Tung Do

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EDUCATION

Master of Science, Electrical and Computer Engineering, emphasis in Robotics   Aug 2023 – May 2025
University of Michigan, Ann Arbor, MI, USA   GPA: 3.9/4.0
- Publication: *Lucid Dreamer: Multimodal World Model for Zero-Shot Policy Transfer in Multi-Agent Autonomous Racing*
- Supervisors: Prof. Ram Vasudevan, Prof. Katherine A. Skinner, Dr. Elena Shrestha
- Relevant Coursework*:* Embedded Control Systems, Self-Driving Cars, Computer Vision, Mobile Robotics, Math for Robotics, Machine Learning

Bachelor of Science, Electromechanical Systems Engineering Technology – Valedictorian   Aug 2018 – May 2023
California State Polytechnic University, Pomona, CA, USA   GPA: 3.7/4.0
- Thesis: *Autonomous/Remote Control Mecanum Wheels Tesla Roadster in real-world*
- Advisor: Prof. Scott Boskovich
- Relevant Coursework: C/C++, Robotics, Autonomous Vehicle, Feedback Control Systems, Digital Design FPGA, Engineering Graphics

ACADEMIC RESEARCH EXPERIENCE

University of Michigan, Ann Arbor, MI, USA
Graduate Research Assistant, **Field Robotics Group**   Dec 2023 - Present
Intelligent Navigation of Autonomous Maritime Robots
Supervisors: Prof. Katherine A. Skinner, Dr. Elena Shrestha
- Programmed the Unified Robot Description Format (URDF) model for the Unmanned Surface Vehicle (USV) and created the "world" model for the University of Michigan's Marine Hydrodynamics Lab using ROS2 and Gazebo Garden. This setup enabled the testing of autonomous functions and facilitated reinforcement learning research.
- Developed and implemented an object avoidance algorithm using Python and C++ and evaluated its performance in both real-world and simulated environments to refine tuning parameters for improved simulations.
- Conducted real-world tests to gather LIDAR, odometry, drive, velocity, and IMU data. Replicated the collected data in the simulation environment and currently focusing on analyzing and post-processing the data using Python.
- Fused the laser/scan frame with the odometry/filtered transform frame to compensate for the absence of the /tf topic in every run. Ensured accurate transformation between base_link, velodyne_base_link, and velodyne frames with correct timestamps. This was critical for using the hector_slam package to run SLAM in RViz for analyzing the trajectories.
- Extracted data and plotted the autonomous trajectories of all tests in the LIDAR scans. Evaluated the vehicle's ability to maintain a straight line in "straightline" tests and navigate through obstacles in "2 buoys" tests under different wave conditions.

Graduate Research Assistant, **Robotics & Optimization for Analysis of Human Motion (ROAHM) Lab**   Aug 2023 - Present
Lucid Dreamer: Multimodal World Model for Zero-Shot Policy Transfer in Multi-Agent Autonomous Racing
Supervisors: Prof. Ram Vasudevan, Dr. Elena Shrestha
- Developed waypoint-follower algorithm for multi-agent experiments using the 'cartographer_ros' package for map building and localization, contributing to the reinforcement learning experiment.
- Accelerated the project's progression to the testing phase by building and programming embedded control systems on STM32 VESC and Jetson TX2 board's Linux environment for a secondary autonomous rover. Successfully configured a basic teleoperation controller, conducted lidar scans, calibrated IMUs, and implemented SLAM using the cartographer. Resolved critical issues with cartographer_ros frame transformations, enhancing system reliability and performance.
- Participated in optimizing the board's performance to enhance the efficiency of semantic segmentation by reducing its callback duration by 5 times.

Robotics Researcher, *Hexapod Robot for Multi-Terrain Exploration*   Jun 2023 - Present
- Currently developing a Hexapod Robot project, aimed at designing a robotic system capable of navigating and exploring diverse terrain types.
- Focusing on the integration of advanced robotics principles, including mechanical design, locomotion algorithms, and sensory feedback systems, to enhance the robot's adaptability to various environments.

Robotics Researcher, *Enhancing Vision based SLAM through Shadow Removal Processing*   Feb 2024 – Apr 2024

Advisor: Prof. Maani Ghaffari

- Applied the SpA-Former algorithm on the KITTI and FinnForest datasets, analyzing its effectiveness compared to traditional shadow removal methods in dynamic and variable lighting environments.
- Collaborated with a research team to integrate and test advanced machine learning techniques in vision-based SLAM, demonstrating the benefits of using existing shadow removal algorithms to refine object detection and environment mapping.

Robotics Researcher, *Enhancing Monocular 3D Object Detection in Foggy Conditions: An Adapted MonoCon*   Oct 2023 – Dec 2023
Approach for Autonomous Vehicles
Advisor: Prof. Maani Ghaffari

- Led the enhancement of the MonoCon model using PyTorch, focusing on transfer learning and image processing techniques to improve 3D object detection in fog.
- Implemented the and fine-tuned advanced image augmentation and pre-processing strategies to enhance detection accuracy and robustness under varied weather conditions.

