Peiyu Yang

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Education Background

Delft University of Technology (TUD), Delft, Netherlands **09/2023-Present**

- **Master Programme:** Msc Robotics
- **GPA:** 8.1/10

Beijing Institute of Technology (BIT), Beijing, China **09/2019-06/2023**

- **Undergraduate Major:** Automation
- **GPA:** 87.44/100

North Carolina State University, North Carolina, US **06/2021-08/2021**

- 2021 Summer Global Education, Academics, and Research Skills (GEARS) Program
- **GPA:** 98/100

ETH Zurich, Zurich, Switzerland **06/2024-07/2024**

- 2024 Robot Summer School (RSS) Program

Internship

école Polytechnique de Montréal, Montreal, Canada **07/2022-11/2022**

- 2022 Mitacs Globalink Research Internship

PUBLICATION

- Qian, Yizhao, **Peiyu Yang**, Weicheng Liu, Shuangyuan Sun, Mengyin Fu, and Wenjie Song. "Generative Design of XingT, A Human-sized Heavy-duty Bipedal Robot." In 2022 IEEE International Conference on Robotics and Biomimetics (ROBIO), pp. 513-518. IEEE, 2022. **(Best Paper in Biomimetics)**

PATENT

- **Peiyu Yang**, Wenjie Song, Weicheng Liu, et al. A Wheel-legged Robot with a Balancing Device
- Wenjie Song, Yizhao Qian, **Peiyu Yang**, et al. A Five-bar-linkage-based Leg Structure for Bipedal Robots

CURRENT RESEAECH

MPC-Based Whole Body Dynamics Legged Locomotion **08/2024-Present**

Individual Research Assignment

Supervisor:

Dr. C. (Cosimo) Della Santina ***Delft University of Technology***

Dr. J. (Jiatao) Ding

- Using none-linear MPC and whole body dynamic methods to control quadruped robots operating in special scenarios.

PROJECT EXPERIENCES

Two-stage Multi-UAV Planning Solution Combining A*, Model Predictive Control, and Artificial Potential Field **11/2023-01/2024**

Position: Co-first Researcher

Supervisor: Dr.J.(Javier) Alonso-Mora ***Delft University of Technology***

- Presented a **two-stage multi-UAV path planning solution** with modified A* as global planner, and MPC combining with APF as local planner.

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- Analized different global planning methods (A*, RRT, RRT*, and modified RRT*), and **modified A* method for multi-UAV missions**.
- Using linear MPC to achieve local optimal path planning for moving obstacles.
- Ensuring the safety of clusters under unexpected disturbances using APF.
- Simulated formations of **a cluster comprising 27 UAVs** in an obstacle environment.
- The video can be accessed at the following link:
  - **https://youtu.be/RkOqEFh1KFM**
- The code can be accessed at the following link:
  - **https://github.com/PatrickYang-5/MPC_drones**
- **My performance score on this project was 9.4/10.**

Design of XingT: A Human-sized Heavy-duty Bipedal Robot **11/2019-05/2023**

Position: Team Leader

Supervisor: Prof. Wenjie Song ***Beijing Institute of Technology***

- Designed a loadable and multi-mode bipedal robot with a height of range 0.9-1.2m.
- Designed the mechanical structure and perform optimization.
- Analyzed and compared symmetric five-bar linkage with traditional leg structures, and demonstrated the validity of symmetric five-bar linkage.
- Developed an active-passive compliant system for bipedal robots, which can **reduce the impact peak by 76% during the reliability tests** when falling from a height.
- Explored a low-cost method for ground reaction force (GRF) measurement: using four angle sensors and the model of passive compliant devices to calculate the GRF.
- Designed a bipedal walking control scheme based on offline trajectory generation and online trajectory optimization.
- Utilized Simulink to simulate the robot walking gait and verified the effectiveness of the control system, and **the robot's walking speed in simulation reached 0.6m/s.**
- Conducted experiments on the robot leg jumping ability, **the jump height reaches 0.95m, and forward speed reaches 0.3m/s.**
- Designed a **robot state estimation system** based on Extended Kalman Filter (EKF), and conduct experiments to verify its estimation performance.

