

Haoyu Shen

✉ haoyus@andrew.cmu.edu ☎ 412-566-3821 📍 401 Shady Ave, Pittsburgh, PA 🌐 haoyus 📧 haoyushen

EDUCATION

- **Carnegie Mellon University** Aug 2023 – May 2025
Master of Science in Mechanical Engineering – Research; GPA: 4.00/4.00 Pittsburgh, PA
 - **Coursework:** Advanced Robotics, Computer Vision, Machine Learning, Autonomous Vehicles, Optimal Control
- **Southern University of Science and Technology** Aug 2019 – June 2023
Bachelor of Engineering in Robotics Engineering; GPA: 3.77/4.00 Shenzhen, China
 - **Coursework:** Robotics, Artificial Intelligence, Control Theory, Mechanical Design, Mathematical Logic

TECHNICAL SKILLS

- **Languages:** C/C++, Python, Java, Shell, Julia, Matlab, CUDA, $\text{\LaTeX}$
- **Robotics:** Robot Kinematics & Dynamics, SLAM, Path Planning, BLDC Motor Motion Control
- **ML Frameworks & Libraries:** TensorFlow, PyTorch, OpenCV, NumPy, Scikit-Learn, Issac Gym
- **Technologies & Tools:** Ubuntu, WSL, Git, Docker, ROS & ROS2, Jupyter, Vim
- **Mechanical Design & Manufacture:** CAD, SolidWorks, 3D Printing, Laser Cutting, Machining

EXPERIENCE

- **CMU CERLAB | UAV Group** Oct 2023 – Present
Research Assistant – Advisor: Prof. Kenji Shimada Pittsburgh, PA
 - **Systems Development:** Developed a light-weight(**2.5kg**) quadcopter with onboard computer, **3D LiDAR** and **RGB-D** camera for dynamic obstacle detection and tracking.
 - **Obstacle Detection:** Developed a **LiDAR-Visual** detector based on **DBSCAN** clustering, capable of effectively detecting dynamic obstacles within a **10m** range at **30 Hz**. The system leverages **sensor fusion** for enhanced accuracy and real-time performance.
 - **Obstacle Tracking:** Developed a robust and efficient obstacle-matching algorithm utilizing point cloud geometric features. Integrated a **Kalman Filter** for obstacle motion estimation, enabling robust dynamic obstacle tracking.
 - **SLAM:** Deployed a robust and efficient **LiDAR** Inertial Odometry on UAV and achieved stable indoor and outdoor environment localization. Applied backpropagation with the flight controller IMU to achieve **30Hz** odometry.

PROJECTS

- **3D Vision Rendering (CMU 16825) | PyTorch, CUDA** Jan 2025 – May 2025
Software Engineer – Advisor: Prof. Shubham Tulsiani Pittsburgh, PA
 - **3D View Generation:** Generated textured, multi-angle 3D views from object models using **PyTorch3D**.
 - **Neural Rendering:** Developed a differentiable pipeline implementing neural volume/surface rendering (**NeRF**, **VolSDF**) for improved visualization.
 - **Gaussian Splatting & Diffusion:** Integrated a 3D Gaussian splatting pipeline with SDS-based diffusion optimization to refine image and mesh quality in custom scenes.
 - **Point Cloud Processing:** Built a PointNet-based model for efficient point cloud classification and segmentation with enhanced local feature integration.
- **Autonomous Obstacle Avoidance UAV (CMU 16745) | MPC, OSQP** Jan 2024 – May 2024
Software Engineer – Advisor: Prof. Zachary Manchester Pittsburgh, PA
 - **MPC Formulation:** Minimized the reference tracking error and control effort, subject to quadrotor state, dynamic constraint, and obstacle constraint.
 - **Cost Optimization:** Applied the ellipsoid obstacle constraint for distance calculation and decreased the computational cost.
- **Battlecity Remastered (CMU 24780) | C++, OpenGL** Sep 2023 – Dec 2023
Software Engineer – Advisor: Dr. Soji Yamakawa Pittsburgh, PA
 - **Software Development:** Built 4 kinds of tank modules with accessible interfaces and various features based on **C++** and **OpenGL**.
- **Vehicle Control in Simulation (CMU 24677) | Python, Webots** Sep 2023 – Dec 2023
Software Engineer – Advisor: Prof. Ding Zhao Pittsburgh, PA
 - **Modern Control:** Designed a discrete-time infinite-horizon **LQR** controller to guide a vehicle in tracking a loop trajectory, achieving a maximum tracking error of **6.59m** and an average tracking error of **0.44m**.