Tairan He

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Education

Carnegie Mellon University — *Pittsburgh, USA*
PH.D. IN ROBOTICS — *Aug. 2023 - Present*

Shanghai Jiao Tong University — *Shanghai, China*
B.ENG. IN COMPUTER SCIENCE — *Aug. 2018 - Jun. 2023*

Research Interests

`Core Research Interests`: My research primarily lies in the intersection of **robotics**, **large-scale machine learning**, and **general-purpose loco-manipulation**. I am passionate robotic hardware systems, with a focus on **humanoid robots**.

`Core research question`: How can we build **scalable robot learning** systems that unify **perception**, whole-body **control**, and dexterous **manipulation**, enabling reliable general-purpose robots in **unstructured, real-world environments**?

Honors and Awards (Selected)

2024 **NVIDIA Graduate Fellowship**, [Link].
2024 **RI Presidential Fellowship**, CMU RI Departmental PhD Fellowships.
2024 **Outstanding Student Paper Award Finalist**, Robotics: Science and Systems. [Link]
2021 **Microsoft Star of Tomorrow**, top-performing interns at Microsoft.
2020 **Shanghai Jiao Tong University Excellent Scholarship**, top 10% students in SJTU.
2019 **Zhiyuan Honorary Scholarship**, top 5% students in SJTU.

Publications (*equal contribution)

PREPRINTS

[P6] VIRAL: Visual Sim-to-Real at Scale for Humanoid Loco-Manipulation.
Tairan He*, Zi Wang*, Haoru Xue*, Qingwei Ben*, Zhengyi Luo, Wenli Xiao, Ye Yuan, Xingye Da, Fernando Castañeda, Shankar Sastry, Changliu Liu, Guanya Shi, Linxi "Jim" Fan, Yuke Zhu
Under review, 2025 [Paper]

[P5] SONIC: Supersizing Motion Tracking for Natural Humanoid Whole-Body Control.
Zhengyi Luo*, Ye Yuan*, Tingwu Wang*, Chenran Li*, Sirui Chen, Fernando Castañeda, Zi-Ang Cao, Jiefeng Li, David Minor, Qingwei Ben, Xingye Da, Runyu Ding, Cyrus Hogg, Lina Song, Edy Lim, Eugene Jeong, Tairan He, Haoru Xue, Wenli Xiao, Zi Wang, Simon Yuen, Jan Kautz, Yan Chang, Umar Iqbal, Linxi "Jim" Fan, Yuke Zhu
Under review, 2025 [Paper]

[P4] Self-Improving Vision-Language-Action Models with Data Generation via Residual RL.
Wenli Xiao*, Haotian Lin*, Andy Peng, Haoru Xue, Tairan He, Yuqi Xie, Fengyuan Hu, Jimmy Wu, Zhengyi Luo, Linxi "Jim" Fan, Guanya Shi, Yuke Zhu
Under review, 2025 [Paper]

[P3] HDMI: Learning Interactive Humanoid Whole-Body Control from Human Videos.
Haoyang Weng, Yitang Li, Nikhil Sobanbabu, Zihan Wang, Zhengyi Luo, Tairan He, Deva Ramanan, Guanya Shi
Under review, 2025 [Paper]

[P2] FALCON: Learning Force-Adaptive Humanoid Loco-Manipulation.
Yuanhang Zhang, Yifu Yuan, Prajwal Gurunath, Tairan He, Shayegan Omidshafiei, Ali-akbar Agha-mohammadi, Marcell Vazquez-Chanlatte, Liam Pedersen, Guanya Shi
Under review, 2025 [Paper]

[P1] Emergent Active Perception and Dexterity of Simulated Humanoids from Visual Reinforcement Learning.
Zhengyi Luo*, Chen Tessler*, Toru Lin, Ye Yuan, Tairan He, Wenli Xiao, Yunrong Guo, Gal Chechik, Kris Kitani, Linxi Fan, Yuke Zhu
Under review, 2025 [Paper]

CONFERENCE PROCEEDINGS

[C20] Humanoid Policy ~ Human Policy.
Ri-Zhao Qiu*, Shiqi Yang*, Xuxin Cheng*, Chaitanya Chawla, Jialong Li, Tairan He, Ge Yan, David J. Yoon, Ryan Hoque, Lars Paulsen, Ge Yang, Jian Zhang, Sha Yi, Guanya Shi, Xiaolong Wang
CoRL, 2025 [Paper]

[C19] Sampling-Based System Identification with Active Exploration for Legged Robot Sim2Real Learning.

