MING–YUAN YU

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EDUCATION

University of Michigan, Ann Arbor, MI September 2016 – December 2021
Doctor of Philosophy in Robotics (GPA: 3.93/4.00)

University of Michigan, Ann Arbor, MI September 2014 – April 2016
Master of Science in Mechanical Engineering (GPA: 3.87/4.00)

National Taiwan University, Taipei, Taiwan September 2009 – June 2013
Bachelor of Science in Mechanical Engineering (GPA: 90.08/100)

WORK EXPERIENCE

The Future Tech Team, Ford AV LLC. March 2022 – Present
Mapping and Localization Engineer *Ann Arbor, MI*

- Designing a mapping toolbox for LiDAR point clouds.
- Developing algorithms to remove dynamic objects from the map.
- Reconstructed a 3D map of size 500m×1000m for an autonomous food delivery shuttle.

The Avante LiDAR Team, Qualcomm Inc. June 2020 – August 2020
Interim Engineering Intern *San Diego, CA*

- Developed a deep neural network to estimate the ground height from LiDAR point clouds in the SemanticKITTI dataset.
- Applied random sample consensus (RANSAC) with a planar model to improve robustness of the network in low-density regions.
- Achieved sub-voxel accuracy on maps in the test set.
- Generated dense representations on city-scaled maps in the SemanticKITTI dataset.

RESEARCH EXPERIENCE

UM & Ford Center for Autonomous Vehicles (FCAV) September 2016 – December 2021
Graduate Student Research Assistant *Ann Arbor, MI*

- Developed an unsupervised convolutional neural network (CNN), running 47× faster than previous state-of-the-art methods, to de-noise LiDAR point clouds collected during snowfall.
- Achieved a 7.30% improvement in precision and a 4.64% improvement in intersection-over-union for de-noising.
- Developed a real-time algorithm to quantify potential risk for autonomous driving in heavily occluded urban environments from LiDAR data.
- Proposed a planning algorithm using the quantified risk for safe navigation at unsignalized intersections.
- Reduced the collision rate by 4.8× compared to traditional occlusion-unaware methods.
- Facilitated data collection of the publicly available PedX dataset.
- Calibrated stereo cameras and Velodyne HDL-32E LiDARs on an autonomous vehicle.
- Containerized projects including Cartographer ROS, OpenPose, and pix2pix, for easy deployment, high modularity, and reproducibility using Docker.

Self-driving Cars: Perception and Control Fall 2017, Fall 2018
Graduate Student Instructor *Ann Arbor, MI*

- Hosted Kaggle challenges for object detection in autonomous driving in classes of more than 200 students.
- Instructed algorithms including iterative closest point (ICP), simultaneous localization and mapping (SLAM), and convolutional neural networks (CNNs) such as VGG, ResNet, Mask-RCNN.
- Guided students to train and evaluate neural networks on Amazon Web Services.

Bio-inspired Robotics Laboratory (BioRoLa) March 2012 – May 2013
Undergraduate Independent Study *Taipei, Taiwan*

- Developed a bio-inspired wall-climbing robot with National Instruments Single-Board RIO and LabVIEW.
- Designed the mechanisms of the robot using SolidWorks and AutoCAD.
- Studied the dynamics of the robot using Lagrange's equations.

PROJECTS

Densely Annotated VIdeo Segmentation (DAVIS) Challenge   March 2017 – April 2017

- Achieved better results in contour accuracy measurement both in mean (+3.5%) and recall (+0.7%) compared to the best performers on the online leaderboard.
- Developed a dual-frame fully convolutional network (DF-FCN) based on VGG16.
- Trained the DF-FCN with an additional adversarial loss to improve the quality of the results.

Two-wheeled Self-balancing Robot   November 2016 – December 2016

- Designed and assembled a two-wheeled self-balancing robot with aluminum extrusions, DC motors, an inertial measurement unit (IMU), and a BeagleBone Black.
- Implemented a PID controller for pose balancing.

Autonomous Exploration by a Differential Drive Robot   October 2016 – November 2016

- Designed a PID controller for a differential drive robot to navigate between waypoints.
- Implemented the A* algorithm to plan paths in a 2D map.
- Validated a SLAM algorithm that builds an occupancy grid map in an enclosed space.

Control and Automate Tasks with a Robot Manipulator   September 2016 – October 2016

- Implemented an object detection algorithm with an RGB camera.
- Derived forward and inverse kinematics for the robot manipulator.
- Implemented a path planning algorithm to generate trajectories in the configuration space.
- Constructed a finite state machine to fully automate grabbing multiple objects to a target location.

PUBLICATIONS

- Ming-Yuan et al., "LiSnowNet: Real-time Snow Removal for LiDAR Point Clouds," in 2022 International Conference on Intelligent Robots and Systems (IROS)
- Ming-Yuan et al., "Risk Assessment and Planning with Bidirectional Reachability for Autonomous Driving," in 2020 IEEE International Conference on Robotics and Automation (ICRA).
- Ming-Yuan et al., "Occlusion-Aware Risk Assessment for Autonomous Driving in Urban Environments," in IEEE Robotics and Automation Letters, April 2019.
- Ming-Yuan (third author) et al., "PedX: Benchmark Dataset for Metric 3-D Pose Estimation of Pedestrians in Complex Urban Intersections," in IEEE Robotics and Automation Letters, April 2019.
- Ming-Yuan Yu (second author) et al., "Learning Rotation-Invariant Representations of Point Clouds Using Aligned Edge Convolutional Neural Networks," in 2020 International Conference on 3D Vision (3DV), pp. 200-209. IEEE, 2020.
- Ming-Yuan (second author) et al., "Clock-Torqued Rolling SLIP Model and Its Application to Variable-Speed Running in a Hexapod Robot," in IEEE Transactions on Robotics, Dec. 2018.
- Ming-Yuan et al., "Trotting horses synchronize their legs during the second half of stance." INTEGRATIVE AND COMPARATIVE BIOLOGY. OXFORD UNIV PRESS INC, 2016.

SKILLS

Applications: LiDAR, TensorFlow, PyTorch, Docker, Robot Operating System (ROS), Virtualization.
Programming Languages: Python, MATLAB, C/C++.