WEI ZHU

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INTEREST

My research focuses on developing intelligent and adaptive control systems for legged and mobile robots operating in complex, dynamic, and human-centered environments. I am particularly interested in **deep reinforcement learning (DRL)** for **quadrupedal and humanoid locomotion on uneven terrains**, **social navigation for legged robots using DRL**, and **mobile robot navigation in highly dynamic environments**. My ultimate goal is to enable robots to **interact naturally and safely with humans**, contributing to the development of robots that can **serve and assist human societies**.

WORK

- **Tohoku University [🌐]** *April 2025 - Present*
  Assistant Professor Sendai, Japan
  ◦ Embodied AI
  ◦ Social navigation for mobile, quadrupedal, and humanoid robots
  ◦ Humanoid whole-body loco-manipulation
  ◦ **Teaching**: Neuro Robotics, Exercises in Computer-Aided Problem Solving

- **Georgia Institute of Technology [🌐]** *April 2024 - March 2025*
  Postdoctoral Researcher Atlanta, USA
  ◦ Collaborator: Ye Zhao
  ◦ Research: Social navigation for bipedal robot using DRL

- **Jingdong Logistics** *October 2023 - March 2024*
  Algorithm Engineer Beijing, China
  ◦ Path planning for service robots and self-driving vehicles

- **Panasonic AI Lab [🌐]** *May 2022 - September 2022*
  Internship Osaka, Japan
  ◦ Vision-based robotic manipulation using DRL

EDUCATION

- **Tohoku University** *October 2020 - September 2023*
  PhD in Robotics Sendai, Japan
  ◦ Supervisor: Mitsuhiro Hayashibe
  ◦ Research: mobile robot navigation in dynamic environments using DRL

- **Nankai University** *September 2017 - June 2020*
  Master in Control Science and Engineering Tianjin, China
  ◦ Supervisor: Yongchun Fang
  ◦ Research: snake-like robots

- **Nankai University** *September 2013 - June 2017*
  Bachelor in Intelligent Science and Technology Tianjin, China

SELECTED PUBLICATIONS IN RECENT FIVE YEARS

[5] T. Yuan, W. Zhu*, and M. Hayashibe, **Iterative Adversarial Learning with Chaser Agents for Time-efficient Crowd-aware Navigation**, *IEEE Robotics and Automation Letters (RA-L)*, accepted, 2026.

[4] W. Zhu, A. Raju, A. Shamsah, A. Wu, S. Hutchinson, and Y. Zhao, **EmoBipedNav: Emotion-aware Social Navigation for Bipedal Robots with Deep Reinforcement Learning**, *IEEE/ASME Transactions on Mechatronics (T-MECH)*, accepted, 2026.

[3] W. Zhu and M. Hayashibe, **Learn to Navigate in Dynamic Environments with Normalized LiDAR Scans**, in *IEEE International Conference on Robotics and Automation (ICRA)*, 2024, pp. 7568-7575.

[2] W. Zhu and M. Hayashibe, **Autonomous Navigation System in Pedestrian Scenarios using a Dreamer-based Motion Planner**, *IEEE Robotics and Automation Letters (RA-L)*, vol. 8, no. 6, pp. 3836-3843, 2023.

[1] W. Zhu and M. Hayashibe, **A Hierarchical Deep Reinforcement Learning Framework with High Efficiency and Generalization for Fast and Safe Navigation**, *IEEE Transactions on Industrial Electronics (TIE)*, vol. 70, no. 5, pp. 4962-4971, 2023.

[27.J]   T. Yuan, W. Zhu*, and M. Hayashibe, **Iterative Adversarial Learning with Chaser Agents for Time-efficient Crowd-aware Navigation**, *IEEE Robotics and Automation Letters (RA-L)*, accepted, 2026.

[26.J]   W. Zhu, A. Raju, A. Shamsah, A. Wu, S. Hutchinson, and Y. Zhao, **EmoBipedNav: Emotion-aware Social Navigation for Bipedal Robots with Deep Reinforcement Learning**, *IEEE/ASME Transactions on Mechatronics (T-MECH)*, accepted, 2026.