Nikhil Sobanbabu, Guanqi He, Tairan He, Yuxiang Yang, Guanya Shi
CoRL, 2025 [Paper]

[C18] Hold My Beer: Learning Gentle Humanoid Locomotion and End-Effector Stabilization Control.
Yitang Li, Yuanhang Zhang, Wenli Xiao, Chaoyi Pan, Haoyang Weng, Guanqi He, Tairan He, Guanya Shi
CoRL, 2025 [Paper]

[C17] ASAP: Aligning Simulation and Real-World Physics for Learning Agile Humanoid Whole-Body Skills.
Tairan He*, Jiawei Gao*, Wenli Xiao*, Yuanhang Zhang*, Zi Wang, Jiashun Wang, Zhengyi Luo, Guanqi He, Nikhil Sobanbab, Chaoyi Pan, Zeji Yi, Guannan Qu, Kris Kitani, Jessica Hodgins, Linxi "Jim" Fan, Yuke Zhu, Changliu Liu, Guanya Shi
RSS, 2025 [Paper]

[C16] HOVER: Versatile Neural Whole-Body Controller for Humanoid Robots.
Tairan He*, Wenli Xiao*, Toru Lin, Zhengyi Luo, Zhenjia Xu, Zhenyu Jiang, Jan Kautz, Changliu Liu, Guanya Shi, Xiaolong Wang, Linxi "Jim" Fan†, Yuke Zhu†
ICRA, 2025 [Paper]

[C15] Bridging Adaptivity and Safety: Learning Agile Collision-Free Locomotion Across Varied Physics.
Yichao Zhong, Chong Zhang, Tairan He, Guanya Shi
L4DC, 2025 [Paper]

[C14] OmniH2O: Universal and Dexterous Human-to-Humanoid Whole-Body Teleoperation and Learning.
Tairan He*, Zhengyi Luo*, Xialin He*, Wenli Xiao, Chong Zhang, Kris Kitani, Weinan Zhang, Changliu Liu, Guanya Shi.
CoRL, 2024 [Paper]

[C13] WoCoCo: Learning Whole-Body Humanoid Control with Sequential Contacts.
Chong Zhang*, Wenli Xiao*, Tairan He, Guanya Shi.
CoRL (Oral), 2024 [Paper]

[C12] Learning Human-to-Humanoid Real-Time Whole-Body Teleoperation.
Tairan He*, Zhengyi Luo*, Wenli Xiao, Chong Zhang, Kris Kitani, Changliu Liu, Guanya Shi
IROS, 2024 (Oral) [Paper]

[C11] Progressive Adaptive Chance-Constrained Safeguards for Reinforcement Learning.
Zhaorun Chen, Binhao Chen, Tairan He, Liang Gong, Chengliang Liu.
IROS, 2024 [Paper]

[C10] Agile But Safe: Learning Collision-Free High-Speed Legged Locomotion.
Tairan He*, Chong Zhang*, Wenli Xiao, Guanqi He, Changliu Liu, Guanya Shi.
RSS, 2024 (Outstanding Student Paper Award Finalist - Top 3) [Paper]

[C9] Safe Deep Policy Adaptation.
Wenli Xiao*, Tairan He*, John Dolan, Guanya Shi.
ICRA, 2024 [Paper]

[C8] State-wise Safe Reinforcement Learning: A Survey.
Weiye Zhao, Tairan He, Rui Chen, Tianhao Wei, Changliu Liu.
IJCAI (Survey Track), 2023. [Paper]

[C7] Probabilistic Safeguard for Reinforcement Learning Using Safety Index Guided Gaussian Process Models.
Weiye Zhao*, Tairan He*, Changliu Liu.
L4DC, 2023. [Paper]

[C6] Visual Imitation Learning with Patch Rewards.
Minghuan Liu, Tairan He, Weinan Zhang, Shuicheng Yan, Zhongwen Xu.
ICLR, 2023. [Paper]

[C5] Safety Index Synthesis via Sum-of-Squares Programming.
Weiye Zhao*, Tairan He, Tianhao Wei, Simin Liu, Changliu Liu.
ACC, 2023. [Paper]

[C4] AutoCost: Evolving Intrinsic Cost for Zero-violation Reinforcement Learning.
Tairan He, Weiye Zhao, Changliu Liu.
AAAI, 2023. [Paper]

[C3] Reinforcement Learning with Automated Auxiliary Loss Search.
Tairan He, Yuge Zhang, Kan Ren, Minghuan Liu, Che Wang, Weinan Zhang, Yuqing Yang, Dongsheng Li.
NeurIPS, 2022. [Paper]

[C2] Model-free Safe Control for Zero-Violation Reinforcement Learning.
Weiye Zhao, Tairan He, Changliu Liu.
CoRL, 2021. [Paper]

[C1] Energy-Based Imitation Learning.
Minghuan Liu, Tairan He, Minkai Xu, Weinan Zhang.
AAMAS, 2021 (Oral) [Paper]

Research Experience

NVIDIA *Santa Clara, USA*
Research Intern at GEAR Lab, advised by Jim Fan and Yuke Zhu *Jun. 2024 - Present*
- **Research Topics**: humanoid whole-body control, dexterous bimanual manipulation.

Carnegie Mellon University *Pittsburgh, USA*
PhD Student, advised by Prof. Guanya Shi and Prof. Changliu Liu *Aug. 2023 - Present*
- **Research Topics**: reinforcement learning, humanoid teleoperation, agile legged robots.

