

# Songyang Han

Applied Scientist

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## Education

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### 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)

M.S. in Electrical and Computer Engineering, Supervisor: Prof. Chengbin Ma

*Sep. 2015 - Mar. 2018*

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

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### Applied Scientist II, Amazon AWS AI Labs

*Sep. 2024 - Present*

- Amazon Q Developer and CodeWhisperer; LLMs for Coding @AWS AI Labs.
- Our project, Amazon Q Developer code review, is announced by AWS CEO Matt Garman at AWS re:Invent 2024.

### Research Scientist, Sony AI America

*Aug. 2023 - Sep. 2024*

- Worked in the Reinforcement Learning group led by Peter Stone and Peter Wurman.
- A revolutionary superhuman racing AI agent that has mastered the highly realistic game of Gran Turismo, to race against and elevate the gaming experience of GT drivers.

### Applied Scientist Intern, Amazon

*May 2023 - Aug. 2023*

- Mentored by Apaar Sadhwani
- Developed machine learning-driven solutions to efficiently handle time-series data characterized by sparse observations.

### Research Assistant, University of Connecticut

Supervisor: Prof. Fei Miao

*Aug. 2018 - May 2023*

Key areas: multi-agent reinforcement learning (MARL), safe MARL, robust MARL, game theory

- Designed algorithms to leverage the extended sensing capabilities of connected autonomous vehicles (CAVs) through information sharing.
- Analyzed quantum key distribution protocols using game theory to enhance noise tolerance and secure communication rates.
- Developed an integrated information sharing and multi-agent reinforcement learning framework for CAV behavior planning to improve traffic efficiency and safety.
- Explored the fundamental properties of robust MARL under adversarial state perturbations, defining and proving the existence of robust agent policies.
- Created a stable and efficient reward reallocation algorithm to promote cooperation among self-interested agents in MARL.

**Research Intern**, Baidu USA Apollo team

*May 2020 - Dec. 2020*

- Mentored by Shiyu Song
- Single and multi-agent RL, distributed learning, algorithm architecture and interface, and a prototype design.
- Built a prototype platform for training and testing RL algorithms for autonomous vehicles on the Apollo platform and AWS.

**Research Assistant**, Dynamic Systems Control Laboratory, UM-SJTU Joint Institute

Supervisor: Prof. Chengbin Ma

*Sep. 2015 - Mar. 2018*

Key areas: game theory, optimization, microgrid energy management, electric vehicle

- Developed a flexible energy management approach to handle weather and sizing uncertainties in isolated microgrids.
- Designed and fabricated high-efficiency bidirectional DC/DC converters for energy management validation in a downsized system.
- Built a hardware testbed to study reconfigurable energy systems.

**Team Leader**, Nippon Chemi-Con Corporation Japan

*Dec. 2016 - Apr. 2017*

Enhanced the energy management approach of a hybrid energy storage system in a novel topology, improving system efficiency without special alternators like MAZDA i-ELoop.

**Team Leader**, National Undergraduate Training Programs for Innovation and Entrepreneurship

*May 2013 - Dec. 2014*

Integrated a camera and structured light to model a feather in 3D, successfully extracting feather strokes using image processing methods like Hough transform.

## Publications

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### Journal Publications

- [1] Sanbao Su, **Songyang Han**, Yiming Li, Zhili Zhang, Chen Feng, Caiwen Ding, Fei Miao. *Collaborative Multi-Object Tracking with Conformal Uncertainty Propagation*. In IEEE Robotics and Automation Letters (RA-L), January 2024.
- [2] **Songyang Han**, Sanbao Su, Sihong He, Shuo Han, Haizhao Wang, Fei Miao. *What is the Solution for State-Adversarial Multi-Agent Reinforcement Learning?* In Transactions on Machine Learning Research (TMLR), January 2024.
- [3] **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, December 2023.

- [4] 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.
- [5] 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.
- [6] 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.
- [7] **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.
- [8] 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.

### Preprints

- [1] Jiangwei Wang, Shuo Yang, Ziyang An, **Songyang Han**, Zhili Zhang, Rahul Mangharam, Meiyi Ma, Fei Miao. *Multi-Agent Reinforcement Learning Guided by Signal Temporal Logic Specifications*. (Under review, available on arXiv:2306.06808)
- [2] Lizhi Wang, Lynn Pepin, Jiangwei Wang, **Songyang Han**, Pranav Pishawikar, Amir Herzberg, Peng Zhang, Fei Miao. *Botnets breaking transformers: Localization of power botnet attacks against the distribution grid*. (Under review, available on arXiv: 2203.10158, 2022)
- [3] **Songyang Han**, Apaar Sadhwani, Tushar Agarwal, Hamid Badiozamani, Tiago Etienne, Jing Zhu, Aarthi Raveendran, William Smart. *Real-time Human Presence Estimation For Indoor Robots*. (Under review)

### Conference Publications

- [1] **Songyang Han**, Sanbao Su, Sihong He, Shuo Han, Haizhao Wang, Fei Miao. *What is the Solution for State-Adversarial Multi-Agent Reinforcement Learning?* In the Frontiers4LCD Workshop at the International Conference on Machine Learning (ICML), 2023, Hawaii, USA, July 2023.
- [2] 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.
- [3] **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**)
- [4] 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), London, UK, May 2023.
- [5] 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), London, UK, May 2023.
- [6] 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.

- [7] **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.
- [8] 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**)
- [9] **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.
- [10] 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.
- [11] 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.
- [12] **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.
- [13] 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.
- [14] **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

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- **Programming:** Python, C/C++, MATLAB, LabVIEW, SQL
- **Tools:** Pytorch, LaTeX, Linux, Git, CARLA, NI myRIO, NI CompactRIO, Arduino, PIC, Altium Designer, Multisim, AutoCAD

## Honors & Awards

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- Predoctoral Research Fellowship, University of Connecticut, May 2023
- **Best Paper Award**, DCAA workshop, 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, Consortium for Mathematics and Its Applications, May 2014
- Outstanding Students of Nanjing University (2 times), Nanjing University, Nov. 2012-Nov. 2013

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## Service Experience

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### Reviewer

- IEEE Transactions on Industrial Informatics
- IEEE Transactions on Neural Networks and Learning Systems
- IEEE Transactions on Automation Science and Engineering
- IEEE Transactions on Cybernetics
- IEEE Transactions on Artificial Intelligence
- 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)
- 2024 IEEE International Conference on Robotics and Automation (ICRA 2024)
- 2024 Conference on Neural Information Processing Systems (NeurIPS 2024)
- 2025 IEEE International Conference on Robotics and Automation (ICRA 2025)

### Program Committee

- The 38th Annual AAAI Conference on Artificial Intelligence (AAAI 2024)

### Invited Talks

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