Kaibo He

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Education

M.S. Aerospace Engineering *Beijing, China*

School of Aerospace, Tsinghua University (THU)   GPA: 3.81/4.0 *2021. 9 - Present*

B.E. Energy and Power Engineering (Outstanding Graduate) *Xian, China*

School of Power and Energy, Northwestern Polytechnical University (NWPU)   GPA: 90.0/100 (Top 1) *2017. 9 - 2021. 6*

Research Interest

My research interest is to use *Reinforcement Learning* to solve problems in the field of *Robotics*.

Publications ** Equal Contribution*

Yang Xu, Wei Yang, **Kaibo He**, Bo Yang, Yanan Sui, Yilin Mo. "Learning Adaptive Locomotion for Wheeled Quadrupedal Robots via Switching Whole-body Prior Gait". *Submitted to RAL (Under Review)*.

Xi Zhang, Yang Lu, Hongda Li, Qingyu Yao, Yunwei Wei, **Kaibo He**, Chenhui Zuo, Yanan Sui, Boyang Zhang, Bozhi Ma, Yu Pan, Guihuai Wang, Luming Li. "Voluntary Single Joint Movement Training with Targeted EES Enabled Neural Recovery for Patients with Spinal Cord Injuries". *Submitted to Science Bulletin (Under Review)*.

Kaibo He, Chenhui Zuo, Chengtian Ma, Yanan Sui. "DynSyn: Dynamical Synergistic Representation for Efficient Learning and Control in Overactuated Embodied Systems". *ICML2024*.

Zeji Yi*, Yunyue wei*, Chu Xin Cheng*, **Kaibo He**, Yanan Sui. "Improving Sample Efficiency of High Dimensional Bayesian Optimization with MCMC on Approximated Posterior Ratio". *L4DC2024, arXiv:2401.02650*.

Kaibo He*, Chenhui Zuo*, Jing Shao, Yanan Sui. "Modeling Full-Body Human Musculoskeletal System and Locomotion Control with Hierarchical Low-Dimensional Representation". *ICRA2024, CosYne Abstract2024, arXiv:2312.05473*.

Jun Hong Lim, **Kaibo He**, Zeji Yi, Chen Hou, Chen Zhang, Yanan Sui, Luming Li. "Adaptive Learning based Upper-Limb Rehabilitation Training System with Collaborative Robot". *EMBC2023, arXiv:2305.10642*.

Xutun Wang, Haocheng Wen, Jiahao Wu, **Kaibo He**, Bin Wang. "PINN-based Flow Field Reconstruction for Rotating Detonation Combustor". *12th National Conference on Fluid Mechanics*.

Research Experience

Full-body Human Musculoskeletal Model and Control *2022. 10 - Present*

Advisor: Prof. Yanan Sui, School of Aerospace, Tsinghua University

- Developed a full-body musculoskeletal model with 700 muscles using anatomical data and existing OpenSim models as references
- Implemented techniques such as imitation learning utilizing the SAC algorithm to enable the model to walk and interact with a frame
- Proposed a two-stage hierarchical training algorithm to control the high-dimensional model and achieved SOTA performance

Learning Robust Wheeled Quadrupedal Locomotion via Deep Reinforcement Learning *2023. 5 - Present*

Advisor: Prof. Yilin Mo, Department of Automation, and Prof. Yanan Sui, School of Aerospace, Tsinghua University

- Modified Unitree's GO1 quadrupedal into a wheeled robot
- Utilize the open-source PCAN to achieve motion control for the motor
- Implemented robust control of the robot in Isaac Gym using DRL to achieve Sim2real capability for stair locomotion

Collaborative Rehabilitation of Exoskeleton and Spinal Cord Stimulation after Spinal Cord Injury *2022. 4 - Present*

Advisor: Prof. Yilin Mo, Department of Automation, and Prof. Yanan Sui, School of Aerospace, Tsinghua University

- Built a multi-process and multi-thread control system to control a modified exoskeleton robot
- Developed a safety algorithm based on multiple data sources to protect patients and improve rehabilitation outcomes during stimulation
- Designed and manufactured another adjustable single-leg 5-DOF lower-limb exoskeleton robot using SolidWorks
- Constructed a control system and algorithm using parameter identification as feedforward and PD control as feedback based on ROS