Carnegie Mellon University *Pittsburgh, USA*
Visiting Intern, at Intelligent Control Lab, advised by Prof. Changliu Liu *Feb. 2022 - Jan. 2023*
- **Research Topics**: safe reinforcement learning, safe control, control theory.

Microsoft Research *Shanghai, China*
Research Intern, advised by Kan Ren and Yuge Zhang *Mar. 2021 - Dec. 2021*
- **Research Topics**: auto ML, reinforcement learning.

Shanghai Jiao Tong University *Shanghai, China*
Research Assistant at APEX Lab, advised by Prof. Weinan Zhang *Jul. 2019 - Jan. 2023*
- **Research Topics**: reinforcement learning, imitation learning.

Academic Services

Reviewer	ICML, ICLR, NeurIPS, RSS, ICRA, IROS, CoRL, Humanoids, CDC, L4DC, AAAI, TRO, TFR, IJRR, RAL, ICCV, CVPR 2021-Present
Teaching Assistant	CMU 16-831 Introduction to Robot Learning [Link] 2024
Teaching Assistant	CMU 16-264 Humanoids [Link] 2024

Skills

Programming	Python, C++, LaTeX, JAVA, Node.js, SQL, Linux, MATLAB, PHP
Frameworks	PyTorch, Tensorflow, NumPy, Flask, MySQL, Git, Anaconda, OpenCV, ROS1, ROS2.
Robots	Kinova, Rosbot, Unitree Go1, Unitree Go2, Unitree H1, Unitree G1, Fourier GR-1

Project Portfolio (Selected)

SJTU Anonymous Forum *Shanghai, China*
Founder & Developer. [Android Code] / [iOS Code] / [Farewell Video] *Feb. 2020 - Apr. 2021*
- Develoed a care-free forum platform for SJTU students to share and talk using anonymous identities.
- More than **10000+** users used this app in the SJTU campus.

Invited Talks

[T3] Scalable Sim-to-Real Learning for General-Purpose Humanoid Skills.
UPenn GRASP Lab, 2025 [Link]

[T2] Learning Humanoid Generalist Agility by Unifying Cognitive and Physical Intelligence.
UCL MLLM Seminar, *OpenDriveLab*, *Tsinghua IIIS*, *SJTU Navigation Seminar*, *Guest Lecture at USC CS699*, 2024

[T1] Bridging Safety, Agility and Generalization for Learning-Based Robotic Control.
TechBeat, 2024 [Link]

Press Coverage (Selected)

[M15] "NVIDIA Research Showcases the Future of Robotics at RSS"
by Diego Farinha, NVIDIA Blogs, 2025[Link]

[M14] "Robots With Moves Like Ronaldo, LeBron and Kobe"
by Mallory Lindahl, CMU Robotics News, 2025[Link]

[M13] "NVIDIA Introduces HOVER, a 1.5 M Parameter Neural Network for Humanoid Robotics"
by Siddharth Jindal, Analytics India Magazine, 2025[Link]

[M12] "NVIDIA AI Releases HOVER: A Breakthrough AI for Versatile Humanoid Control in Robotics"
by Jean-marc Mommessin, MARKTECHPOST, 2024[Link]

[M11] "NVIDIA Advances Robot Learning and Humanoid Development With New AI and Simulation Tools"
by Spencer Huang, NVIDIA Blog, 2024 [Link]

[M10] "Interview with OmniH2O Project Initiator Tairan He: Exploring a Feasible Path from Humanoid Robot Teleoperation to Embodied Intelligence"
by Shuwei Rao, AI Tech Comments, 2024 [Link]

[M9] "Human-to-humanoid robot designed by young uni student can chop vegetables, clean and create art"
by Almara Abgarian, NEED TO KNOW, 2024 [Link]

[M8] "System Enables Human-to-Humanoid Robot Operation"
by Scarlett Evans, IoT World Today, 2024 [Link]

[M7] "Swift and Secure: CMU Researchers Develop Collision-Free, High-Speed Robots"
by Mallory Lindahl, CMU Robotics News, 2024 [Link]

[M6] "Human to Humanoid: Your Weekly Selection of Awesome Robot Videos"
by Evan Ackerman, IEEE Spectrum, 2024 [Link]

[M5] "System Enables Human-to-Humanoid Robot Operation"
by Scarlett Evans, IoT World Today, 2024 [Link]

[M4] "Human-to-humanoid Robot Full-body Teleoperation Unlocked in Real-time"
by Jijo Malayil, Interesting Engineering, 2024 [Link]

[M3] "A scalable reinforcement learning–based framework to facilitate the teleoperation of humanoid robots"
by Ingrid Fadelli, Tech Xplore, 2024 [Link]

[M2] "CMU's Agile Robot Dog is Half the Size of Spot, Can Avoid Obstacles at High-Speed"
by Jackson Chung, TechEBlog, 2024 [Link]

[M1] "Video Friday: Agile but Safe: Your Weekly Selection of Awesome Robot Videos"
by Evan Ackerman, IEEE Spectrum, 2024 [Link]