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 2024*

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*)   *Jul. 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 2023 – Sep. 2023*

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.
- *International Conference on Robotics and Automations (ICRA)* 2024, Accepted. 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)