High-dimensional Bayesian Optimization with MCMC *2022. 3 - 2022. 12*

Advisor: Prof. Yanan Sui, School of Aerospace, Tsinghua University

- Elaborated an MCMC-based candidate selecting method to reduce the computation cost
- Boosted Bayesian optimization on high-dimensional spaces for synthetic functions and RL benchmarks compared to SOTA algorithm

Adaptive Learning based Upper-Limb Rehabilitation Training System with Collaborative Robot *2022. 1 - 2022. 12*

Advisor: Prof. Yanan Sui, School of Aerospace, Tsinghua University

- Utilized a general-purpose robotic arm to construct a remote rehabilitation system, enabling rehabilitation for both broad and fine-scale movements
- Conducted experimental evaluations separately in simulation integrated with Gazebo and OpenSim, as well as in a real-world environment
- Applied imitation learning to use expert-recommended trajectories for different patients

Work Experience

Beijing THeWake System Co., Ltd. *2021. 5 - 2021. 8*

Intern R&D Engineer, Beijing

- Enhance the performance of the active noise cancellation algorithm and the open-source graphics library LVGL, optimize memory access to accelerate RNN inference by 91%, improve FFT in ARM DSP_Lib by 6.6%, and achieve 1400% increase in a image rendering function
- Transplanted DL applications on the domestic OS, and transplanted a program from the X86 to Arm

Honors & Awards

Scholarships & Honors

2023, 22	Excellent Comprehensive Scholarship(×2)	*THU*
2023, 22	School-level Excellent Comprehensive Scholarship(×2)	*School of Aerospace, THU*
2022	Excellent Social Practice Scholarship	*THU*
2021	Outstanding Graduate	*NWPU*
2021	Excellent Graduation Thesis	*NWPU*
2018, 19, 20	National Scholarship (×3, **only 1 person in the major**)	*MOE Chinese*
2020	BaoSteel Outstanding Student Scholarship, Outstanding Student Pioneer (**highest honor, only 2 undergraduates in the university**)	*BSEF*
2020	Aviation Power China Heart Innovation Scholarship (**only 5 undergraduates nationwide**)	*BHUEF*
2020	Undergraduate Science and Technology Star	*NWPU*
2018, 20	Special Scholarship, Outstanding Student Pioneer (×2, **only 31, 20 undergraduates in the university**)	*NWPU*
2019	First-class Scholarship, Outstanding Individual Student of Undergraduate Students	*NWPU*

Seleted competition awards

2023	**Student Award**, NeurIPS 2023 Competition - MyoChallenge 2023: Towards Human-Level Dexterity	*Team MyoSuite*
2022	**Innovation Award**, The 2nd MATLAB Cup Global (China Region) Student UAV Competition	*MathWorks & SJTU*
2022	**First Prize**, The 2nd MATLAB Cup Global (China Region) Student UAV Competition	*MathWorks & SJTU*
2019	**International Champion**, 24th FIRA Robotics World Cup SimuroSot Large Size Project	*FIRA*
2019	**National Champion**, National Robotics Championship Wheeled 11 vs 11 Simulation Robot Soccer	*CAAI-RSC*
2019	**National Champion**, China Robotics Competition FIRA Small Group Simulation Group 11vs11 Project	*CAA*
2019	**National Third Prize**, China University Computer Competition - WeChat Mini Program Application Development Competition	*AFCEC*

I have won **4** international competition championships, **1** third prize in international competition, **2** national competition championships, **1** third prize in national competition, **1** provincial first prize in national competition, **13** school-level competitions, and **3** software copyrights published.

Skills

- **Programming Language:** Python > C/C++ = Matlab > JavaScript > Assembly language
- **Protocol & Framework:** MPI, OpenMP, Cuda, PyTorch, Socket, ROS, QT, MuJoCo, LCM
- **Tool & System:** SolidWorks, Linux, Raspberry Pi, Makefile, CMake, Docker, Git, Adobe Pr, Adobe Ae, LaTeX
- **Language:** Chinese, English

* BHUEF: Beihang University Education Foundation. BSEF: Baosteel Education Foundation. MOE Chinese: Ministry of Education, China. SJTU: Shanghai Jiao Tong University. AFCEC: Association of Fundamental Computing Education in Chinese Universities. CAA: Chinese Association of Automation.