[25.J]   Irfan Tito Kurniawan, W. Zhu, Dai Owaki, and M. Hayashibe, **Learning Perceptive Legged Robot Locomotion in the Real World: A Systematic Review**, *IEEE Robotics and Automation Magazine (RAM)*, accepted, 2025.

[24.J]   Z. Yao, X. Chen, M. Hayashibe, N. Xu, T. Yuan, and W. Zhu, **Spatiotemporal Feature-Encoded Navigation for USVs in Unpredictable Maritime Scenarios**, *IEEE Transactions on Vehicular Technology (TVT)*, accepted, 2025.

[23.J]   I. T. Kurniawan, W. Zhu, D. Owaki, and M. Hayashibe, **Learning Perceptive Legged Robot Locomotion in the Real World: A Systematic Survey**, *IEEE Robotics and Automation Magazine (RAM)*, accepted, 2025.

[22.C]   Z. Gu, W. Zhu*, and M. Hayashibe, **Multi-Object Loco-Manipulation using Body Holding Primitives for Humanoids**, *IEEE/SICE International Symposium on System Integration (SII)*, accepted, 2025.

[21.J]   F. W, X. Nal, J. Jang, W. Zhu, Z. Gu, A. Wu, and Y. Zhao, **Learn to Teach: Sample-Efficient Learning for Humanoid Locomotion Over Real-World Uneven Terrain**, *IEEE Robotics and Automation Letters (RA-L)*, vol. 10, no. 9, pp. 9048-9055, 2025.

[20.J]   Z. Yao, X. Chen, M. Hayashibe, W. Zhu, and N. Xu, **Local Collision Avoidance for Unmanned Surface Vehicles Based on an End-to-End Planner With a LiDAR Beam Map**, *IEEE Transactions on Intelligent Transportation Systems (TITS)*, vol. 26, no. 6, pp. 7990-8005, 2025.

[19.C]   W. Zhu and M. Hayashibe, **Learn to Navigate in Dynamic Environments with Normalized LiDAR Scans**, in *IEEE International Conference on Robotics and Automation (ICRA)*, 2024, pp. 7568-7575.

[18.T]   W. Zhu, **Prior Knowledge-free Robot Navigation in Dynamic Environments through Deep Reinforcement Learning**, *PhD Thesis*, 2023.

[17.J]   W. Zhu and M. Hayashibe, **Autonomous Navigation System in Pedestrian Scenarios using a Dreamer-based Motion Planner**, *IEEE Robotics and Automation Letters (RA-L)*, vol. 8, no. 6, pp. 3836-3843, 2023.

[16.J]   W. Zhu and M. Hayashibe, **A Hierarchical Deep Reinforcement Learning Framework with High Efficiency and Generalization for Fast and Safe Navigation**, *IEEE Transactions on Industrial Electronics (TIE)*, vol. 70, no. 5, pp. 4962-4971, 2023.

[15.J]   W. Zhu, X. Guo, D. Owaki, K. Kutsuzawa, and M. Hayashibe, **A Survey of Sim-to-Real Transfer Techniques Applied to Reinforcement Learning for Bioinspired Robots**, *IEEE Transactions on Neural Networks and Learning Systems (TNNLS)*, vol. 34, no. 7, pp. 3444-3459, 2023.

[14.C]   W. Zhu, F. Raza, and M. Hayashibe, **Reinforcement Learning based Hierarchical Control for Path Tracking of a Wheeled Bipedal Robot with Sim-to-Real Framework**, in *IEEE/SICE International Symposium on System Integration (SII)*, 2022, pp. 40-46.

[13.P]   Y. Fang, W. Zhu, X. Guo, and X. Zhang, **Auto-assembly Modular Robot**, *Chinese Patent*, 2022, Grant No. ZL 2019 1 0083530.X.

[12.P]   Y. Fang, W. Zhu, X. Guo, and X. Zhang, **A Claw-bolt-baffle Mechanism**, *Chinese Patent*, Grant No. ZL 2019 1 0083528.2, 2022.

