

Siyue Ren

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Research Interests

My research interests span a spectrum of **social norms**, **multi-agent systems (MASs)**, **large language models (LLMs)**, and **game theory**.

I am interested in advancing cooperative AI in the era of LLMs by addressing key challenges in LLM-based MASs. Specifically, my research draws on foundational mechanisms and principles from MASs and game theory, and operationalizes them into LLM-based agents capable of exhibiting cooperative intelligence.

Education and Working Experience

Northwestern Polytechnical University (NWPU) Sep 2022 – Present
Ph.D. Candidate

- **Thesis Title:** Emergence and Evolution of Social Norms in MASs
- **Advisor:** [Zhen Wang](#) and [Shuyue Hu](#)

Shanghai Artificial Intelligence Laboratory Aug 2024 – Mar 2026
Research intern

- **Advisor:** [Shuyue Hu](#)

Northwestern Polytechnical University Sep 2018 – Jun 2022
B.Sc. in the School of Automation

Publications & Preprints

Emergence of Social Norms in Generative Agent Societies: Principles and Architecture

Siyue Ren, Zhiyao Cui, Ruiqi Song, Zhen Wang, and Shuyue Hu.

- *Conference version accepted on HAI track (acceptance rate: 4%) of IJCAI 2024 ([Paper link](#))*
- *Journal version submitted to Artificial Intelligence, Major Revision*

Social norms are essential for coordinating behavior and reducing conflicts in MASs, yet current LLM-based MASs lack normative understanding and exhibit human-like social conflicts. To address this, we propose *CRSEC*, the first architecture that enables the emergence of social norms in LLM-based MASs through four modules: **Creation & Representation, Spreading, Evaluation, and Compliance**. Experiments in a sandbox environment show that *CRSEC* empowers agents to foster norm and reduce social conflicts among LLM agents.

Reputation as a Solution to Cooperation Collapse in LLM-based MASs

Siyue Ren, Wanli Fu, Xinkun Zou, Chen Shen, Yi Cai, Chen Chu, Zhen Wang, and Shuyue Hu.

- *Conference version accepted on AAMAS 2026, and nominated as **AAMAS best student paper**. ([Paper link](#))*
- *Journal version submitted to SCIENCE CHINA: information sciences.*

Cooperation is fundamental to both human societies and AI systems, yet recent studies show that LLM-based MASs often suffer from *cooperation collapse*. To address this, we propose *RepuNet*, a dynamic dual-level reputation framework that models both **agent-level reputation dynamics** and **system-level network evolution**. Experiments across diverse scenarios demonstrate that *RepuNet* effectively prevents cooperation collapse and fosters sustained collaboration, giving rise to rich emergent behaviors such as cooperative clustering, isolation of exploitative agents, and positive gossip propagation.

Emergence of Machine Language in LLM-based Agent Communication

Xinkun Zou, [Siyue Ren](#), Yang Chen, Zhen Wang, Shuyue Hu.

- *Preprint* ([Paper link](#))

Language emergence is a hallmark of human intelligence and a key test for artificial intelligence. We investigate whether LLM agents can develop their own, possibly non-human language through *referential games*. By designing agents that retrieve semantically related words for message generation and interpret meaning through structural similarity, we find that **LLM agents rapidly form a shared, compositional machine language** exhibiting key properties of human language such as generalization, morphemes, and polysemy.

An AI researchers' perspective: At the crossroad of LLMs, agent-based modeling, and complex systems: Comment on "LLMs and generative agent-based models for complex systems research" by Y. Lu et al

[Siyue Ren](#), Ziyue Gan, Zhenfei Yin, Jing Shao, and Shuyue Hu.

- *Comment on Physics of Life Reviews* ([Paper link](#))

LLMs open new possibilities for agent-based modeling (ABM) and complex systems by combining language understanding with reasoning and interaction capabilities. Building on a comprehensive review by Lu et al., we examine how LLMs can both advance the study of ABM and complex systems, and benefit from ABM principles to improve their own robustness and adaptability. Our comment outlines this emerging interdisciplinary frontier, highlighting key opportunities and challenges for integrating LLMs with complex systems research.

PerPilot: Personalizing VLM-based Mobile Agents via Memory and Exploration

Xin Wang, Zhiyao Cui, Hao Li, Ya Zeng, Chenxu Wang, Ruiqi Song, Yihang Chen, Kun Shao, Qiaosheng Zhang, Jinzhuo Liu, [Siyue Ren](#), Shuyue Hu, and Zhen Wang.

- *Preprint. arXiv: 2508.18040 [cs.AI]* ([Paper link](#))

A Comprehensive Survey of LLM-Driven Collective Intelligence: Past, Present, and Future

Peng Ye, Yichen Jiang, Suorong Yang, SHengji Tang, Shenghe Zheng, Jianjian Cao, [Siyue Ren](#), Zhihao Dou, Weida Wang, Haonan He, Hao Li, Zhiyao Cui, Zhijie Zhong, Mengsong Wu, Shufei Zhang, Dongzhan Zhou, Bo Zhang, Shuyue Hu, Tao Chen, Wenjun Wu, Wanli Ouyang, Lei Bai.

- *Preprint. DOI: 10.13140/RG.2.2.24421.26087* ([Paper link](#))

Awards & Honors

NWPU Scholarship <i>Second Prize</i>	<i>2023-2025</i>
NWPU Scholarship <i>First Prize</i>	<i>2022-2023</i>
Outstanding graduates of NWPU <i>30 selected among 297 candidates</i>	<i>2022</i>

Academic Services

Subreviewer for Conferences:

- International Joint Conference on Artificial Intelligence (IJCAI) *Since 2024*
- International Conference on Autonomous Agents and Multiagent Systems (AAMAS) *Since 2024*
- Annual AAAI Conference on Artificial Intelligence (AAAI) *Since 2024*
- European Conference on Artificial Intelligence (ECAI) *2025*
- Distributed AI (DAI) *2025*
- The Pacific Rim International Conference on Artificial Intelligence (PRICAI) *2023*

Subreviewer for Journals:

- Humanities and Social Sciences Communications *Since 2025*