Jianhong Wang

PERSONAL DETAILS

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EDUCATION

Imperial College London, UK *2019.01-2023.01*

Ph.D. in Electrical and Electronic Engineering Research

Thesis title: *Shapley Value Based Multi-Agent Reinforcement Learning: Theory, Method and Its Application to Energy Network*

Scholarship Provider: *The Engineering and Physical Sciences Research Council of UK under awards EP/S000909/1*

Supervisors: *Dr. Yunjie Gu, Prof. Tim C. Green (FREng, FIEEE), Prof. Tae-Kyun Kim*

University College London, UK *2017.09-2018.09*

M.Res. in Web Science and Big Data Analytics

Supervisor: *Prof. Jun Wang*

Grade: *Distinction* degree

Imperial College London, UK *2016.09-2017.09*

M.Sc. in Computing (Machine Learning)

Supervisor: *Prof. Bjoern Schuller (FIEEE)*

Grade: *Merit* degree

University of Liverpool, UK *2012.09-2016.07*

B.Eng. in Computer Science and Electronic Engineering

Supervisors: *Prof. Danushka Bollegala, Prof. Karl Tuyls*

Grade: *First-class honours* degree

PROFESSIONAL MEMBERSHIP

- **Member of the *European Lab for Learning and Intelligent Systems* (ELLIS)**, endorsed by *Prof. Frans A. Oliehoek (ELLIS Scholar)* and *Prof. Aleksei Tiulpin (ELLIS Member)*.
- **Member of the *Institute of Electrical and Electronics Engineers* (IEEE)**.

RESEARCH INTERESTS

- **Multi-Agent Reinforcement Learning:** Designing multi-agent learning algorithms grounded in game theory.
- **Ad Hoc Teamwork:** Investigating how an agent makes decisions to collaborate on the fly with unknown teammates, from the theoretical perspective.
- **Machine Learning for Real-World Problems:** Applying reinforcement learning, game-theoretical models and end-to-end learning, to solve robotics, smart grids, energy markets, dialogue systems, etc.

WORKING EXPERIENCE

University of Bristol *2024.09-Present*

Senior Research Associate

Responsibility: Investigating trustworthy and resilient distributed AI (multi-agent systems), working with *Prof. Jonathan Lawry*.

University of Manchester *2023.02-2024.09*

Postdoctoral Research Associate

Responsibility: Investigating Ad Hoc Teamwork, Human-AI Interaction and Reinforcement Learning in *Center for AI Fundamentals*, working with *Prof. Samuel Kaski (ELLIS Fellow)*.

Imperial College London *2021.09-2022.05*

Graduate Teaching Assistant

Responsibility: Working as a Graduate Teaching Assistant for an undergraduate course *ELEC60019 Machine Learning* and a graduate course *ELEC60009 Deep Learning*.

Huawei London Research Center *2020.11-2021.03*

Part-Time Research Internship

Responsibility: Investigating the switching control mechanism for reward shaping in reinforcement learning. A reward-shaping framework is proposed, where the shaping-reward function is constructed in a Markov game between two agents. A reward-shaping agent (shaper) employed switching controls to determine which states to add shaping rewards to the original rewards for more efficient learning, while another agent (controller) learned the optimal policy for a task using the integrated rewards. This framework is also extended to the scenarios involving multiple agents (decentralised controllers).

SELECTED PUBLICATIONS

1. **Jianhong Wang**, Yang Li, Yuan Zhang, Wei Pan, and Samuel Kaski. "Open Ad Hoc Teamwork with Cooperative Game Theory." In International Conference on Machine Learning, pp. 50902-50930. PMLR, 2024.

2. **Jianhong Wang**, Yuan Zhang, Yunjie Gu, and Tae-Kyun Kim. "Shaq: Incorporating shapley value theory into multi-agent q-learning." Advances in Neural Information Processing Systems 35 (2022): 5941-5954.

3. **Jianhong Wang**, Wangkun Xu, Yunjie Gu, Wenbin Song, and Tim C. Green. "Multi-agent reinforcement learning for active voltage control on power distribution networks." Advances in Neural Information Processing Systems 34 (2021): 3271-3284.

4. **Jianhong Wang**, Yuan Zhang, Tae-Kyun Kim, and Yunjie Gu. "Modelling Hierarchical Structure between Dialogue Policy and Natural Language Generator with Option Framework for Task-oriented Dialogue System." In International Conference on Learning Representations. 2021.

