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*

Skills

- **AI** Reinforcement Learning, Robotics, Large Language Models, Diffusion, Multi-Agent
- **Programming Languages** Python, C, Wolfram
- **OS** Linux (Ubuntu, Deepin, OpenSUSE), MacOS, Windows
- **Frameworks** PyTorch, Numpy, Matplotlib, Plotly, Git
- **Languages** Chinese, English

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 focuses on

- **Learning from Interactions** Reinforcement Learning, Robot Design, Multi-Agent
- **Modern Models** Large Language Models, Diffusion Models

Selected Research Projects

- **Enhancing Decision-Making of Large Language Models** Project Leader (2024)
  - Improving Decision Making in Large Language Models Using Ideas from the Actor-Critic Algorithm in Reinforcement Learning.
  - **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.
  - **Related Paper:** "Enhancing Decision-Making of Large Language Models via Actor-Critic"
  - **Project Link:** https://sites.google.com/view/lang-ac
  - **Ability:** LLM fine-tuning, LLM agent construction

- **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.
  - **Related Paper:** 1. "Leveraging Hyperbolic Embeddings for Coarse-to-Fine Robot Design"; 2. "Symmetry-Aware Robot Design with Structured Subgroups"

- **Project Link**1. https://sites.google.com/view/hyperbolic-robot-design; 2. https://sites.google.com/view/robot-design
  - **Ability:** algorithm design, idea rapid iteration and implementation
- **Robot Control**   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.
  - **Related Paper:** "Low-Rank Modular Reinforcement Learning via Muscle Synergy"
  - **Project Link:** https://sites.google.com/view/synergy-rl
  - **Ability:** collaboration, problem identification

PUBLICATIONS AND PREPRINTS

Modern Models (Large Language Models, Diffusion Models)

- 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". Preprint (https://arxiv.org/pdf/2410.13953).
- **Heng Dong***, Kefei Duan*, Chongjie Zhang. "Enhancing Decision-Making of Large Language Models via Actor-Critic". Submit to *The Thirteenth International Conference on Learning Representations* (ICLR 2025).

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

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

HONORS AND AWARDS

- Interdisciplinary Information Institute Scholarship - *Sep. 2023*

- Interdisciplinary Information Institute Scholarship - *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*
- Bronze scholarship for Excellent student - *Oct. 2018*
- Bronze scholarship for Excellent student - *Oct. 2017*
- Silver scholarship for Excellent student - *Oct. 2016*

RESEARCH EXPERIENCE

- **Modern Models**   Harvard University (remote)
  Cooperation   *Aug. 2024 - Present*
  - Collaborator: Prof. Milind Tambe and Prof. David C. Parke
  - Diffusion Models
- **Learning from Interactions**   Tsinghua University, Beijing, China
  Ph.D. Student   *Sep. 2020 - Present*
  - Supervisor: Prof. Chongjie Zhang and Prof. Yi Wu
  - Reinforcement Learning, Large Language Model, Robot Design, Multi-Agent
- **Multi-Agent Systems**   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*
  - Advisor: Prof. Tong Xu
  - Intelligent Healthcare based on Knowledge Graph from electronic medical records

REVIEWER ACTIVITIES

- **NeurIPS (2022-2024)**   Conference on Neural Information Processing Systems
- **ICML (2022-2024)**   International Conference on Machine Learning
- **ICLR (2022-2025)**   International Conference on Learning Representations
- **AAAI (2025)**   Association for the Advancement of Artificial Intelligence

OTHER EXPERIENCE

- **Teaching Assistant**   Artificial Intelligence: Principles and Techniques, Fall, 2021
- **Teaching Assistant**   Reinforcement Learning, Spring, 2022