Honghao Zhu

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Research Interest

I am focused on enhancing the capabilities of robots across various environments and enabling them to successfully tackle challenging tasks. My specific interest lies in implementing SLAM (Simultaneous Localization and Mapping) with sensor fusion techniques to ensure both robustness and real-time operational efficiency.

EDUCATION

Carnegie Mellon University, Carnegie Institute of Technology Pittsburgh, PA
Master of Research in Mechanical Engineering | GPA: 4.0/4.0 *Aug. 2022 - Present*

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

RESEARCH EXPERIENCE

Shaky Perception, Pittsburgh, PA *Sep. 2022 – Present*
Development of robust SLAM system under high robotic motion| Advisors: Dr. Aaron Johnson

- 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.
- Implement algorithms using C++ and test LiDAR-inertial SLAM in Gazebo ROS simulation and real world.

Off-Road Trajectory Planning, Pittsburgh, PA *June. 2022 – Present*
Off-Road autonomous driving with 4-wheeled robots using MPPI trajectory planning on different context surface | Advisors: Dr. Aaron Johnson

- Embedded implementation using Python with the robot to ensure real-time ROS communication and optimization pipeline flow.
- Conduct extensive field experiments with GPS RTK

Robotic Painting, Atlanta, GA *Aug. 2021 – Aug. 2022*
Graffiti on canvas using a Franka Emika Panda robotic arm | Advisors: Dr. Frank Dellaert

- 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

Undergraduate Research Assistant, **GaTech Power Lab**, Atlanta, GA *Aug. 2019 – Dec. 2019*
The development of lower-limb robotic devices for improving both healthy and impaired human locomotion

- 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

Architect Intern, **Midea Intelligence and Innovation Center**, Shanghai *Apr. 2021 – Aug. 2021*
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*

Design 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.

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

Design an autonomous system using fabrication and testing and compete in the final competition

- 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*

Exploration of predicting 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: https://github.com/adrienzhh/Machine-Learning-LyricsProject#readme

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.

Internet of Things Design Project, Atlanta, GA *Aug. 2019 – Dec. 2019*

Designed a wearable device that detects force consumption and predicts muscle strain for running players

- Transferred user data collected by the device to the server (device monitored striking force between users' feet and the ground).
- Designed the conceptual renderings of an app to suggest activity duration and frequency to runners; presented the team report with 5 other teams.

SKILLS

Programming: MATLAB, Java, Arduino, C/C++, Python, Jupyter Notebook, Git, ROS, Gazebo
CAD: SolidWork, HSMWorks, 3D Printer
Office and Design: Word, LaTeX, Excel, PowerPoint, iMovie, AdobeXD
Interests: Basketball, rowing, traveling, cuisine