Yongseok Kwon

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Education

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

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

Publications

- 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. [webpage, arXiv, code]

Experience

Korea Army Research Center for Future and Innovation (KARCFI), 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.

Robotics and Optimization for Analysis of Human Motion (ROAHM) Lab & *Jul. 2021 – Jan. 2023*
Ford Center for Autonomous Vehicles (FCAV), University of Michigan *Jun. 2022 – Jan. 2023*
Research Assistant & Research Engineer *Advisor: Prof. Ram Vasudevan*
- Developed a Python framework for parallel reachable set computation using polynomial zonotopes, resulting in a 2,000-fold speed enhancement. [webpage, code]
- Trained a neural signed distance function between reachable workspace and surrounding objects using Eikonal loss.
- Developed a novel trajectory planner with neural implicit constraints, achieving a speed of 40 Hz for 7 DoF robot arm.
- Created a provably safe reinforcement learning algorithm incorporating polynomial zonotope-based safety shield.

Locomotor Control Systems (LOCO) Lab, University of Michigan *Jan. 2021 – May 2021*
Research Assistant *Advisor: Prof. Robert D. Gregg IV*
- Trained a neural network for a gait model with positional encoded gait phase based on human walking data.
- Designed a gait state estimator using an Extended Kalman Filter (EKF) integrated with the neural gait model.
- Demonstrated real-time swing motion of an EKF-based controller using open-source robotic leg hardware.

Bio-Robotics and Control (BiRC) Lab, UNIST *Mar. 2019 – Jul. 2019*
Research Intern *Advisor: Prof. Joonbum Bae*
- Designed a novel decoupling mechanism for tendon-driven serial link robots.
- Managed various components of a hydraulic robot arm, including hydraulic actuators, encoders, and assembly.

COURSE PROJECTS

Transformers for Motion Planning, University of Michigan *Fall 2021*
Course: Introduction to Robotic Manipulation *Advisor: Prof. Nima Fazeli*

- Generated expert dataset via trained agent for offline reinforcement learning.
- Deployed the decision transformer for a multi-link arm reaching task.

Model Predictive Control for Autonomous Car, University of Michigan *Fall 2021*
Course: Self Driving Car *Advisor: Prof. Ram Vasudevan*

- 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 *Spring 2019*
Course: UAV Flight Control and Simulation *Advisor: Prof. Hyondong Oh*

- Developed a comprehensive simulation dynamics model 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, Stable-Baseline3, Weights & Biases, 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.