5. **Jianhong Wang**, Yuan Zhang, Tae-Kyun Kim, and Yunjie Gu. "Shapley Q-value: A local reward approach to solve global reward games." In Proceedings of the AAAI Conference on Artificial Intelligence, vol. 34, no. 05, pp. 7285-7292. 2020. [**Oral**]

6. Wangkun Xu, **Jianhong Wang**, and Fei Teng. "E2E-AT: A Unified Framework for Tackling Uncertainty in Task-Aware End-to-End Learning." In Proceedings of the AAAI Conference on Artificial Intelligence, vol. 38, no. 14, pp. 16220-16227. 2024.

7. Yuan Zhang, **Jianhong Wang**, and Joschka Boedecker. "Robust reinforcement learning in continuous control tasks with uncertainty set regularization." In Conference on Robot Learning, pp. 1400-1424. PMLR, 2023.

8. Dawei Qiu, **Jianhong Wang**, Zihang Dong, Yi Wang, and Goran Strbac. "Mean-field multi-agent reinforcement learning for peer-to-peer multi-energy trading." IEEE Transactions on Power Systems (2022).

9. Mingrui Zhang, **Jianhong Wang**, James B. Tlhomole, and Matthew Piggott. "Learning to Estimate and Refine Fluid Motion with Physical Dynamics." In International Conference on Machine Learning, pp. 26575-26590. PMLR, 2022. [**Spotlight**]

10. Dawei Qiu, **Jianhong Wang**, Junkai Wang, and Goran Strbac. "Multi-Agent Reinforcement Learning for Automated Peer-to-Peer Energy Trading in Double-Side Auction Market." In IJCAI, pp. 2913-2920. 2021.

11. Rui Luo, **Jianhong Wang**, Yaodong Yang, Jun Wang, and Zhanxing Zhu. "Thermostat-assisted continuously-tempered Hamiltonian Monte Carlo for Bayesian learning." Advances in Neural Information Processing Systems 31 (2018).

12. Yang Li, Wenhao Zhang, **Jianhong Wang**, Shao Zhang, Yali Du, Ying Wen and Wei Pan. "Aligning Individual and Collective Objectives in Multi-Agent Cooperation." Advances in Neural Information Processing Systems 37 (2024).

13. Yuan Zhang, Umashankar Deekshith, **Jianhong Wang** and Joschka Boedecker. "Improving the Efficiency and Efficacy of Multi-Agent Reinforcement Learning on Complex Railway Networks with a Local-Critic Approach." In Proceedings of the International Conference on Automated Planning and Scheduling. 2024, 34: 698-706.

14. David Mguni, Taher Jafferjee, **Jianhong Wang**, Nicolas Perez-Nieves, Wenbin Song, Feifei Tong, Matthew Taylor et al. "Learning to shape rewards using a game of two partners." In Proceedings of the AAAI Conference on Artificial Intelligence, vol. 37, no. 10, pp. 11604-11612. 2023.

15. Dawei Qiu, Yi Wang, **Jianhong Wang**, Ning Zhang, Goran Strbac, and Chongqing Kang. "Resilience-Oriented Coordination of Networked Microgrids: a Shapley Q-Value Learning Approach." IEEE Transactions on Power Systems (2023).

16. Wangkun Xu, Martin Higgins, **Jianhong Wang**, Imad M. Jaimoukha, and Fei Teng. "Blending data and physics against false data injection attack: An event-triggered moving target defence approach." IEEE Transactions on Smart Grid (2022).

17. David Mguni, Taher Jafferjee, **Jianhong Wang**, Nicolas Perez-Nieves, Oliver Slumbers, Feifei Tong, Yang Li, Jiangcheng Zhu, Yaodong Yang, and Jun Wang. "LIGS: Learnable Intrinsic-Reward Generation Selection for Multi-Agent Learning." In International Conference on Learning Representations. 2021.

18. David Mguni, Haojun Chen, Taher Jafferjee, **Jianhong Wang**, Longfei Yue, Xidong Feng, Stephen Marcus Mcaleer, Feifei Tong, Jun Wang, and Yaodong Yang. "MANSA: learning fast and slow in multi-agent systems." In International Conference on Machine Learning, pp. 24631-24658. PMLR, 2023.

19. Dawei Qiu, Juxing Xue, Tingqi Zhang, **Jianhong Wang**, and Mingyang Sun. "Federated reinforcement learning for smart building joint peer-to-peer energy and carbon allowance trading." Applied Energy 333 (2023): 120526.

