

# Tianyu Ren

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## RESEARCH STATEMENT

I am currently pursuing a PhD in Machine Learning, specializing in multi-agent reinforcement learning and its application to evolutionary game theory. My research focuses on applying multi-agent learning frameworks to explore the emergence of cooperative behaviours and interaction dynamics within groups. I aim to model these evolutionary dynamics to better reflect real-world phenomena. Ultimately, my goal is to uncover how cooperative strategies develop and stabilize across varied environments.

## EDUCATION

### University of Manchester

PhD student in Computer Science

Manchester, U.K.

Supervised by Prof. Xiao-Jun Zeng; Sep 2022 – present

### Wuhan University

M.Sc. in Management Science and Engineering

Wuhan, China

Supervised by Prof. Junjun Zheng; Sep 2019 – Jun 2022

### Wuhan University of Technology

B.Sc. in Management Information Systems

Wuhan, China

Sep 2015 – Jun 2019

## AWARDS

Outstanding Graduate Student Award (Top 5%)

Wuhan University, 2022

China National Scholarship for Graduate Student (Top 1%)

Ministry of Education (China), 2021

Horizon Scholarship for Graduate Student (Top 1%)

Beijing Horizon Charity Foundation, 2021

First Place Academic Scholarship

Wuhan University, 2021

Outstanding Undergraduate Student Award

Wuhan University of Technology, 2019

Merit Undergraduate Student (Top 5%)

Wuhan University of Technology, 2018

## PUBLICATIONS

- M. Zhang, T. Ren\*, X.J. Zeng and J. Li. “Promoting Cooperation through Dynamic Trustworthiness in Spatial Public Goods Games.” accepted by *Applied Mathematics and Computation*. (2024).
- Y. He, T. Ren\*, X.J. Zeng, H. Liang, L. Yu and J. Zheng. “Temporal Interaction and its Role in the Evolution of Cooperation.” Under Review. (2024).
- T. Ren\* and X.J. Zeng. “Enhancing Cooperation through Selective Interaction and Long-term Experiences in Multi-Agent Reinforcement Learning.” *International Joint Conference on Artificial Intelligence (IJCAI)*. Jeju, Korea (2024).
- T. Ren and X.J. Zeng\*. “Reputation-based Interaction Promotes Cooperation with Reinforcement Learning.” *IEEE Transactions on Evolutionary Computation*. Early Access (2023).
- Y. Huang, T. Ren\*, J. Zheng, W. Liu and M. Zhang. “Evolution of Cooperation in Public Goods Games with Dynamic Resource Allocation: A Fairness Preference Perspective.” *Applied Mathematics and Computation*. 445 (2023): 127844.
- S. Zhuo, J. Liu, T. Ren\* and J. Sun. “Evolution Dynamics with the Switching Strategy of Punishment and Expulsion in the Spatial Public Goods Game.” *New Journal of Physics* 24.12 (2022): 123020.
- J. Zheng, Y. He, T. Ren\* and Y. Huang. “Evolution of Cooperation in Public Goods Games with Segregated Networks and Periodic Invasion.” *Physica A: Statistical Mechanics and its Applications* 596 (2022): 127101.
- G. Ma, T. Ren\*, J. Zheng, T. Ding and J. Liu. “Incentive strategy models of household waste separation based on cost uncertainties: A perspective of social networks.” *Journal of Cleaner Production* 363 (2022): 132429. *Physica A: Statistical Mechanics and its Applications* 596 (2022): 127101.
- K. Zhou and T. Ren\*. “Low-carbon Technology Collaborative Innovation in Industrial Cluster with Social Exclusion: An Evolutionary Game Theory Perspective.” *Chaos: An Interdisciplinary Journal of Nonlinear Science* 31, 3 (2021).
- J. Zheng\*, J. Dong and T. Ren. “A Stochastic Differential Cooperative Game Model Based on the Third-party Governance of Environmental Pollution.” *Journal of Management Science in China* 24, 7 (2021): 76-93.
- J. Zheng, T. Ren\*, G. Ma and J. Dong. “The emergence and implementation of pool exclusion in spatial public goods game with heterogeneous ability-to-pay.” *Applied Mathematics and Computation* 394 (2021): 125835.
- T. Ren\* and J. Zheng. “Evolutionary Dynamics in the Spatial Public Goods Game with Tolerance-based Expulsion and Cooperation.” *Chaos, Solitons & Fractals* 151 (2021): 111241.

