systems, Digital Signal Processing, Circuit Analysis, Analog Circuit, Digital Circuit, Principles of Microcomputer*

RESEARCH EXPERIENCE

University of Connecticut
Research Assistant, supervised by Prof. Fei Miao ***Aug. 2018-Present***

- **Key words:** multi-agent reinforcement learning (MARL), safe MARL, robust MARL, game theory
- Designed an algorithm to exploit the advantages raised by the extended sensing capability of connected autonomous vehicles (CAVs) through beneficial information sharing.
- Analyzed quantum key distribution protocols through a game theoretic framework to show improved noise tolerance and secure communication rate assuming adversaries are "rational".
- Designed an integrated information sharing and multi-agent reinforcement learning framework for the behavior planning of connected autonomous vehicles to improve traffic efficiency and safety.
- Studied the fundamental properties of the robust multi-agent RL problem under adversarial state perturbations. We define the concept of a robust agent policy and prove its existence.
- Designed a stable and efficient reward reallocation algorithm to motivate cooperation for multi-agent reinforcement learning assuming all agents are self-interested.

Reinforcement Learning for Autonomous Driving
Research Internship, Baidu USA Apollo team ***May 2020-Dec. 2020***

- Summarized existing reinforcement learning methods and the state-of-art deep learning methods used in autonomous driving.
- Wrote a design document for single and multi-agent RL, distributed learning, algorithm architecture and interface, and a prototype design.
- Built a prototype platform to train and test RL algorithms for autonomous vehicles in the Apollo platform and Amazon Web Services (AWS).

Machine Learning for Amazon Astro
Applied Scientist Internship, Amazon ***May 2023-Aug. 2023***

- Working on machine learning design for Amazon Astro.

Dynamic Systems Control Laboratory, UM-SJTU Joint Institute
Research Assistant, supervised by Prof. Chengbin Ma ***Sep. 2015-Mar. 2018***

- **Key words:** game theory, optimization, microgrid, energy management, electric vehicle
- Designed a flexible energy management approach to handle the uncertainties of weather and sizing in an isolated microgrid, which would not be influenced dramatically by different weather conditions.
- Designed and fabricated high efficient bidirectional DC/DC converters to conduct and validate energy management approaches in a downsized system.
- Built a hardware testbed to study reconfigurable energy systems.

Energy Management of Battery/Super Capacitor Hybrid System
Team Leader, collaborating with Nippon Chemi-Con Corporation, Japan ***Dec. 2016-Apr. 2017***

- Improved the energy management approach of a hybrid energy storage system in a novel topology.
- Improved the system efficiency without the help from special alternator like MAZDA i-ELoop.

3D Laser Processing Based on Computer Vision ***May 2013-Dec. 2014***
Team Leader, sponsored by National Undergraduate Training Programs for Innovation and Entrepreneurship

- Combined a camera and structured light to model a feather in 3D, which rebuilt the feather's shape.
- Successfully extracted the feather stroke with image processing methods, including Hough transform.

PUBLICATIONS

- **Songyang Han**, Shanglin Zhou, Jiangwei Wang, Lynn Pepin, Caiwen Ding, Jie Fu, Fei Miao. *A Multi-Agent Reinforcement Learning Approach For Safe and Efficient Behavior Planning Of Connected Autonomous Vehicles.* In IEEE Transactions on Intelligent Transportation Systems. (Under review, available on arXiv:2003.04371)
- **Songyang Han**, Sanbao Su, Sihong He, Shuo Han, Haizhao Wang, Fei Miao. *What is the Solution for State-Adversarial Multi-Agent Reinforcement.* (Under review, available on arXiv:2212.02705)
- Jiangwei Wang, Lili Su, **Songyang Han**, Dongjin Song, Fei Miao. *Towards Safe Autonomy in Hybrid Traffic: Detecting Unpredictable Abnormal Behaviors of Human Drivers via Information Sharing* . In ACM Transactions on Cyber-Physical Systems (TCPS), June 2023.
- Sihong He, **Songyang Han**, Sanbao Su, Shuo Han, Shaofeng Zou, and Fei Miao, *Robust Multi-Agent Reinforcement Learning Considering State Uncertainties.* In Transactions on Machine Learning Research (TMLR), May 2023.
- Sihong He, **Songyang Han**, Sanbao Su, Shuo Han, Shaofeng Zou, and Fei Miao, *Robust Multi-Agent Reinforcement Learning Considering State Uncertainties*, in the AI4ABM workshop at the 11th International Conference on Learning Representations (ICLR), Kigali Rwanda, May 2023.
- **Songyang Han**, Shanglin Zhou, Lynn Pepin, Jiangwei Wang, Caiwen Ding, Fei Miao. *Shared Information-Based Safe And Efficient Behavior Planning For Connected Autonomous Vehicles.* In the DCAA workshop at the 37th AAAI Conference on Artificial Intelligence, Washington, DC, USA, Feb. 2023. (**Best paper award**)

