WENKAI REN

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EDUCATION

M.S. Robotics, Johns Hopkins University, Baltimore, MD	Aug.2018 - May.2020
M.S. Mechanical Engineering(Control), Columbia University**,** New York, NY	Aug.2016 - Dec.2017
B.S. Mechanical Engineering, Northern Arizona University**,** Flagstaff, AZ	Aug.2013 - May.2016

Minor: Electrical Engineering and Mathematics
GPA: 3.75/4.0 (cum laude)

EXPERIENCE

Advanced Products Robotics Intern, Think Surgical, Fremont, CA	June.2019 - Aug.2019

- Worked on next generation of surgical robot
- Implemented real-time computational geometry algorithms for visibility failure correction on tracker (C++)
- System integration of the correction algorithm and conducted user study(C++, python)

Course Assistant**,** Algorithms for sensor based robotics**,** Johns Hopkins University	Feb.2019 - now
Research Assistant, 3D printing error analysis, Creative Machine Lab, Columbia University	Jun.2017 - Sep.2017
Udacity Self-driving nano-degree Program **(**C++, Python)	Jun.2017 - Feb.2018

PROJECT

Robotics Motion Planning Projects

Sampling Based Planner (RRT, RRT*, BiRRT, PRM), C++
- Generated collision-free variations of RRT and PRM algorithms on both mobile robot and manipulator
- Implemented collision checking algorithm incremental and BFS, "lazy" collision checking
- Sampling methods with Obstacle, Bridge, Gaussian

Discrete Motion Planner (Dijkstra, A*, Weighted A*), ROS, C++
- 2D and 3D planning with variations of heuristic (Manhattan, Euclidian and Diagonal)
- Adding deterministic random numbers to heuristic for Tie breaker to improve searching efficiency
- Performance analysis for random generated occupancy grid map and resolution adjustment

Planning Based on Kinematics models, ROS, C++
- Hybrid A* and RRT based bicycle kinematic model
- Discretized the control space respect to the steering angle
- Collision checking swath sliding window, circle estimation

Parallel Multi-agent Motion Planner, ROS, C++
- Simulated multi-agent parallel planning on on 2D shared map with collision free
- Each agent can choose its own desired start and goal pose

Combinatorial Planner, MATLAB
- Implemented Vertical Cell Decomposition and Visibility Graph on 2D grid map with convex shape obstacles

Robotics Control and Optimization Projects

Race Car Trajectory Generation and tracking, ROS, C++
- Used race car bicycle dynamic model generate trajectory based on differential flatness
- Designed functionality with dynamic lookahead , replanning and timeout based on current pose
- Designed Multithreaded system by sharing the generated trajectory with the tracking class
- Trajectory tracking based on Feedback Linearization and referenced control law in Gazebo

BackStepping Controller for mobile robot trajectory tracking, C++
Optimal Boundary Value Problem (OBVP) for trajectory generation.
PID, LQR Controller for trajectory tracking, C++

Autonomous Planning and Navigation in Dynamic Environment
(Robot System Programming Class Team Project), ROS, C++
- Implemented move_base module setup on race car (1/5th scale of real car) to planning in department basement
- Modified Global planner with relaxed A* and optimal teb_local_planner with trajectory generation and control

LANGUAGES & SKILLS

- *C++/C, Python, java*
- *ROS, MATLAB, Linux, git, Solidworks*