Curriculum Vitae / Resume - Terry Tao

Graduate Program - Robotics

**University of Michigan - Ann Arbor** **|** Ann Arbor, MI Sept 2022 – Expected April 2025

**B.S.E Robotics Engineering | GPA 3.8 / 4.0**

* **U.S citizen. Senior in Robotics, applying for Robotics SUGS starting F25**

**Formula SAE (MRacing) |** Ann Arbor, MI Sept 2022 – Present

**Autonomous Director (3 years) + Founder of Autonomous System**

* Leading a team of 35 members, including 4 subsystem leads
* System Overview: Jetson Orin, Novatel RTK INS, Ouster LiDAR, Stereolabs camera, custom power + interface board, manual e-stop, model-based optimal controls, emergency pneumatic brakes, electronic power steering
* **Managed sponsorships of over $40,000 worth of camera, LiDAR, GNSS and processing hardware**

**Freshman Year:**

* **Trained a YOLOv7 traffic cone detector to achieve 90% accuracy and 8ms inference time**
* **Wrote a ROS driver for stereo 3D object detection with a custom TensorRT model, tested to be accurate for cones up to 10m**

**Sophomore Year:**

* **Mounted two inexpensive low-resolution 32 channel LiDARs with a 0.66° pitch difference to increase vertical resolution and achieve the same range (detect traffic cones up to 25m) as a much more expensive higher resolution LiDAR**
* **Transitioned to planar RANSAC from Patchwork++ (learning based ground removal) to decrease false negative rate by 70% and improve LiDAR inference time by 60%**
* **Validated mapping algorithm with real driving data, achieved a 0.1m covariance between measured map and ground truth**

**Junior Year:**

* **Modelled a FORCESPRO nonlinear model predictive controller to obtain a 5s skidpad time in simulation**
* **Ensured 50% braking performance under any single point failure with DFMEA and failure tree analysis after designing e-brakes**
* **Designed Jetson-to-vehicle interface board to handle power distribution, ADC, autonomous system state logic, shutdown circuit relays, status indicators, and several CAN to USB devices through a custom USB hub**

**H3D Gamma** **|** Ann Arbor, MI May 2024 – August 2024

**SLAM Intern**

* Automated extrinsic lidar-camera alignment for H3D’s Jetson environment using a targetless method
* Advised H3D to not fuse GNSS and instead solely rely on the INS after evaluating GNSS as a source of odometry within Cartographer
* Decreased Cartographer CPU runtime by 50% by building OpenBLAS from source with ARMv8 optimizations
* Simulated radiation in a Nav2 and Gazebo environment to test control policies for a future radiation mapping robot.
* Tested a centroid-sampling-based frontier exploration policy to search any indoor environment for radiation in simulation

**Ford Motor Company** **|** Allen Park, MI May 2023 – August 2023

**ADAS L3 Self Driving Intern**

* Flagged DOC (Duty of Care safety envelope) violation events during L3 test drives using a custom vehicle deceleration model
* Compared driving policies based on DOC violation frequency to find which policy had an acceptable risk for Ford
* Synchronized CAN logs with INS logs by automating data acquisition and post processing to determine root cause of flagged events

**Ground Effect Plane Controls | Class Project** Fall 2023

* **Combined ground effect dynamics with traditional fixed-wing 6DOF model in MATLAB and Simulink to solve EOMs**
* **Decoupled the altitude, airspeed, and heading controllers to make tuning of nested PID controllers more straightforward**
* **Result is a simulated plane capable of navigating any set of waypoints in order, at a setpoint altitude of 5m above water under reasonable wave and wind disturbances**

**SLAM Robot | Class Project** Fall 2023

* **Applied a model-based state estimator, LiDAR occupancy grid mapping, particle filter for fusing, and an exploration policy**
* **Result is a robot capable of mapping out a small maze and finding the exit autonomously**

**Stewart Platform (6DOF parallel manipulator) | Personal Project** 2021

* **Designed, built, tested manipulator that has 6 hobby servos, 6 linkage rods, 12 ball joints and mostly 3D printed parts**
* **Solved for the inverse kinematics and controlled position of end effector using PID on an Arduino microcontroller**
* **Dampened the acceleration on end effector in all axes using measurements from an IMU with a closed loop controller**

**Java | Python | C++ | OpenCV | ROS1&2 | Julia | Git | MATLAB | Pytorch | Simulink | LaTeX | EKF | Regression**

**Solidworks | Siemens NX | Fusion 360 | YOLO | NVIDIA Jetson| Canalyzer | Ubuntu | CAN | RTK GNSS (RTCM) | SSH**