Design and Fabrication of a Legged Robot Prototype: Phase II **07/2022-11/2022**

2022 Mitacs Globalink Research Internship

Position: Independent Researcher

Supervisor: Prof. Lionel Birglen ***École Polytechnique de Montréal, Canada***

- Designed a self-adaptive robotic leg based on Hoecken's linkage and pantograph.
- Conducted simulations of various linkage mechanisms, and developed an intuitive visual simulation program.
- Proposed a damping compliant method for adaptive structure of the pantograph, which can **significantly improve the flexibility of the adaptive structure**.
- Developed a mode-switch mechanism for adaptive structure.
- Designed and manufactured several prototypes utilizing diverse optimization metrics.
- Conducted experiments on robot's obstacles adaptive ability to approve that robot trajectory linearity has been significantly enhanced.

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Target Detection and Kinematic Reconstruction Based on Computer Vision **06/2021-08/2021**

2021 Summer Global Education, Academics, and Research Skills (GEARS) Program; Position: Team Leader

Supervisor: Prof. Andre Mazzoleni ***North Carolina State University, US***

- Designed a feature recognition and motion reconstruction system based on orthogonal vision.
- Established a visual processing system for the experimental environment to enhance the extraction of valid information.
- Built and trained an NN framework (R-CNN) to detect the chosen object, give the data of labeling, including location and size.
- Established the visual motion curve of the target object based on the information which include six degrees of freedom given by the orthogonal perspective.
- Utilized Structure from motion algorithm to reconstruct the 3D point cloud of the environment and target.
- Built a system that used computer vision algorithms to detect object automatically and finished 3D reconstruction of the motion, and reconstruction accuracy reached to 1cm.
- **My performance score was 98/100, ranking first in a group of 10, which was rated by *Prof. Andre Mazzoleni* and Administration of North Carolina State University.**

Intelligent control methods for robotic arms **02/2024-04/2024**

Position: Independent Researcher

Supervisor: Dr. C. (Cosimo) Della Santina ***Delft University of Technology***

- Based on the Intelligent Control Systems course, using Python to train LNN (Learning Neural Network) for obtaining the dynamic model of a robotic arm.
- Developed a torque controller based on the robotic arm's dynamic model using PD and gravity compensation control, and compared it with PD and PD+ methods.
- Used Gaussian Processes to train the robotic arm for feedback control.
- **My performance score on this project was 9.2/10.**

Intelligent Vehicle Navigation Algorithm Design Based on Neural Network Algorithm and Genetic Algorithm **03/2022-07/2022**

Position: Independent Researcher

Supervisor: Prof. Chen Chen ***Beijing Institute of Technology***

- Proposed an evolutionary neural networks (E-NN) for vehicle navigation system based on LIDAR
- Used fusion intelligence algorithms based on E-NN to process the LIDAR output data and gained the proper vehicle control signals.
- Optimized the key parameters of the intelligent system (way of iterations, number of children generation, probability of variation, etc.) to obtain the fastest and most accurate convergence results.
- Designed a visual ploting tool on Matlab to visualize the vehicle model, sensor data acquisition process and the environmental information.

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- Carried out the simulations, and results showed that the vehicle model can achieve full path tracking operation in about 10 generations in the regular track, and can achieve full path tracking in about 50 generations in the sinusoidal track.

Honor

- First Prize, BIT Century Cup Science and Technology Competition 09/2022
- First Prize, National College Mechanical Innovation Competition 07/2022
- First Prize, BIT Mechanical Innovation Competition 01/2022
- Third Prize, BIT Century Cup Science and Technology Competition 09/2021

Others

- Programming Languages C++, Python
- Tools Matlab, Simulink, ADAMS, SolidWorks, Keyshot, LabView, Multisum, etc.
- Framework Linux, ROS, PyBullet