20. Mengyue Yang, Yonggang Zhang, Zhen Fang, Yali Du, Furui Liu, Jean-Francois Ton, **Jianhong Wang**, and Jun Wang. "Invariant learning via probability of sufficient and necessary causes." Advances in Neural Information Processing Systems 36 (2024). [**Spotlight**]

ACADEMIC SERVICES

Working as a PC member of AAAI-2025
Responsible for reviewing papers in my research areas.

Working as a PC member of ECAI-2024
Responsible for reviewing papers in my research areas.

Working as a technical reviewer of RLC-2024
This is an innovative venue launched in 2024, focusing on the research in reinforcement learning.

Working as reviewers for the following top-tier AI conferences
NeurIPS, ICML, ICLR, AISTATS, etc.

Working as reviewers for the following journals

- IEEE Transactions on Pattern Analysis and Machine Intelligence
- IEEE Transactions on Smart Grid
- IEEE Transactions on Power Systems
- IEEE Transactions on Emerging Topics in Computational Intelligence

ACADEMIC ACTIVITIES

Organizing a workshop called *Coordination and Cooperation in Multi-Agent Reinforcement Learning* (CoCoMARL) at Reinforcement Learning Conference (RLC) 2024 *2024.08*

Aim and Scope: This workshop aims to promote the advancement of cooperative and coordinated multi-agent reinforcement learning in both theory and real-world applications (e.g. swarm robotics, traffic management, etc.). To achieve the goal, this workshop is constituted of paper submissions, invited talks and panel discussions.

Member of the organizing committee (`https://sites.google.com/view/cocomarl-2024/home`).

UNIVERSITY ADMINISTRATIVE WORK

Working for recruiting PhD students (University of Manchester)

- Reviewing and sifting the applicants' resumes.
- Responsible for the first-stage interview as a principal interview panel member.
- Responsible for the second-stage review.

Managing the research group (University of Manchester)

- Operating a Slack group for sharing research information.
- Mentoring PhD students.

SOFTWARE CONTRIBUTIONS

- **MAPDN** (`https://github.com/Future-Power-Networks/MAPDN`): An open-source environment for multi-agent active voltage control on power distribution networks and the paper titled "Multi-Agent Reinforcement Learning for Active Voltage Control on Power Distribution Networks." [**195 stars**]
- **SQDDPG** (`https://github.com/hsvgbkhgbv/SQDDPG`): A framework for the research on multi-agent reinforcement learning and the implementation of the experiments in the paper titled by "Shapley Q-value: A Local Reward Approach to Solve Global Reward Games." [**111 stars**].
- **Shapley-Q-Learning** (`https://github.com/hsvgbkhgbv/shapley-q-learning`): An implementation based on PyMARL and JaxMARL for the paper titled "SHAQ: Incorporating Shapley Value Theory into Multi-Agent Q-Learning." [**40 stars**].

RESEARCH PROJECTS

EPSRC AI hubs: Information theory for distributed AI (INFORMED-AI) *2023.09 - Present*

Supported by Engineering and Physical Sciences Research Council (EPSRC)

Team Member: Investigating how to develop trustworthy and resilient multi-agent systems.

Turing AI World-Leading Researcher Fellowship: Human-AI Research Teams - Steering AI in Experimental Design and Decision-Making *2023.02 - 2023.09*

Supported by UK Research & Innovation (UKRI)

Team Member: Investigating how an agent makes decision to collaborate with other unknown agents.

SKILLS

Languages	Mandarin Chinese (Native), English (Proficient)
Programming	Python, Pytorch, Bash Script, Jax

REFEREES

- **Prof. Samuel Kaski** (`samuel.kaski@manchester.ac.uk`), University of Manchester / Aalto University, Full Professor, my line manager at the University of Manchester
- **Prof. Jun Wang** (`jun.wang@cs.ucl.ac.uk`), University College London (UCL), Full Professor, my master supervisor and present research collaborator
- **Prof. Tae-Kyun Kim** (`kimtaekyun@kaist.ac.kr`), Korea Advanced Institute of Science and Technology (KAIST) / Imperial College London, Full Professor, my PhD co-supervisor
- **Dr. Yunjie Gu** (`yunjie.gu@imperial.ac.uk`), Imperial College London, Assistant Professor, my PhD supervisor
- **Dr. David Mguni** (`d.mguni@qmul.ac.uk`), Queen Mary University of London, Assistant Professor, my present research collaborator