## RESEARCH AND WORK EXPERIENCE

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### University of Manchester

Manchester, U.K.

*Teaching Assistant*

*Sep 2022 – Present*

- COMP34812 Natural Language Understanding: 2022-2023 Summer Preparation, 2023-2024 2nd Semester and Summer Preparation with Riza Batista-Navarro.
- COMP23412 Software Engineering II: 2023-2024 2nd Semester with Markel Vigo.
- COMP60711 Data Engineering: 2023-2024 1st Semester with Sandra Sampaio and John Keane.
- COMP16412 Introduction to Programming II: 2022-2023 2nd Semester with Markel Vigo and Terry Morley.

### University of Manchester

Manchester, U.K.

*PGR Mentor*

*Apr 2023 – Present*

- Collaborate with the PGR Mentor Team. Actively engage in planning, managing, and coordinating routine social activities for Postgraduate Research students within the Department of Computing Science.
- Serve as a liaison to department management, articulating and advocating the needs and requests of Postgraduate Research students.

### National Natural Science Foundation of China Fund Project

Wuhan University, China

*Main Participant | Participant*

*Mar 2019 – Dec 2022*

- Contributed to the research project "Experimental Research and Complexity Analysis of Group Selection Behavior" (Project No. 71771181). Leveraged funding from this project to publish five academic papers as the first author or corresponding author.
- Participated in the research project "Group Selection Behavior Based on Behavioral Experiment and Stochastic Differential Game" (Project No. 72171180). Utilized funding from this project to publish four academic papers as the first author or corresponding author.

### The Logistics Support Department in Wuhan University of Technology

Wuhan, China

*Program Manager Intern*

*May 2019 – Sep 2022*

- Organized a small development team to design and develop two new management information systems to streamline staff housing and maintenance services at the university. The systems manage information for over 2,000 housing units and serve more than 8,000 faculty and staff members.
- Managed a budget of 280,000 Yuan and secured software copyright registration. Following the successful completion of the first development phase, the department initiated a second phase for continued enhancements.

### Pinggao Electric Company Limited

Henan, China

*Business Analyst Intern*

*Oct 2020 – Apr 2021*

- Utilized empirical and machine learning methods to analyze user electricity consumption data, organized, and generated data analysis reports for decision-making support for the competent authorities.
- Participated in the full lifecycle management of the company's assets, primarily focusing on analyzing the residual value of equipment.

## SERVICE TO PROFESSION

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- IEEE Transactions on Evolutionary Computation (2023), Reviewer
- Journal of Intelligent & Fuzzy Systems (2023), Reviewer
- PLOS One (2022, 2023), Guest Editor, Reviewer

## PROJECTS

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### CNKI spider | [GitHub](#), 490+ Stars

- Developed a Python-based spider for CNKI to optimize the efficiency of literature search and download. This project eliminates the need to switch between pages to view document abstracts by automating the retrieval process. It efficiently fetches document previews and downloads from search results, enhancing user experience and interaction with CNKI's web interface.

### MOOC download | [GitHub](#), 80+ Stars

- A Python-based spider developed to automate the downloading of video lectures and files from Chinese MOOC platforms, particularly targeting poor user interfaces and streaming issues encountered on existing platforms. The spider leverages the requests and regex libraries to handle dynamic web content, scrape necessary data, and streamline the process of accessing educational content effectively.