Heng Dong

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Education

- **Tsinghua University (THU)** Beijing, China
  Ph.D. student majoring in Artificial Intelligence *Sep. 2020 - Jun. 2025*

- **University of Science and Technology of China (USTC)** Hefei, China
  B.S. majoring in Computer Science and Technology *Sep. 2016 - Jun. 2020*

Research Area

The goal of my research is to endow agents with superhuman intelligence, which I believe can be achieved through *learning from interactions* using *modern models*. Toward this goal, my previous research mainly focused on

- **Learning from Interactions** RL, Robot Control & Design, Multi-Agent
- **Modern Models** Large Language Models, Diffusion Models, Flow Models

Publications and Preprints

Modern Models (Large Language Models, Diffusion Models, Flow Models)

[1] Huang Fang*, Mengxi Zhang*, **Heng Dong***, Wei Li*, Zixuan Wang, Qifeng Zhang, Xueyun Tian, Yucheng Hu, Hang Li. "Robix: A Unified Model for Robot Interaction, Reasoning and Planning". *Technical Report* (2025).

[2] **Heng Dong***, Kefei Duan*, Chongjie Zhang. "Enhancing Decision-Making of Large Language Models via Actor-Critic". *Forty-Second International Conference on Machine Learning* (ICML 2025).

[3] Tonghan Wang*, **Heng Dong***, Yanchen Jiang, David C. Parkes, Milind Tambe. "On Diffusion Models for Multi-Agent Partial Observability: Shared Attractors, Error Bounds, and Composite Flow". *Proc. of the 24th International Conference on Autonomous Agents and Multiagent Systems* (AAMAS 2025).

[4] Xinyi Yang, Liang Zeng, **Heng Dong**, Chao Yu, Xiaoran Wu, Huazhong Yang, Yu Wang, Milind Tambe, Tonghan Wang. "Policy-to-Language: Train LLMs to Explain Decisions with Flow-Matching Generated Rewards". *arXiv preprint* (2025).

Learning from Interactions (Robot Design, Robot Control, Multi-Agent RL)

[5] **Heng Dong***, Junyu Zhang*, Chongjie Zhang. "Leveraging Hyperbolic Embeddings for Coarse-to-Fine Robot Design". In *The Twelfth International Conference on Learning Representations* (ICLR 2024).

[6] **Heng Dong**, Junyu Zhang, Tonghan Wang, Chongjie Zhang. "Symmetry-Aware Robot Design with Structured Subgroups". In *Fortieth International Conference on Machine Learning* (ICML 2023).

[7] **Heng Dong**, Tonghan Wang, Jiayuan Liu, Chongjie Zhang. "Low-Rank Modular Reinforcement Learning via Muscle Synergy". In *Thirty-sixth Conference on Neural Information Processing Systems* (NeurIPS 2022).

[8] **Heng Dong***, Tonghan Wang*, Jiayuan Liu, Chi Han, Chongjie Zhang. "Birds of a Feather Flock Together: A Close Look at Cooperation Emergence via Multi-Agent RL." *arXiv preprint* (2021).

[9] Yihan Wang*, Beining Han*, Tonghan Wang*, **Heng Dong**, Chongjie Zhang. "DOP: Off-Policy Multi-Agent Decomposed Policy Gradients". In *Ninth International Conference on Learning Representations* (ICLR 2021).

[10] Tonghan Wang, **Heng Dong**, Victor Lesser, Chongjie Zhang. "ROMA: Multi-Agent Reinforcement Learning with Emergent Roles". In *Thirty-seventh International Conference on Machine Learning* (ICML 2020).

Selected Research Projects

Enhancing Decision-Making of Large Language Models Project Leader (2024)

- A novel LLM-based Actor-Critic framework that enhances LLMs' decision-making through long-term action evaluations and efficient policy improvements
- **Contribution:** The obtained algorithm can dramatically improve the decision-making ability with a small amount of data, alleviating the decision-making problem of robots in the open world, and even surpassing the GPT-4 in some of the household tasks.
- **Published Paper:** "Enhancing Decision-Making of Large Language Models via Actor-Critic" (see LAC).

Automatic Robot Design for Various Tasks Project Leader (2022-2023)

- Mimicking natural evolution to rapidly design efficient robots to solve different tasks.
- **Contribution:** Deeply practiced in the field and designed efficient algorithms that can be used in rigid and soft body robots, respectively. The designed robots are more accessible to the control algorithms and are better able to accomplish the assigned tasks.
- **Published Paper:** 1. "Leveraging Hyperbolic Embeddings for Coarse-to-Fine Robot Design" (see HERD); 2. "Symmetry-Aware Robot Design with Structured Subgroups" (see SARD).

Low-Rank Robot Control Learnng Project Leader (2021)

- An efficient modeling structure is proposed to uniformly control morphologically inconsistent robots.
- **Contribution:** Inspired by the principle of muscle synergy in human control of limbs, a network structure is designed to be able to simultaneously control robots of different morphologies while handling higher degrees of freedom control problems.
- **Published Paper:** "Low-Rank Modular Reinforcement Learning via Muscle Synergy" (see SOLAR).

Honors and Awards

- Tsinghua Friends - Ubiquant Excellence Scholarship *Sep. 2024*
- Interdisciplinary Information Institute Scholarship *Sep. 2023, Sep. 2022*
- Huiyan Scholarship of Excellence *Sep. 2021*
- Outstanding Undergraduate Thesis Award *Jun. 2020*
- Scholarship for HUA Xia Talent Program (top 30) *Aug. 2017* *Jul. 2020*
- Scholarship for Excellent student *Oct. 2016, Oct. 2017, Oct. 2018*

Research Experience

Modern Models: Diffusion Models and Flow Models Harvard University (remote)
Cooperation *Aug. 2024 - May 2025*

- Supervisor: Prof. Milind Tambe and Prof. David C. Parke
- Diffusion Models, Rectified Flow for Explainable LLMs

Learning from Interactions & Modern Models Tsinghua University, Beijing, China
Ph.D. Student *Sep. 2020 - Jun. 2025*

- Supervisor: Prof. Chongjie Zhang and Prof. Yi Wu
- Reinforcement Learning, Large Language Model, Robot Design, Multi-Agent

Multi-Agent: Role-Based, Self-Interested Tsinghua University, Beijing, China
Intern *Sep. 2019 - Jul. 2020*

- Supervisor: Prof. Chongjie Zhang
- Role-Oriented Multi-Agent Systems, Self-Interested Agents

Knowledge Graph of Intelligent Healthcare USTC, Hefei, China
Lab Research Work *Sep. 2018 - Jun. 2019*

- Supervisor: Prof. Tong Xu
- Intelligent Healthcare based on Knowledge Graph from electronic medical records

Professional Services

Reviewer

- Annual Conference on Neural Information Processing Systems (NeurIPS) *2022 - Present*
- International Conference on Machine Learning (ICML) *2022 - Present*
- International Conference on Learning Representations (ICLR) *2022 - Present*
- Association for the Advancement of Artificial Intelligence (AAAI) *2025 - Present*

Teaching Assistant

- Artificial Intelligence: Principles and Techniques (Tsinghua, IIIS) *Fall, 2021*
- Reinforcement Learning (Tsinghua, IIIS) *Spring, 2022*

Engineering Skills

- **Programming Languages** Python, C, Wolfram
- **OS** Linux (Ubuntu, Deepin, OpenSUSE), MacOS, Windows
- **Frameworks** PyTorch, Transformers, Numpy, Matplotlib, Plotly, Git