

# WEI ZHU

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## EDUCATION

Oct 2020 - Sept 2023

Tohoku University

Robotics (Doctorate)

*Minors: reinforcement learning, motion planning, legged robots*

*Advisor: Prof. Mitsuhiro Hayashibe*

Sept 2017 - Jun 2020

Nankai University

Control Science and Engineering (Master)

*Minors: reinforcement learning, nonlinear control, snake robots*

*Advisor: Prof. Yongchun Fang*

Sept 2013 - Jun 2017

Nankai University

Intelligent Science and Technology (Bachelor)

*Minors: reinforcement learning, snake robots*

## RESEARCH INTEREST

My research interest lies at the intersection of **control, robotics, and learning**. My research aims to develop intelligent autonomous agents with deep reinforcement learning frameworks in either industry (e.g., robotic manipulation) or human society (e.g., navigation among crowds).

I am interested in making the end-to-end reinforcement learning algorithms applicable both in simulated and real worlds. Applications of my research include **motion planning of snake robots, balancing control and motion planning of a wheeled bipedal robot, navigation with a quadruped robot, and robotic manipulation**.

## WORK EXPERIENCE

May 2022 - Sept 2022

Panasonic

*Intern, model-based reinforcement learning & robotic manipulation (Host: Masashi Okada)*

## PUBLICATIONS

### Expected PhD Dissertation

Deep Reinforcement Learning based Motion Planning and Navigation for Legged Robots, May 2023.

### Master Dissertation

Mechanical Design and Intelligent Control of Modular Snake-like Robots, June 2020.

### Bachelor Dissertation

The Design of a Distributed Controller for the Modular Snake Robot, June 2017.

### Under Review

- W. Zhu**, M. Okada, and T. Taniguchi, Mastering Robotic Skills in Real Visual Worlds through Model-based Reinforcement Learning, *ICRA 2023*, under review.
- W. Zhu**, M. Hayashibe, Sampling Efficient Deep Reinforcement Learning for Dynamic Navigation with Raw Laser Scans, *IEEE/ASME Transactions on Mechatronics (TMECH)*, under review.

Journal

1. **W. Zhu**, and M. Hayashib, A Hierarchical Deep Reinforcement Learning Framework with High Efficiency and Generalization for Fast and Safe Navigation, *IEEE Transactions on Industrial Electronics (TIE)*, 2022.
2. **W. Zhu**, X. Guo, D. Owaki, K. Kutsuzawa, and M. Hayashibe, A Survey of Sim-to-Real Transfer Techniques applied to Reinforcement Learning for Bio-Inspired Robots, *IEEE Transactions on Neural Networks and Learning Systems (TNNLS)*, 2021.
3. F. Raza, **W. Zhu**, M. Hayashibe, Balance Stability Augmentation for Wheel-legged Biped Robot through Arm Acceleration Control, *IEEE Access*, 2021.
4. **W. Zhu**, X. Guo, Y. Fang, and X. Zhang, A Path-Integral-Based Reinforcement Learning Algorithm for Path Following of an Auto-Assembly Mobile Robot, *IEEE Transactions on Neural Networks and Learning Systems (TNNLS)*, 2020.
5. **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*, 2020.
6. 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)*, 2019.
7. Y. Fang, **W. Zhu**, and Xian Guo, Target-Directed Locomotion of a Snake-Like Robot Based on Path Integral Reinforcement Learning, *Pattern Recognition and Artificial Intelligence*, 2018.

Conference Proceedings

1. **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.
2. 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.
3. X. Guo, **W. Zhu**, and Yongchun Fang (2019). Any Curve Path Following of Snake-like Robots, in *IEEE International Conference on Robotics and Biomimetics (ROBIO)*, 2019.
4. X. Zhang, Y. Fang, **W. Zhu**, 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.
5. **W. Zhu**, X. Guo, and Y. Fang, Design of a Modular Snake Robot and Control with Internet of Things, in *Chinese Automation Congress (CAC)*, 2017.

Patent

1. Y. Fang, **W. Zhu**, X. Guo, and X. Zhang, Auto-assembly Modular Robot, *Chinese Patent*, 2019.
2. Y. Fang, **W. Zhu**, X. Guo, and X. Zhang, A Claw-bolt-baffle Mechanism., *Chinese Patent*, 2019.

Working Paper

**W. Zhu** and M. Hayashibe, An Autonomous Navigation System among Pedestrians with a Deep Reinforcement Learning based Motion Planner, in preparation for submission to *IEEE Robotics and Automation Letters (RA-L)*.

AWARDS AND SCHOLARSHIPS

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MEXT Scholarship from Japanese Government (2020.10-2023.9)  
National Scholarship from Nankai University (2019.12, top 3%)

ACADEMIC SERVICES

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Reviewer

- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE Transactions on Industrial Electronics (TIE)
- IEEE Transactions on Neural Networks and Learning Systems (TNNLS)
- IEEE Transactions on Industrial Informatics (TII)