(763) 327-4907
lee04484@umn.edu

Tzu-Hsien Lee

github.com/BenTzuHsien
https://bentzuhsien.github.io/

Research Interests

Mobile manipulation; data-efficient imitation learning for manipulation.

Education

M.S. in Robotics, University of Minnesota, Twin Cities 09/2023 - Present

- Advisor: Prof. Karthik Desingh
- Courses: Robot Vision, Computer Vision, Robotics, Deep Learning for Robotics, Optimal Estimation

B.S. in Mechanical Engineering, National Yang Ming Chiao Tung University 09/2018 - 06/2022

- Courses: Robotics, Object Oriented Programming, Microcomputer System and Lab, Nonlinear Control

Publications

- Tzu-Hsien Lee, Fidan Mahmudova, Karthik Desingh.
  "Learning Category-level Last-meter Navigation from RGB Demonstrations of a Single Instance."
  arXiv: 2512.11173, 2025.

Presentations

- **Poster Presentation**. "Learning Object-Centric Local Navigation from RGB Demonstrations." Midwest Robotics Workshop (MWRW), TTIC, Chicago, IL, June 2025.
- **Student Lecture**. "RGB-D Networks." CSCI 5980: Deep Learning for Robot Manipulation, University of Minnesota, Minneapolis, MN, November 2024.

Experience

Teaching Assistant, CSCI 5561: Computer Vision, University of Minnesota 09/2025 - Present

- Designed and maintained an automated grading system for coding assignments, enabling scalable and consistent evaluation of student submissions.
- Held weekly office hours and provided technical guidance on computer vision algorithms, deep learning models, and course projects.
- Contributed to midterm exam design and grading, and managed overall course grading logistics.

Research Graduate Student, RPM Lab, University of Minnesota, Twin Cities 09/2024 - Present

- Led the system design, real-robot data collection, and experimental evaluation for a research project resulting in an arXiv preprint on category-level visual navigation for mobile manipulation.
- Built and deployed pipelines for constructing and navigating semantically enhanced topological maps using foundation models, enabling spatially-aware planning and downstream manipulation on Boston Dynamics Spot robot.
- Created SpotStack, an open-source utility repository to streamline interface development and programming workflows for Boston Dynamics Spot robot, accelerating research iteration across the lab.
- Currently developing eye-in-hand perception pipelines to transfer one-shot imitation learning manipulation policies to a mobile manipulator, addressing viewpoint and perception challenges specific to gripper-mounted cameras.

Intern, Industrial Technology Research Institute 11/2022 - 02/2023

- Established an autonomous grinding line for irregularly shaped water faucets by independently designing force-adaptive trajectories using dual-robot arms and a force feedback sensor.
- Improved on-site calibration efficiency by designing a coordinate transformation algorithm for adaptive trajectory tuning.

Software Lead, NYCU Autonomous Underwater Vehicle (AUV) Team 02/2021 - 09/2022

- Spearheaded the design and implementation of the software architecture, control system, and navigation.
- Established a modular high-level/low-level robotics system by using an embedded system (STM32) for low-level attitude and motion control, and deploying ROS on Raspberry Pi and Jetson Nano for task planning and navigation.
- Reduced high-frequency noise in attitude estimation by 10% through implementing a gradient descent-based Madgwick filter on embedded hardware.
- Developed a real-time obstacle-aware navigation system by employing A* algorithm and sonar-based localization.

Selected Projects

One-Shot Imitation Learning via Visual Servoing
11/2024 – 12/2024

- Implemented a one-shot imitation learning framework for robotic manipulation based on a two-stage architecture combining object-centric visual segmentation and learned visual servoing.
- Implemented a U-Net–based segmentation module with FiLM conditioning and tiling, followed by a Siamese CNN visual servoing policy that predicts incremental end-effector motions.
- Evaluated the system in ROS Gazebo using a Kinova arm, demonstrating generalization to unseen objects under extremely limited data settings.
- Presented the work as a course poster for CSCI 5980: Deep Learning for Robotics.

Visual SLAM in Dynamic Environments
04/2024 - 05/2024

- Achieved 0.005 rad (rotation) and 0.36 m (translation) relative pose error by extracting and matching visual features using ORB and FLANN, and refining correspondences through RANSAC after filtering out moving objects.
- Improved SLAM robustness by employing scene flow and KL divergence to distinguish moving from non-moving dynamic objects, and reintegrating the latter into pose estimation.

LiDAR-guided Autonomous Mobile Robot in Unstructured Environments
04/2024 - 05/2024

- Achieved autonomous package delivery and exploration by developing a navigation system on real-world TurtleBot, using LiDAR-based feature extraction for perception and the Bug algorithm for path planning.
- Presented the work as a course poster for CSCI 5551: Robotics.

Object Assembly Using Visual Servoing
11/2023 - 12/2023

- Achieved accurate object assembly by implementing Iterative Closest Point (ICP) algorithm using visual features and establishing a robotic system in CoppeliaSim with two robot arms, each equipped with a camera.

Technical Skills

Languages: C, C++, Python, Matlab, Assembly, Java, JavaScript

Packages and Libraries: PyTorch, ROS, Gazebo, OpenCV, MySQL, Qt

Tools and Systems: Git, Docker, SolidWorks, Spot Robot, FANUC Robot, STM32, Raspberry Pi, Jetson Nano, Intel 8051