Zhihao Ruan

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Education

University of Pennsylvania — Philadelphia, PA
- *Master of Science in Engineering in Robotics,* ***GPA: 3.9/4.0*** — *Sept 2020 – May 2022*
  General Robotics, Automation, Sensing & Perception (GRASP) Laboratory
  - **Selected Coursework:** GPU Programming & Rendering, Distributed & Multi-agent Robotics, Graph Neural Networks, Modern Convex Optimization, Reinforcement Learning, Deep Learning for Computer Vision

University of Michigan — Ann Arbor, MI
- *Bachelor of Science in Computer Science Engineering,* ***GPA: 3.9/4.0*** — *Sept 2018 – May 2020*
  College of Engineering

Shanghai Jiao Tong University — Shanghai, China
- *Bachelor of Science in Electrical and Computer Engineering,* ***GPA: 3.6/4.0*** — *Sept 2016 – Aug 2020*
  University of Michigan-Shanghai Jiao Tong University Joint Institute (UM-SJTU Joint Institute)

Work Experience

- **TuSimple, Inc.** — San Diego, CA
  Planning Research Engineer — *June 2022 – Present*
  - Developed motion planning software & algorithms for autonomous trucks.
- **TuSimple, Inc.** — Philadelphia, PA (Remote)
  Planning & Prediction Research Engineer Internship — *May 2021 – Aug 2021*
  - Developed motion planning software & algorithms for autonomous trucks.

Research Experience

- **F1/10 Autonomous Racing Group, Real-Time & Embedded Systems Lab (mLab)** — Philadelphia, PA
  CAD2CAV: Computer Aided Design for Cooperative Autonomous Vehicles. Link. — *Feb 2021 – Present*
  - Wrote graph-based multi-agent path planner in ROS (Robotics Operating System) & C++ with **Ant Colony Optimization solver for Capacitated Vehicle Routing Problem**, **Spectral Clustering**, and k**-Way Graph Partitioning**.
  - Implemented **FMT*** for real-time obstacle avoidance and **Pure Pursuit** as the controller for F1/10 autonomous racing vehicles.
  - Developed data import utility library in ROS C++ from Autodesk Revit 3D building model to ROS occupancy map.

Project Experience

- **Implementation of Dynamic Vehicle Routing (DVR) Algorithms** — Philadelphia, PA
  MEAM 624: Distributed Robotics — *Apr 2022 – May 2022*
  - Implemented m**-SQM, UTSP,** m**-Divide and Conquer**, and **No-Communication** dynamic vehicle routing (DVR) policies in Python and a self-designed distributed robotic simulation framework.
  - Realized the **geometric optimization** algorithm over Laguerre-Voronoi diagram for **distributed 2D partitioning** in Python.
- **Minimum-Snap Trajectory Generation and Control for Quadrotors** — Philadelphia, PA
  ESE 650: Learning in Robotics, Univ. of Pennsylvania — *April 2021 – May 2021*
  - Planned quadrotor trajectory in densely cluttered environments with **A*/Dijkstra's Algorithm** .
  - Formulated minimum-snap trajectory smoothing algorithm into a **Quadratic Programming (QP) problem** with CVXPY.
  - Designed **Constrained Gradient Descent solver** to optimize time duration for each min-snap trajectory segment.
  - Analyzed quadrotor dynamics and developed **Non-linear Geometric Controller** for quadrotors.
- **DOAPP: Dynamic Object Avoidance and Path Planning** — Ann Arbor, MI
  Undergraduate Major Design Experience, Univ. of Michigan. Link. — *Oct 2019 – Dec 2019*
  - Implemented a **GPU-accelerated motion planning algorithm** originally proposed by Chonhyon Park, et al. in **ROS C++ & CUDA** with Nvidia GPU parallel programming & optimization that could perform **real-time obstacle avoidance**.
  - Built a controller and trajectory follower in **ROS C++** for Dynamixel motors on robot arm and achieved **30 Hz signal transmission**.

Skills

Programming Languages: C/C++, Python, MATLAB.
Development Tools: CVXPY, ROS (Robotics Operating System), CUDA, OpenCV, PyTorch, Scikit-Learn, LCM (Lightweight Communications and Marshalling), STM32CubeMX