Heng Dong

drdhxi@gmail.com | drdh | Heng Dong | drdh.cc | +86 18326695197

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, GPT, 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 robots 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** Diffusion Model, Large Language Model

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.
  - **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.
  - **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.
- **Ability:** collaboration, problem identification

Publications and Preprints

Modern 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

- **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

董恒

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教育经历

- **清华大学 (THU)** 北京
  博士生，交叉信息研究院，方向：人工智能 *2020 年 9 月 - 2025 年 6 月*

- **中国科学技术大学 (USTC)** 合肥
  本科，计算机科学与技术学院，专业：计算机科学与技术 *2016 年 9 月 - 2020 年 6 月*

技能

- **人工智能** Reinforcement Learning, Robotics, GPT, Diffusion, Multi-Agent
- **编程语言** Python, C, Wolfram
- **操作系统** Linux (Ubuntu, Deepin, OpenSUSE), MacOS, Windows
- **框架** PyTorch, Numpy, Matplotlib, Plotly, Git
- **语言** 汉语，英语

研究领域

我的科研目标是赋予机器人以超越人类的智能，我相信这个目标需要通过从交互中学习以及使用更现代化的模型来实现。为此，我之前的研究主要集中在：

- **从交互中学习** 包括：强化学习，机器人设计，多智能体
- **更现代化的模型** 包括：扩散模型，大语言模型

部分科研项目

- **大语言模型决策能力增强** 项目负责人 (2024)
  - 利用强化学习里演员-评论家算法的思想，提高大语言模型的决策能力。
  - **贡献：** 得到的算法在使用少量数据的情况下就能大幅提高决策能力，缓解开放世界中机器人的决策问题，在部分家务任务中，甚至超过了 GPT-4.
  - **能力：** 大模型的 finetuning，大模型智能体的构建
- **机器人设计** 项目负责人 (2022-2023)
  - 模仿自然演化，快速设计高效的机器人来解决不同的任务。
  - **贡献：** 深耕了该领域，分别设计了能使用在刚体机器人和软体机器人的高效算法。设计出来的机器人更容易得到控制算法，并且更好完成指定任务。
  - **能力：** 算法设计，idea 快速迭代和实现
- **机器人控制** 项目负责人 (2021)
  - 提出一个高效的模型结构统一控制形态不一致的机器人。
  - **贡献：** 受到人类控制四肢的肌肉协同原理启发，设计了一个网络结构能同时控制不同形态的机器人，同时能处理更高自由度的控制问题。
  - **能力：** 团队项目协作，发掘当前方法中存在的问题

已发表或预印的论文

更现代化的模型

- 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).

从交互中学习

- **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).

获奖经历

- 交叉信息研究院院设奖学金 - *2023* 年 *9* 月
- 交叉信息研究院院设奖学金 - *2022* 年 *9* 月
- 惠妍英才奖学金 - *2021* 年 *9* 月
- 本科生杰出毕业设计 - *2020* 年 *6* 月
- 华夏英才奖学金 (前 30/186) *2017* 年 *8* 月 - *2020* 年 *7* 月
- 英才奖学金（铜奖）- *2018* 年 *10* 月
- 英才奖学金（铜奖）- *2017* 年 *10* 月
- 英才奖学金（银奖）- *2016* 年 *10* 月

科研经历

- **更现代化的模型** 哈佛大学（远程）
  学术合作 *2024* 年 *8* 月 - 现在
  - 合作者: Milind Tambe 教授 和 David C. Parke 教授
  - 扩散模型与多智能体系统

- **从交互中学习** 清华大学，北京
  博士生 *2020* 年 *9* 月 - 现在
  - 导师：张崇洁副教授和吴翼助理教授
  - 强化学习，大语言模型，机器人设计，多智能体
- **多智能体系统** 清华大学，北京
  实习 *2019* 年 *9* 月 - *2020* 年 *7* 月
  - 导师：张崇洁副教授
  - 基于角色的多智能体系统，利己多智能体系统
- **知识图谱** 中科大，合肥
  实验室项目 *2018* 年 *9* 月 - *2019* 年 *6* 月
  - 导师：徐童教授
  - 基于知识图谱的智慧医疗系统

评审经历

- **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

其他经历

- **助教** 《人工智能：原理与技术》2021 年秋季学期，交叉信息研究院姚班
- **助教** 《强化学习》2022 年春季学期，交叉信息研究院姚班