Yuliang Zhong

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Education

- **Eidgenössische Technische Hochschule (ETH) Zürich, Switzerland** **Sept. 2020 – present**
Master of Science in Robotics, Systems and Control Core Course GPA: 5.79/6.00
- **Shanghai Jiao Tong University (SJTU), Shanghai China** **Sept. 2016 – June 2020**
Bachelor of Science in Mechanical Engineering Major GPA: 90.686/100
Tsien Hsue-Shen Class (Honor Class) Class Ranking: 1/32
Zhiyuan Honors Program in Engineering of Zhiyuan College (top5%)
- **Carnegie Mellon University (CMU), Pittsburgh, USA** **July 2019 – Sept. 2019**
Summer Intern in Biorobotics Lab of the Robotics Institute

Professional Skills

- **Programming:** C/C++11; Python/Pytorch; MATLAB/Simulink; ROS2/Gazebo/Rviz; Git; LaTeX
- **Robotics:** Path/Motion Planning; State Estimation; Model Predictive Control; Machine Learning
- **Mechanical Engineering:** Solidworks/Fusion360; Ansys/Abaqus; CNC machine tool; 3D printing

Publications

• Schmid, L.*, Ni, C.*, **Zhong Y.**, Siegwart, R., and Andersson, O. (2022). Fast and Compute-efficient Sampling-based Local Exploration Planning via Distribution Learning. *IEEE (RA-L) & IROS 2022* [IEEE]

Research Experiences

After-mission autonomous return-home navigation of drones in confined space Nov. 2022 – Apr. 2023
Internship, *Flyability SA, Lausanne Switzerland*
- Utilized global mapping libraries (OctoMap, Voxblox) for 3D point status inquiry and collision checking.
- Implemented global motion planning algorithms (PRM*, FMT*, RRT*, informed-RRT*) using C++.
- Integrated Open Motion Planning Library (OMPL) to access state-of-the-art motion planning alogrithms.
- Conducted performance testing of global planners in various datasets (garage, office, factory, mine).
- Generated minimum-snap collision-free trajectories to home based on planned paths (PGD, BFGS).
- [In progress] Preparing experiments for drone autonomous return-home navigation in confined space.
- Exposed to various development tools: Clang-Format, GoogleTest, GDB, GitHub Actions workflows, Ansible, Conan, JFrog, Docker and RTOS.

Autonomous precision landing platform for rocket recovery with a parafoil Apr. 2022 – Sept. 2022
Master Thesis, *Institute for Dynamic Systems and Control, ETH Zurich* Prof. Melanie Zeilinger
- Investigated path planning, state estimation, and control algorithms of parafoil precision landing.
- Developed a 6-DOF simulator in MATLAB/Simulink for closed-loop control validation, incorporating rigid-body/aerodynamics, sensor models, and animations.
- Applied Extended Kalman filter (EKF) for estimation of system states and wind disturbances.

- Solved parafoil landing path planning with Pontryagin's minimum principle (ode45/fminsearch), sequential convex programming (ECOS/YALMIP), and direct numerical optimization (Ipopt/CasADi).
- Implemented control algorithms of varying complexity for path following, including Active Disturbance Rejection Control (ADRC), Linear Quadratic Regulator (LQR), offset-free Model Predictive Control (MPC), and Model Predictive Contouring Control (MPCC).
- Built a prototype for experiments using sensors with SPI/I2C protocols, Raspberry Pi4, ROS2, and Docker.

Contact-based Grasped Pose Estimation via Particle Filter with Memory Sept. 2021 – Dec. 2021

Semester Project, *Robotic Systems Lab, ETH Zurich* Dr. Johannes Pankert, Prof. Marco Hutter

- Conducted a literature review on vision-based and contact-based grasped pose estimation approaches.
- Proposed an extended particle filter (PF) with a memory buffer, which improves the performance of standard particle filters when the frequency of contact observation updates increases.
- Implemented a Gaussian Mixture Model (GMM) for roughening to alleviate sample impoverishment.
- Verified the algorithm in a physical simulator (RAISIM) with Rviz, and on the Anymal robot with Dynaarm.
- Reduced grasped object 2D pose errors by 40% - 90% with 85% robustness confidence.
- Suitable for arbitrary object shapes and general configurations of industrial robots and grippers.

Fast Sampling-based Local Exploration Planning via Distribution Learning Mar. 2021 – Mar. 2022

Research Course Project, *Autonomous Systems Lab, ETH Zurich* Dr. Lukas Schmid, Dr. Olov Andersson

- Applied a Conditional Variational Autoencoder (CVAE) network to learn a distribution of decisions from a Next-Best-View uniform sampling planner, leveraging priors of environments to find more efficient views.
- Designed a CNN-based sample selector via exploration gain prediction. [code]
- Evaluated the generalization ability of learned planner on multiple test environments. Achieved faster unknown map exploration speed and less computational cost with the same amount of samples from the learned distribution. [code]
- Realized sim-to-real transfer on TurtleBot 3 platform.

Selected Courses

Probabilistic Artificial Intelligence Prof. Andreas Krause

- Modeling with Gaussian processes to predict groundwater contamination distribution.
- Applying Bayesian optimization methods to efficiently find the max. of an unknown function with constraints.

Robot Dynamics Prof. Marco Hutter

- Five MATLAB coding exercises covering kinematics, dynamics and control, legged robots and UAVs
- Numerical inverse kinematics; Hybrid position and force control; Dynamic window algorithm

Advanced / Model Predictive Control Prof. Melanie Zeilinger

- Feasibility and stability, LQR, Standard MPC, Robust MPC, Tube MPC
- Nonlinear robust MPC, Nonlinear stochastic MPC, Learning-based MPC, MPC as safety filters

Awards and Scholarships

- Outstanding Graduate Scholarship, Zhiyuan College June 2020
- Excellent Graduate, Shanghai June 2020
- Champion of RoboCup China Open 2018, Small Size League Apr. 2018
- The 2nd Place of International Design Contest ROBOCON 2018 Oct. 2018
- National Scholarship, China Nov. 2018