Yuchen Zhang

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OBJECTIVE & RESEARCH INTERESTS

Become a research scientist in robotics to develop algorithms that would enable robots to locomote in current infrastructure, a prerequisite for performing manipulations. Specifically, I am interested in robot locomotion in unmodeled environments and online adaptation that accounts for model inaccuracies/hardware changes over time. Especially, I am interested in real-world verification of ideas.

EDUCATION

University of California, San Diego
BS, Electrical Engineering Expected Jun. 2023

- Overall GPA: 3.972

PUBLICATION

1. Imai, C., Zhang, M., **Zhang, Y.**, Kierebinski, M., Yang, R., Qin, Y., & Wang, X. (2021). Vision-Guided Quadrupedal Locomotion in the Wild with Multi-Modal Delay Randomization. *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. [arxiv][website]

RESEARCH EXPERIENCE

Existential Robotics Laboratory, San Diego, CA **Summer.2022-present**
Researcher, *Advisor: Nikolay Atanasov*

- Tuning visual odometry algorithm DSOL for localization used in research. Produced code for photometric calibration of stereo cameras, which reduced closed loop error by 12%.
- Assembled drone based on PX4 and revised position control code on onboard computer. Added safety takeover functionality.
- Evaluated odometry algorithms' performance (MSCKF, DSOL) using Vicon motion capture system. Compiled findings as report.

Xiaolong Wang's Lab, San Diego, CA **Summer.2021-Spring.2022**
Summer research Intern, ***Advisor: Xiaolong Wang***

- Handled transfer of trained policy in simulator to unitree A1 robot: Overseen the process of real sensor input to match that in the training environment, developed a delay-sensitive structure to execute policy, and collected data of interest.
- Self-studied basics of reinforcement learning via CS234 by Stanford online.
- Collected experiment data for paper *Vision-Guided Quadrupedal Locomotion in the Wild with Multi-Modal Delay Randomization* [arxiv] with other team members. Accepted to IROS22.
- Learned to use Isaac Gym – a parallel simulation environment for efficient reinforcement learning research.

ROBOTICS EXPERIENCE

Yonder Dynamics, San Diego, CA **Sep.2019-Spring.2021**
Software team member

- Developed simulation environment in gazebo, including a desert terrain and the URDF description of the rover. Set up multiple sensors with gazebo plugin, including IMU, camera, GPS, and stereo camera.
- Developed localization module capable of fusing IMU, GPS, magnetometer, and air pressure data into pose and twist.

FRC 5449 & FTC 12527, Beijing, China **Jul.2012-Sep.2019**
Co-captain, programming lead, robot driver

- Led the software team (~8 people) over 5 years of FTC & FRC competition. Held group meetings, discussed plans, and trained new members at the beginning of each season. Learned ideas such as linear algebra and vector mathematics first and introduced them to my fellow members.

- Implemented various features/algorithms on robots, including PID control, motion planning & following, and localization based on odometry + computer vision (OpenCV).
- Automated remote control with sensors to reduce the pressure of robot drivers during competition.
- Volunteered to translate some of the rule videos.

SELECTED PROJECTS

1. Quadcopter drone hardware & software design (CSE176E project):
Instructor: Steven Swanson

- Designed 4-layer board for our mini- quadcopter (~14 cm in diagonal).
- Implemented height estimation based on fusing accelerometer with pressure sensor via Kalman filter.
- Modeled single axis dynamics in Simulink and used it to guide the PID tuning.
- Achieved stable flight enough to consume entire battery life (demo).

2. Reinforcement learning for quadruped robot using Isaac Gym (ECE276C final project)
Instructor: Michael Yip

- Proposed a network architecture modification that proved in simulation to combine the strength of low-level controllers for velocity tracking and dash tasks. The result shows my modification with a simple network (MLP) is worse than state-of-the-art Google's MPC controller, but better significantly compared to MLP without my modification. [link]

3. Dual channel field-oriented controller for BLDC motor torque control (DIY project)

- Designed high speed current shunt sensing & 3 phase half bridge.
- Implemented FOC mathematics and PID controller on STM32.
- Fine Tuned parameters with Simulink.

4. Blind Deconvolution via Convex Programming (ECE273 Course project)
Instructor: Piya Pal

- Recreated result in paper *blind deconvolution using convex programming* with rigorous proof on its convex relaxation steps. [report link]
- Compared blind deconvolution with non-blind problem.

5. XIMU – compact localization module with ROS interface (Yonder Dynamics)

- Designed PCB to hold all sensors compactly.
- Implemented ESKF algorithm onboard.
- Ported rosserial to enable interfacing with ROS.

6. Handheld Gimble – STM32 driven 3-axis BLDC phone stabilizer (DIY project)

- Surveyed components and selected DRV8313 as inverter driver. Designed PCB using Altium Designer. Designed structure via Solidworks.
- Developed inverse kinematics to obtain joint angles from orientation difference sensed by 2 IMUs located on the body and terminal. Implemented the algorithm and a library for 3D rigid body rotation in C. Generated SPWM pules using TIMs to drive the BLDCs. (demo)

SKILLS

- **Programming Language:** C++, Python, C, MATLAB, Java
- **Robotics:** ROS, OpenCV, Eigen, NumPy, PyTorch, Isaac Gym, PyBullet
- **Embedded system design:** PCB designing & manufacturing, STM32, Arduino. Interfacing with Simulink.
- **Prototyping:** CAD (Inventor, Solidworks), 3D printing (also hobby), fine tuning of 3D printers.
- **Theory:** reinforcement learning, sensing & estimation in robotics [course projects], linear system control theory, advanced data structure, convex optimization, real analysis, abstract algebra

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AWARDS

alwaysAI award, 2020 H.A.R.D. Hacks, UCSD	San Diego	2020
FRC Innovation in Control Award Regional	Shenzhen	2019
FRC Autonomous Award	Australia	2019
FIRST Dean's List Finalist Award	Shenzhen	2018

FRC Finalists & Innovation in Control Award	Shenzhen	2018
FRC Judges Award	Shenzhen	2017
FTC Championship, Beijing regional	Beijing	2016
FTC Control Award, Beijing regional	Beijing	2016