**Honghao Zhu**
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## EDUCATION

**Carnegie Mellon University** Pittsburgh, PA
***Master of Science in Mechanical Engineering-Research*** | GPA: 4.0/4.0 *May. 2023*
Selected Courses*: Robot Dynamics and Analysis, Robot Localization and Mapping, Computer Vision, Linear Control Systems, Engineering Computation (C++)*

**Georgia Institute of Technology, College of Engineering** Atlanta, GA
***Bachelor of Science in Mechanical Engineering, Minor in Computer Science*** | GPA: 3.67/4.0 (*Highest Honor)* *May 2022*

## RESEARCH PROJECTS

**Development of robust SLAM system under high robotic motion**, Pittsburgh, PA *Sep. 2022 – Present*
*Robomechanics Lab*

- Develop a novel LiDAR-inertial SLAM using IMU pre-integration and GTSAM backend optimization that ensure high robustness when robot is under high pitch motion.
- Build a test robot in Gazebo ROS that has varied head pitch motion to simulate high robot dynamics.
- Test LiDAR-inertial SLAM in simulation and real world; Analyze absolute pose error on different pitch frequency.
- Integrate IMU measurement to conduct IMU only odometry to assist LiDAR odometry when features are sparse; Use IMU odometry exclusively and train a learning framework that uses robot gait as a constraint to propagate IMU covariance.
- Facilitate the development of robots capable of maintaining reliable localization and mapping in extreme outdoor environments that induce high dynamic motion for robots.

**Risk aware off-Road driving adaption**, Pittsburgh, PA *June. 2022 – Sep. 2022*
*Robomechanics Lab*

- Embedded implementation using Python with the robot to ensure real-time ROS communication and optimize pipeline flow.
- Conducted extensive field experiments with a four-wheeled robot using GPS RTK.
- Resulted in 41% improvement in lap time using implemented adaptive model over non-adaptive baseline model while maintain safe driving all across.
- Submitted to *International Conference on Robotics and Automations (ICRA)* 2024, under review. arXiv | Video

**Graffiti on canvas using a Franka Emika Panda robotic arm**, Atlanta, GA *Aug. 2021 – Aug. 2022*
*BorgLab*

- Simulated painting on canvas and dipping paints with a robotic arm using ROS MoveIt and Gazebo.
- Wrote Python packages, including GTDynamics and IKFastPy to solve forward and inverse dynamic and kinematic equations to control the trajectory of the robotic arm.
- Demo video of robotic arm painting link

**Lower-limb exoskeleton for improving healthy and impaired human locomotion**, Atlanta, GA *Aug. 2019 – Dec. 2019*
*GaTech Power Lab*

- Collected, processed and analyzed data using Motion Capture and Vicon; recorded the movements of experimental subjects' calf muscles by ultrasonic scanning and conducted deep learning by image.
- Analyzed the collected data to determine the robotic device's availability in different age groups (18-65).

## WORK EXPERIENCE

**Midea Intelligence and Innovation Center**, Shanghai, China *Apr. 2021 – Aug. 2021*
*Architect intern; built the next generation multi-functional home robot*

- Created test standard sheets and tested sensors (e.g., LiDARs and RGB-Ds) from different companies; reduced company sensor budget by 40% by choosing the most cost-efficient plan based on testing results.

- Developed an early product prototype for elderly fall detection by experimenting on TI IWR6843ISK mmWave sensors.
- Built ROS environment for evaluating myCobot Pro robotic arm; wrote Python scripts to capture RGB and depth of images to generate point cloud for 3D perception learning model.

## ACADEMIC AND RESEARCH PROJECT

**Space Explorer Video Game**, Pittsburgh, PA *Sep. 2022 – Dec.2022*

- Designed a spacecraft combat video game using C++with openGL library.
- Programmed the movement of spacecraft in 3D space and mechanism of shooting missile using geometry; Loaded 3D models using shape and mesh; Added sound effect of explosion when spaceship hit the target; Completed the project in team of 4.
- Presented a demo in final presentation in front of 12 teams.

**Space Capsule Capstone Project**, Atlanta, GA *May. 2022 – Aug. 2022*

- Designed space capsules for next generation space delivery.
- Prototyped space capsule using Solidwork and 3D printing.
- Conducted material selections for space capsule using GRANTA EduPack.
- Designed a pogo pin plate to enable communication with BUS and magnetic connection for docking mechanism; Completed the project in team of 6.
- Video link

**Automated Wheel System Design Project**, Atlanta, GA *Aug. 2021 – Dec. 2021*

- Designed an autonomous system using fabrication and Arduino programming.
- Built an autonomous wheel system controlled by Arduino by sketching the design, 3D modeling, fabrication (e.g., laser cutting) and 3D printing with a team of four; the autonomous system includes a scissor lift that can raise an object up to 100 inches, launch and place the RC cars into the center.
- Competed in a final competition in December 2021with ~60 other teams; placed 20/60 teams.

**Machine Learning Subject Research**, Atlanta, GA *Sept. 2020 – Dec. 2020*

- Predicted music genres for emotion analysis with machine learning.
- Imported ~3600 lyrics databases on the Internet using Genius API, then used Python to delete punctuation and stop words; trained the analyzer using supervised algorithms such as Gaussian Naive Bayes, Linear and Lasso Regression to predict music genres.
- Designed 12 graphics to visualize the data and results using Matplotlib and Seaborn; present PPT for video performance with other 47 groups.
- GitHub repository link

**Gameboy Game Project**, Atlanta, GA *Mar. 2020 – Apr. 2020*

- Programmed an arcade game with C language in GBA Simulator
- Designed and built game roles with different attributes such as health status, speed and positions; programmed the Gameboy's physical logic and designated order keys; downloaded pictures for game background; achieved O(1) solution to avoid image defect.

## SKILLS

**Programming**: MATLAB, Java, Arduino, C/C++, Python, Git, ROS, Gazebo
**Prototyping**: SolidWork, HSMWorks, 3D Printer, Basic Fabrication
**Office and Design**: Word, LaTeX, Excel, PowerPoint, Adobe
**Spoken language**: Chinese, English, German (elementary proficiency)