- Sanbao Su, Yiming Li, Sihong He, **Songyang Han**, Chen Feng, Caiwen Ding, Fei Miao. *Uncertainty Quantification of Collaborative Detection for Self-Driving.* Accepted to 2023 IEEE International Conference on Robotics and Automation (ICRA), London, UK, May 2023.
- Zhili Zhang, **Songyang Han**, Jiangwei Wang, Fei Miao. *Spatial-Temporal-Aware Safe Multi-Agent Reinforcement Learning of Connected Autonomous Vehicles in Challenging Scenarios.* Accepted to 2023 IEEE International Conference on Robotics and Automation (ICRA), London, UK, May 2023.
- Jiangwei Wang, Lili Su, **Songyang Han**, Dongjin Song, Fei Miao. *Towards Safe Autonomy in Hybrid Traffic: The Power of Information Sharing in Detecting Abnormal Human Drivers Behaviors.* In the AI4TS workshop at the 31st International Joint Conference On Artificial Intelligence (IJCAI), Messe Wien, Vienna, Austria, 2022.
- Yukun Yuan, Meiyi Ma, **Songyang Han**, Desheng Zhang, Fei Miao, John Stankovic, Shan Lin. *DeResolver: A Decentralized Negotiation and Conflict Resolution Framework for Smart City Services.* In ACM Transactions on Cyber-Physical Systems (TCPS), 2022.
- **Songyang Han**, He Wang, Sanbao Su, Yuanyuan Shi, Fei Miao. *Stable and Efficient Shapley Value-Based Reward Reallocation for Multi-Agent Reinforcement Learning of Autonomous Vehicles.* In 2022 IEEE International Conference on Robotics and Automation (ICRA), Philadelphia, USA, May 2022.
- Yukun Yuan, Meiyi Ma, **Songyang Han**, Desheng Zhang, Fei Miao, John Stankovic, Shan Lin. *DeResolver: A Decentralized Negotiation and Conflict Resolution Framework for Smart City Services.* In 12th ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS), Nashville, USA, May 2021. (**Best paper award**)
- **Songyang Han**, Walter O. Krawec, Fei Miao. *A Game Theoretic Security Framework for Quantum Cryptography: Performance Analysis and Application.* Quantum Information Processing 19.10 (2020): 1-24.
- **Songyang Han**, Jie Fu, Fei Miao. *Exploiting Beneficial Information Sharing Among Autonomous Vehicles.* In 2019 IEEE 58th Conference on Decision and Control (CDC), Nice, France, Dec. 2019.
- Amro Alsabbagh, Dongxiang Yan, **Songyang Han**, Yandong Wang, Chengbin Ma. *Behaviour-based distributed energy management for charging EVs in photovoltaic charging station.* In 2018 IEEE International Conference on Industrial Electronics for Sustainable Energy Systems (IESES), Hamilton, New Zealand, Jan. 2018.
- Shuangke Liu, Ming Liu, **Songyang Han**, Xinen Zhu, Chengbin Ma. *Tunable Class-E2 DC-DC Converter with High Efficiency and Stable Output Power for 6.78 MHz Wireless Power Transfer*. IEEE Transactions on Power Electronics 33.8 (2018): 6877-6886.
- Amro Alsabbagh, He Yin, **Songyang Han**, Chengbin Ma. *Two-stage distributed energy management for islanded DC microgrid with EV parking lot.* In 2017 43rd Annual Conference of the IEEE Industrial Electronics Society (IECON), Beijing, China, Oct. 2017.
- **Songyang Han**, He Yin, Amro Alsabbagh, Chengbin Ma. *A Flexible Distributed Approach to Energy Management of an Isolated Microgrid*. In 2017 IEEE 26th International Symposium on Industrial Electronics (ISIE), Edinburgh, Scotland, June 2017.
- Yandong Wang, He Yin, **Songyang Han**, Amro Alsabbagh, Chengbin Ma. *A novel switched capacitor circuit for battery cell balancing speed improvement.* In 2017 IEEE 26th International Symposium on Industrial Electronics (ISIE), Edinburgh, Scotland, June 2017.
- **Songyang Han**, Xianzhong Zhou, Chunlin Chen. *Path Planning for Multi-robot Systems Using PSO and Critical Path Schedule Method*. In 2016 IEEE 13th International Conference on Networking, Sensing, and Control (ICNSC), Mexico City, Mexico, April 2016.

