Yang-Lun (Alan) Lai

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EDUCATION

University of Michigan, Ann Arbor, MI, United States *Aug. 2021 — May 2023*
M.S.E. in Electrical and Computer Engineering (Robotics track) *(Expected)*
- Overall GPA: 4.0/4.0
- Coursework: Math for Robotics, Algorithmic Robotics, Mobile Robotics, Machine Learning, Deep Learning for Computer Vision, Navigation and Guidance of Aerospace Vehicles, Flight and Trajectory Optimization

National Taiwan University (NTU), Taipei, Taiwan *Sept. 2016 — June 2020*
B.S. in Biomechatronics Engineering
- Overall GPA: 3.78/4.30 (with Dean's Awards)
- Coursework: Dynamics and Control of Robots, Practical Data Structures and Algorithms, Introduction to AI and ML, Robot Vision

SKILLS

Software & Tool: Robot Operating System (ROS/ROS2), PyTorch, OpenCV, GTSAM, MATLAB, Simulink, Git, Docker
Programming: C++, Python, MATLAB   **Operating System**: Windows, Linux (Ubuntu)

WORK & RESEARCH EXPERIENCES

Isuzu Technical Center of America, Plymouth, MI, United States *May 2022 — Dec. 2022*
Advanced Engineering Intern – Autonomous Driving Software Team *(Expected)*
- Implemented spline interpolation and evaluated curvature for smoothing waypoints of the path planning component.
- Built the waypoints loader functionality based on ROS2 component for efficiently sending large messages between nodes.
- Improved localization accuracy by 10% by fusing GNSS/IMU data with LiDAR odometry based on Extended Kalman Filter.
- Created C++ unit test codes that achieved 90% code coverage for GNSS/IMU processing nodes based on GoogleTest.
- Developed ROS nodes for real-time deep learning-based monocular 3D object detector based on MMdetection3D toolbox.

Robots and Medical Mechatronics Lab (National Taiwan University), Taipei, Taiwan *Sept. 2019 — Feb. 2021*
Robotics Researcher
Project: Collaborative Motion System of the Collaborative Tea Harvesting Vehicle | *C++, Python, ROS* **[Video]**
- Implemented the PID-based visual servoing framework using RGBD camera for the robot to move side-by-side with human.
- Processed LiDAR data to detect the tea trees by RANSAC model-fitting algorithm and make the robot avoid collisions.
- Reduced the farmer's average physical loads by 85% and maintained the harvesting quality during tea harvesting.

Project: Navigation System of the Mobile Robot for Security Robot Competition | *Python, ROS*
- Applied Dynamic Window Approach (DWA) navigation algorithms to avoid collision and to navigate the mobile robot.
- Implemented the Frontier-based Exploration algorithm for the robot to explore in an unknown corridor.

SELECTED COURSE PROJECTS

Robot Localization using ORB-SLAM and Graph-Based Sensor Fusion| *C++, MATLAB, GTSAM* **[Video]** *Apr. 2022*
- Pre-processed a custom vision dataset (NCLT dataset) and applied the ORB-SLAM to get the trajectory of the robot.
- Solved the lost tracking problem by coupling wheel encoder using Levenberg–Marquardt algorithm for graph optimization.

Novel View Synthesis with Neural Radiance Fields (NeRF)-based Neural Networks| *Python, PyTorch* *Apr. 2022*
- Built a NeRF model from scratch to synthesize images showing the scene from new viewpoints unseen in the training set.
- Improved performance of peak signal-to-noise ratio (PSNR) by 15 % by adapting the architecture based on the FastNeRF.

Kinodynamic RRT Motion Planning for a Planar Hover-craft Robot | *Python, PyBullet* **[Video]** *Dec. 2021*
- Developed a kinodynamic motion planning algorithm based on the Rapidly-exploring Random Tree (RRT) with the best-input extension algorithm to search for a collision-free path in a 2D environment.
- Improved performance of computation time and path quality by 50% by increasing motion primitives for the algorithm.

Trajectory Prediction with Modern Machine Learning Models | *Python, PyTorch* *Dec. 2021*
- Applied Convolutional Neural Network (CNN) based and LSTM-based sequence-to-sequence learning models to predict the pedestrian trajectory based on the Euro-PVI dataset.

PUBLICATIONS

Conference Proceeding
- **Y.-L. Lai,** P.-L. Chen, and P.-L. Yen,"A human-robot cooperative vehicle for tea plucking,"in *2020 IEEE 7th International Conference on Control, Decision and Information Technologies (CoDIT)*, 2020.

Patent
- P.-L. Yen, H.-Y. Hsu, **Y.-L. Lai**, P.-L. Chen, and H.-Y. Chan. 2020. "Supporting Vehicle System." Taiwan Patent I737348, filed June 2020, and issued December 2021.