California State Polytechnic University, Pomona, CA, USA

Robotics Researcher, *Autonomous/Remote Control Mecanum Wheel Tesla Roadster in real-world*   Jan 2022 – Dec 2022
Advisor: Prof. Scott Boskovich

- Independently designed and fabricated a 1:6 scale model of a Tesla Roadster with mecanum wheels, integrating omnidirectional mecanum wheels to investigate enhanced mobility in electric vehicles for urban settings.
- Leveraged SolidWorks for the detailed design and manufacture of mecanum wheels, emphasizing the creation and assembly of wheel components for optimal functionality, while also engineering the overall vehicle to meet the scale model's specification and aesthetic requirements.
- Developed autonomous navigation and obstacle avoidance systems using Arduino, implementing sensors and control algorithms to enable smart vehicle functionalities.
- Constructed a dual-mode control system for the vehicle, facilitating both manual remote control and autonomous operations, and performed extensive testing to assess maneuverability and self-parking capabilities.
- Analyzed and refined the vehicle's design and functionality through iterative testing, optimizing the integration of mecanum wheels for improved maneuverability and space-efficient parking in urban environment.

PUBLICATIONS

- Shrestha, E., Wan, H., Do, T., Rawal, M., Singh, S., & Vasudevan, R. (2024). *Lucid Dreamer: Multimodal World Model for Zero-Shot Policy Transfer in Multi-Agent Autonomous Racing*. Submitted to IEEE International Conference on Robotics and Automation (ICRA).
- Wan, H., Kusumadjaja, K., Lee, S.H., & Do, T. (2024). *Enhancing Vision-based SLAM through Shadow Removal Preprocessing*. Unpublished manuscript, University of Michigan, Ann Arbor.
- Do, T., Liu, X., & Swayampakula, R. (2023). *Enhancing Monocular 3D Object Detection in Foggy Conditions: An Adapted MonoCon Approach for Autonomous Vehicles*. Unpublished manuscript, University of Michigan, Ann Arbor.
- Do, T. (2023). *Autonomous/Remote Control Mecanum Wheels Tesla Roadster in real-world*. Unpublished manuscript, California State Polytechnic University, Pomona.

PROFESSIONAL EXPERIENCE

PACCAR - Peterbilt Motors Company, PACCAR Innovation Center, Sunnyvale, CA, USA
Advanced Mobility Tech Engineering Intern   Jun 2024 – Aug 2024

- Successfully completed the 3D CAD design, prototyping, and testing of a fully functional tool changer for robotics, ensuring seamless operation and reliability.
- Designed, prototyped, and tested a self-aligning mechanism for the automatic docking and connection of critical systems in an industrial application, achieving precise alignment and reliable performance.
- Collaborated with my manager to refine concepts, ensure feasibility, and complete the bill of materials for industry-grade components, contributing to the overall success of the project.
- Completed embedded programming and control system integration using advanced control techniques, resulting in an automated solution for a key industrial process.

Northrop Grumman Collaboration Project, California State Polytechnic University, Pomona*,* CA, USA
Embedded Software Engineer, *Unmanned Aerial & Ground Vehicles (UAV & UGV)*   Aug 2022 – May 2023

- Developed Python scripts for the Jetson Nano computer to implement autonomous in-flight control on the Pixhawk controller. Successfully met the Northrop Grumman Demo's requirement by autonomously piloting the UAV at 200 feet from the ground for 10 minutes to scout the test area for wildfires and injured hikers.

- Programmed embedded software using Embedded C with STM32 microcontroller and developed ROS Python scripts for communication between two Raspberry Pi computers to wirelessly control the UGV over a range of 700ft. Achieved the Northrop Grumman Demo's objective of safely transporting the injured hiker back to the Ground Control Station.

PROJECTS

Advanced Driver Assistant Systems (ADAS) Simulation, University of Michigan, Ann Arbor, MI, USA

Embedded Software Engineer   Aug 2022 – Dec 2022
- Developed Embedded C code, block diagram, and S-function for implementing Manual Control, Adaptive Cruise Control, and Auto-Steering on the NXP S32 board. This setup controls car simulation in Simulink using a haptic wheel connected to an encoder DC motor.
- Developed embedded C code that enables communication with other car simulations via the CAN network. This allows for the mutual transmission of each car's position to be displayed on the screen.

Autonomous Robot Competition, California State Polytechnic University, Pomona, CA, USA

Robotics Engineer   Aug 2022 – Dec 2022
- Successfully designed the front bumper with the highest possibility for aerodynamics but still be able to keep the log in contact under a considerable velocity.
- Led a team of 6 people to win 2nd place in the competition. Our robot was praised as the best and most stable performance throughout the competition. The hardware never had any issues.

SKILLS

- Robotics: ROS, ROS2, Simulation (Rviz, Gazebo), Sensor Integration (LIDAR, Camera, IMU), SLAM, Machine Learning (PyTorch, TensorFlow), Control Systems (PID, MATLAB, Simulink), Computer Vision (OpenCV)
- Software: Python, C++, C, Linux, Bash/Shell Scripting, Git, Debugger, Docker
- Hardware: Microcontrollers (STM32, Arduino PLC), GPIO, ADC, PWM, Timer, ISR, RTOS, CAN, I2C, SPI, USART
- Mechanical: Creo Parametric, SolidWorks, 3D Printing, ANSYS FEA

HONORS & AWARDS

- Valedictorian: Electromechanical Systems Engineering Technology, California State Polytechnic University, Pomona (2023)
- International Student Award Scholarship: California State Polytechnic University, Pomona
- Dean's Honor List: 2019, 2020, 2021, 2022; President's Honor List: 2020, 2021

ORGANIZATIONS

- Robotics and Optimization for Analysis of Human Motion (ROAHM) Lab
- Field Robotics Group
- Tau Beta Pi - The Engineering Honor Society (TBP)
- Eta Kappa Nu - International Honor Society of Electrical and Electronics Engineers (IEEE-HKN)
- Institute of Electrical and Electronics Engineers (IEEE)