# 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(expected)***
- 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 exiting 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 AMS.

**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.

[**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.

**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. *Robust Multi-Agent Reinforcement Learning Under Adversarial State Perturbations.* In 37th AAAI Conference on Artificial Intelligence. (Under review)
- Sanbao Su, Yiming Li, Sihong He, **Songyang Han**, Chen Feng, Caiwen Ding, Fei Miao. *Uncertainty Quantification of Collaborative Detection for Self-Driving.* In 2023 IEEE International Conference on Robotics and Automation (ICRA). (Under review, available on arXiv:2209.08162)
- Zhili Zhang, **Songyang Han**, Jiangwei Wang, Fei Miao. *Spatial-Temporal-Aware Safe Multi-Agent Reinforcement Learning of Connected Autonomous Vehicles in Challenging Scenarios.* In 2023 IEEE International Conference on Robotics and Automation (ICRA). (Under review, available on arXiv:2210.02300)
- 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, 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

- 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)