Yongseok Kwon

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Education

University of Michigan *Aug. 2020 – Aug. 2022*
M.S.E. in Mechanical Engineering Ann Arbor, MI
- Foucs: Robotics, Deep Learning, Motion Planning, Optimization
- GPA: 4.0/4.0

Ulsan National Institute of Science and Technology (UNIST) *Mar. 2016 – Feb. 2020*
B.S. in Mechanical and Aerospace Engineering, Human Factors Engineering Ulsan, Republic of Korea
- Honors: *Summa Cum Laude*
- GPA: 3.94/4.3

Publications & Preprints

[1] **Yongseok Kwon**, Jonathan Michaux, Seth Isaacson, Bohao Zhang, Matthew Ejakov, Katherine A. Skinner, Ram Vasudevan. "Conformalized Reachable Sets for Obstacle Avoidance With Spheres" In Submission, 2024. [project page, arXiv, code]

[2] Jonathan Michaux, Qingyi Chen, **Yongseok Kwon**, Ram Vasudevan. "Reachability-based Trajectory Design with Neural Implicit Safety Constraints." *Robotics: Science and Systems*, Daegu, Republic of Korea, 2023. [project page, arXiv, code]

Experience

ROAHM Lab, University of Michigan *Jul. 2021 - Jan. 2023, Aug. 2024 - Present*
Researcher *Advisor: Prof. Ram Vasudevan*
- Developed a probabilistically safe trajectory planner with conformalized neural network-based reachable sets, ensuring collision-free motion in both simulation and hardware experiments with the Kinova Gen3 robot. [📄]
- Developed a novel trajectory planner with neural implicit safety constraints, achieving a planning speed of 40 Hz for 7 DoF robot arms in simulation.
- Developed a Python library for handling various continuous sets (e.g., intervals, zonotopes, and polynomial zonotopes) to compute reachable sets in robotic arm kinematics and dynamics, with support for parallel computation, resulting in a 2,000-fold speed enhancement. [zonopy, zonopy-robots]

Institute of Innovation for Future Army (IIFA), Republic of Korea Army *Feb. 2023 - Aug. 2024*
Robotics Researcher (Mandatory Military Obligation)
- Conducted fieldwork near the Korean Demilitarized Zone to identify technological needs for national defense.
- Managed national defense research initiatives with a specific focus on unmanned reconnaissance systems.

Locomotor Control Systems (LOCO) Lab, University of Michigan *Jan. 2021 - May 2021*
Research Assistant *Advisor: Prof. Robert D. Gregg IV*
- Trained a neural network-based gait model on human walking datasets with positional encoding for gait phases.
- Developed a gait state estimator by integrating an Extended Kalman Filter (EKF) with the neural network-based gait model for real-time tracking of motion.
- Demonstrated real-time swing motion of an EKF-based controller using open-source robotic leg hardware. [📄]

Course Projects

Transformer for Reaching Tasks, University of Michigan *Fall 2021*
Course: Introduction to Robotic Manipulation [📄]
- Generated expert dataset via trained agent for offline reinforcement learning.
- Applied the decision transformer for a 7 DoF robotic arm reaching task.

Trajectory Planning for Autonomous Car, University of Michigan *Fall 2021*
Course: Self-Driving Car [📄]
- Implemented a high-level planner to predict waypoints for lane-changing maneuvers in autonomous driving.
- Formulated convex collision avoidance constraints for trajectory planning in dynamic racing scenarios.

UAV Navigation via Dubins Path Planning, UNIST *Fall 2021*
Course: UAV Flight Control and Simulation [📄]
- Developed a simulation dynamics and a tracking controller for UAV navigation.
- Implemented a Dubins-curve-based RRT to generate paths under kinematic constraints for UAVs.

Skills

- **Programming:** Python, MATLAB
- **Software:** IPOPT, Gurobi, OSQP, MuJoCo
- **Frameworks and Others:** Pytorch, Weight & Biases, Stable-Baseline3, Linux, Conda, Git

Honors and Awards

National Science and Engineering Scholarship, Korea Student Aid Foundation (KOSAF) *2018 – 2019*

◦ Full-tuition scholarship for the last two years of undergraduate studies.

Academic Performance Scholarship, UNIST *2016 – 2017*

◦ Full-tuition scholarship for the first two years of undergraduate studies.