[11.J]   F. Raza, W. Zhu, and M. Hayashibe, **Balance Stability Augmentation for Wheel-Legged Biped Robot Through Arm Acceleration Control**, *IEEE Access*, vol. 9, pp. 54022-54031, 2021.

[10.J]   W. Zhu, X. Guo, Y. Fang, and X. Zhang, **A Path-Integral-Based Reinforcement Learning Algorithm for Path Following of an Autoassembly Mobile Robot**, *IEEE Transactions on Neural Networks and Learning Systems (TNNLS)*, vol. 31, no. 11, pp. 4487-4499, 2020.

[9.J]   W. Zhu, X. Guo, Y. Fang, and X. Zhang, **Development of a Reconfigurable Modular Snake-like Robot and Research on Multiple Motion Modes**, *Information and Control*, vol. 49, no. 1, pp. 69-77, 2020.

[8.C]   X. Zhang, X. Guo, Y. Fang, and W. Zhu, **Reinforcement Learning-based Hierarchical Control for Path Following of a Salamander-like Robot**, in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2020, pp. 6077-6083.

[7.T]   W. Zhu, **Mechanical Design and Intelligent Control of Modular Snake-like Robots**, *Master Thesis*, 2020.

[6.J]   X. Guo, W. Zhu, and Y. Fang, **Guided Motion Planning for Snake-like Robots Based on Geometry Mechanics and HJB Equation**, *IEEE Transactions on Industrial Electronics (TIE)*, vol. 66, no. 9, pp. 7120-7130, 2019.

[5.C]   X. Guo, W. Zhu, and Y. Fang, **Any Curve Path Following of Snake-like Robots**, in *EEE International Conference on Robotics and Biomimetics (ROBIO)*, 2019, pp. 1286-1291.

[4.C] X. Zhang, Y. Fang, <u>W. Zhu</u>, and X. Guo, **A Novel Locomotion Controller Based on Coordination Between Leg and Spine for a Quadruped Salamander-Like Robot**, in *International Workshop on Robot Motion and Control (RoMoCo)*, 2019, pp. 68-73.

[3.J] Y. Fang, <u>W. Zhu</u>, and Xian Guo, **Target-Directed Locomotion of a Snake-Like Robot Based on Path Integral Reinforcement Learning**, *Pattern Recognition and Artificial Intelligence*, 2018.

[2.C] <u>W. Zhu</u>, X. Guo, and Y. Fang, **Design of a Modular Snake Robot and Control with Internet of Things**, in *International Workshop on Robot Motion and Control (CAC)*, 2017, pp. 850-854.

[1.T] <u>W. Zhu</u>, **The Design of a Distributed Controller for the Modular Snake Robot**, *Bachelor Thesis*, 2017.

SUBMISSIONS

[1] I. T. Kurniawan, <u>W. Zhu</u>, and M. Hayashibe, **Functional Roles of Postural Reflex and Exteroception in Learning-Based CPG-Driven Quadrupedal Locomotion**, *Scientific Reports*, under review, 2025.

HONORS AND AWARDS

- FY2023 JSAE Graduate Research Encouragement Award, September 2023
- Graduate National Scholarship, Top 3%, November 2019
- Chinese Challenge Cup, National Third Prize, November 2019

ACADEMIC SERVICES

- Reviewer of IEEE Robotics and Automation Letters (RA-L)
- Reviewer of IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
- Reviewer of IEEE International Conference on Robotics and Automation (ICRA)
- Reviewer of IEEE Transactions on Industrial Electronics (TIE)
- Reviewer of IEEE Transactions on Neural Networks and Learning Systems (TNNLS)
- Reviewer of IEEE Transactions on Industrial Informatics (TII)
- Reviewer of IEEE/ASME Transactions on Mechatronics (T-MECH)
- Reviewer of IEEE Transactions on Intelligent Transportation Systems (TITS)
- Reviewer of Scientific Report