SKILLS

Standardized Tests: TOEFL iBT: 107, GRE: V152 + Q170 + AW3.5
Programming: Python, C/C++, MATLAB, LabVIEW, SQL
Tools: Deep reinforcement learning, LaTeX, Linux, Git, CARLA, NI myRIO, NI CompactRIO, Arduino, PIC, Altium Designer, Multisim, AutoCAD

HONOR & AWARDS

- Predoctoral Research Fellowship, University of Connecticut ***May 2023***
- Best Paper Award, in the DCAA workshop at the 37th AAAI Conference ***Feb.2023***
- GE Fellowship of Excellence, University of Connecticut ***Aug. 2022***
- Predoctoral Research Fellowship, University of Connecticut ***May 2022***
- First Place Award, 8th Annual Graduate Poster Competition, University of Connecticut ***Mar. 2022***
- Predoctoral Research Fellowship, University of Connecticut ***May 2021***
- Best Paper Award, 12th ACM/IEEE International Conference on Cyber-Physical Systems ***May 2021***
- Cigna Graduate Fellowship, University of Connecticut ***Aug. 2020***
- Predoctoral Research Fellowship, University of Connecticut ***May 2020***
- Postgraduate Academic Excellence Scholarship, Shanghai Jiao Tong University ***Oct. 2016***
- Guanghua Scholarship, Shanghai Jiao Tong University ***Dec. 2015***
- Outstanding Graduates of Nanjing University ***May 2015***
- National Endeavor Fellowship, 3 times, Nanjing University ***Dec. 2012-Dec. 2014***
- Outstanding Winner of Educational Robot Competition in China, Chinese Association for Artificial Intelligence ***Nov. 2014***
- Meritorious Winner of 2014 MCM, the Consortium for Mathematics and Its Applications ***May 2014***
- Outstanding Students of Nanjing University, 2 times, Nanjing University ***Nov. 2012-Nov. 2013***

SERVICE EXPERIENCE

Reviewer,

- IEEE Transactions on Industrial Informatics
- IEEE Transactions on Neural Networks and Learning Systems
- The 43rd Annual Conference of the IEEE Industrial Electronics Society (IECON 2017)
- The 58th Conference on Decision and Control (CDC 2019)
- The 2020 American Control Conference (ACC 2020)
- The 59th Conference on Decision and Control (CDC 2020)
- The 2021 American Control Conference (ACC 2021)
- 2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2020)
- 2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2021)
- 2022 IEEE International Conference on Robotics and Automation (ICRA 2022)
- 2023 IEEE International Conference on Robotics and Automation (ICRA 2023)
- The 60th Conference on Decision and Control (CDC 2023)
- The 14th ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS 2023)

Invited Talk,

- Department of Computer Science, University of Maryland, College Park. ***Feb. 2023***
- Institute For Data, Systems, And Society (IDSS), Massachusetts Institute of Technology. ***May 2023***