Wenzhe Tong

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EDUCATION

University of Michigan, Ann Arbor, MI   Aug. 2021 – Apr. 2023
M.S.E. in ECE&ME, GPA: 4.0/4.0
- **Core Courses:** Math for Robotics, Linear System Theory, Mobile Robotics, Introduction to Algorithmic Robotics, Flight and Trajectory Optimization, Machine Learning, Experimental UAV Design, Self-driving Cars: Perception and Control.

University of California, Berkeley, CA   Aug. 2019 – Sept. 2020
Visiting Student in EECS & ME, GPA: 3.73/4.0
- **Core Courses:** Robotic Manipulation and Interaction, Feedback Control Systems, Hybrid Systems and Intelligent Control, Machine Learning, Mechatronics Design, Geometry and Learning for 3D Vision.

Harbin Institute of Technology, Weihai, China   Aug. 2017 – June 2021
B.S. in Robotics, GPA: 89.00/100 (ranking top 3%)
- **Awards:** National Scholarship (top 0.2% in China)

PUBLICATION

- "Fully Proprioceptive Slip-Velocity-Aware State Estimation for Mobile Robots via Invariant Kalman Filtering and Disturbance Observer", X. Yu, S. Teng, T. Chakhachiro, **W. Tong**, T. Li, T. Lin, S. Koehler, M. Ahumada, J. M. Walls and M. Ghaffari, *submitting to IEEE International Conference on Robotics and Automation (ICRA) 2023.*[Arxiv]

- "A Quadrupedal Robot Leading Human with Leash-Guided Hybrid Physical Interaction", A. Xiao*, **W. Tong***, L. Yang*, J. Zeng, Z. Li and K. Sreenath, *IEEE International Conference on Robotics and Automation (ICRA) 2021.*[Arxiv] **(Best Service Robotics Paper Finalist at ICRA 2021)**

RESEARCH

Slip-Velocity-Aware State Estimation for wheeled robot | CURLY Lab @ UMich   Jan. 2022 – now
Research Assistant; *Advisor: Prof. Maani Ghaffari*
- Developed **wheel slip detector** using the invariant observer and disturbance observer for Husky mobile robot.
- Developed state estimator using Right Invariant Extend Kalman Filter, which provides real-time accurate body velocity and wheel slip velocity estimates on different terrains.

Leash-Guiding Quadrupedal Robot | Hybrid Robotics Lab @ UC Berkeley   Mar. 2020 – Nov. 2020
Research Assistant; *Advisor: Prof. Koushil Sreenath*
- Designed a sensor suite for the MIT Mini Cheetah quadruped robot. Deployed **planning, perception and communication** for robotic guide dog based on ROS and LCM.
- Formulated the first hybrid physical **human-robot-interaction(pHRI) motion planning framework** for autonomously navigating and leading a visually-impaired person by leash.
- Built a mixed-integer programming problem in the local path planner to safely lead a human to avoid obstacles based on the robot-leash-human model.

INTERNSHIP

Industrial AGV Localization and Mapping | BOSCH GmbH, Shanghai   Dec. 2020 – May 2021
Software Engineer Intern; *Advisor: Dr. Marc Patrick*
- Developed top-down view **localization** and **mapping** algorithms for industrial AGVs. Adding UWB indoor positioning system for VIO drift correction, improved 70% accuracy evaluated by EVO with MoCAP system.
- Implemented Lidar 3D visibility voxel mapping algorithm with *Octomap* package for **urban autonomous driving**.

PROJECT

Neural Landing Controller for Quadcopter | FLY Lab @ UMich   Jan. 2022 – May 2022

Project Leader; *Advisor: [Prof. Peter Gaskell](#)*

- Assembled quadcopter from parts to whole, soldered ESC, motors and power distribution boards. Identified thrust map, mass, MoI for controller. Developed a PID **hovering controller** using *C* and *librobotcontrol* package in BeagleBone.
- Designed a trajectory generator and PID follower given waypoints using indoor MoCAP system.
- Implemented smooth landing maneuver by **compensating the estimated ground effect** from our pre-trained neural networks. Which uses only several take-off and landing datasets, recorded with indoor MoCAP system.

Motion & Grasp planning for Bi-Manual humanoid robot   Sept. 2020 – Dec 2021

- Developed gripper position controller, joint angle controller and joint torque controller for bi-manual robot arm.
- Implemented **search-based planner** (A*, ANA*, ARA*) for PR2 bi-manual mobile robot platform and **sample-based motion planner** (RRT, RRT-connect, bi-RRT, RRT*, informed-RRT*) for PR2's robot arm in *pybullet* simulation.
- Implemented novel optimization-based collision-free grasping metrics, which discretized the friction cone to convex polygons. Encoded all the constraints for the grasping planner in *Python* with *cvxpy* package. Tested object grasp motion by executing grasp metrics, motion planner, and low-level controller with PR2.

Automatic Book Scanner | ME102B: Mechatronics Design @ UC Berkeley   Sept 2019 – Dec 2019

- Designed a book page flipping and flattening structure for the book scanner, manufactured and assembled mechanical components in the college machine shop.
- Integrated electrical control systems, including Arduino, servos, step motors and sensors into the book scanner for the book page flipping and flattening function.
- Implemented image capture, distortion correction and image enhancement callback functions for a USB camera with OpenCV in ROS.

Auto-aiming Pellet Launcher UAV | HIT-UAV Lab&HERO @ HIT, Robomaster National Robotic Competition

Team leader; *Advisor: Prof. Mingjian Sun, Prof. Tong Yao*   Feb. 2018 – Aug. 2019

- Designed and analyzed the quadcopter mechanical structure using SolidWorks and ANSYS, designed the lightweight and robust auto-aiming pellet launcher gimbal payload using carbon fiber sheets.
- Enhanced pellet launching accuracy to 90% by applying Kalman filter to IMU and encoder data, developed auto-aiming framework including detection and tracking with OpenCV. Designed flight data playback workflow using Python and *matplotlib*.

SKILLS

- **Languages**: C++, C, Python, MATLAB, Latex, HTML, SQL.
- **Tools**: ROS, Linux, Git, Docker, Gazebo, CUDA, LCM, SSH, MoCAP.
- **Packages**: numpy, cvxpy, CasADi, pytorch, pybullet, Eigen, OpenCV, Octomap.

HONORS

- Best Service Robotics Paper Finalist at ICRA 2021   2022
- Provincial Outstanding Graduate Student   2021
- First Prize in Course Coding Competition "Scheme Art Contest" (1/59 teams)   2020
- First Prize in Robomaster Northern China Robotic Competition   2019
- Second Prize in Robomaster National Robotic Competition   2019
- National Scholarship   2018

INTERESTS

- RC model planes, aerial photography, cooking.
- Sports: Snowboarding, table tennis, badminton.