Kanghyun Kim

Ph.D. Candidate

Korea Advanced Institute of Science and Technology (KAIST)

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Education

Korea Advanced Institute of Science and Technology (KAIST) *Daejeon, Korea*

Ph.D. Candidate | Department of Electrical Engineering *Sep 2021 - present*

- Research topic: Manipulation planning (Task/Grasp/Motion) for dual-arm robot manipulation
- Advisor: Prof. Min Jun Kim

Sogang University *Seoul, Korea*

M.S. | Department of Mechanical Engineering *Mar 2016 - Feb 2018*

- Research topics: Wearable Robots, Soft sensor system for human intention recognition
- Thesis: An air-filled pad with elastomeric pillar array designed for a force-sensing insole
- Advisor: Prof. Kyoungchul Kong

Sogang University *Seoul, Korea*

B.S. | Department of Mechanical Engineering *Mar 2009 - Feb 2016*

Research Interests

- Dual-arm Manipulation
- Task and motion planning
- Grasp detection
- Robot perception
- Geometry learning
- Numerical Optimization

Work Experience

Samsung Electronics *Suwon, Korea*

Control Engineer | Digital Appliance Business *Mar 2018 - Jul 2021*

- Implemented digital controllers for PMSM inverters.
- Developed machine learning inference algorithms for smart home appliances.

Research Experience

Intelligent Robotic Systems Lab (@KAIST) *Daejeon, Korea*

Advisor: Prof. Min Jun Kim *Sep 2021 - Present*

Project Highlights

- **Perception-driven Manipulation Planning (Ongoing):**
  Focus on multi-stage manipulation planning of grasp and motion for unseen objects, enhancing robotic interaction with unstructured environments.
- **Reachability-tree based Task and Motion Planner:**
  Developed a novel task and motion planning (TAMP) algorithm enablihg mutual guidance between task and motion planners, presented at **ICRA 2023**.

Washing Machine R&D Lab (@Samsung) *Suwon, Korea*

Project Highlights *Mar 2018 - Sep 2021*

- **On-line Parameter Estimation for Washing Machines:**
  Developed a model-based parameter estimator, achieving continuous laundry weight sensing for dehydrate rate detection. **US Patent (Pending)**.
- **Motor Current Signal Classification for Laundry Detection:**
  Developed a method for fabric type identification through motor current analysis based on machine learning, and implemented the algorithm suited for embedded processors. **US Patent (Pending)**.

Exoskeleton Laboratory (@Sogang Univ., currently at KAIST) *Seoul, Korea*

Advisors: Prof. Kyoungchul Kong *2016-2018*

Project Highlights

- **Soft Force-sensing Insole System:**
  Developed an air-filled pand integrated with an elastomeric pillar array for soft sensing, along with algorithms for human intention monitoring. Published in the **IEEE Sensors Journal**
- **Semi-active Pneumatic Actuators for Exoskeleton Robots:**
  Developed and simulated energy-efficient actuation for exoskeleton robots using semi-active pneumatic actuators.

Publications

K. Kim, D. Park and M. J. Kim, "A Reachability Tree-Based Algorithm for Robot Task and Motion Planning," 2023 IEEE International Conference on Robotics and Automation (ICRA), London, United Kingdom, 2023, pp. 3750-3756

K. Kim, S. Shin and K. Kong, "An Air-Filled Pad With Elastomeric Pillar Array Designed for a Force-Sensing Insole," in IEEE Sensors Journal, vol. 18, no. 10, pp. 3968-3976, 15 May15, 2018

H. Choi., **K. Kim**, P.G. Jung, B. Na, D.W. Rha, K. Jung, and K. Kong, "Ankle Joint Moment Estimation Based on Smart Shoes" IFAC-PapersOnLine, vol. 50, no. 1, pp. 1366–1371, 2017.

Y. Kim, C. Kwon, H. Moon, **K. Kim**, J. Cho, and K. Kong, "Optimization of semi-active pneumatic actuators for an exoskeleton robot for running," in 2018 15th International Conference on Ubiquitous Robots (UR), 2018.

K. Kim, and K. Kong, Accuracy Improvement Algorithms for Ground Reaction Force Measurement by an Insole-type Sensor System," International Conference on Control, Automation, and Systems (ICCAS), 2017.

K. Kim, P.G. Jung, and K. Kong, "Design of an Elastomer-Based Soft Force Sensor for Measuring Ground Reaction Force in a Shoe," in Proceedings of the Korean Society of Mechanical Engineers (KSME) Annual Conference, pp. 1508-1513, 2016

Patents

K. Kong, **K. Kim**, et al. "Ground Reaction Force Sensor Module, Shoe having the same, Measuring System of Ground reaction Force of Sole and Measuring Method of Ground reaction Force of Sole." KR Patent (Granted)

K. Kim, et al. "Washing machine and control method thereof (Artificial intelligence laundry fabric detection of Washing machine)." URL: https://patents.google.com/patent/US20220243382A1,US20240084490A1/en, US Patent (Pending)

K. Kim, et al. "Washer and control method thereof (Drum inertia sensing method at high speed for washing machine.)." URL: https://patents.google.com/patent/US20220372687A1/en, US Patent (Pending)

Skills

Keywords: Robotics | Machine Learning | 3D Vision | Numerical Optimization | Embedded Systems

Programming: Python | C/C++ | Matlab/Simulink | LabVIEW | Julia

Robotics/ML: ROS | ML (Pytorch, JAX) | Vision (Open3d, OpenCV) | Simulation(Pybullet) | Optimization (IPOPT, Ceres)

Design: AutoCAD, Solidworks, KiCad

Control HW: Easy-to-use boards (Arduino/Raspberry Pi/Jetson...) | Microcontrollers (ARM Cortex-M) | DAQ (NI myRIO)

Extra-curricular activities

Reviewer: International Conference on Robotics and Automation (2023, 2024)

Teaching:

2024 **Control System Engineering (Undergrad.)**, Teaching Assistant
2023 **Robot Control (Grad.)**, Teaching Assistant (Outstanding TA Award)
2023 **Electronics Design Lab <Robotic Manipulator> (Undergrad.)**, Course Development TA
2022 **Special Topics in EE <Introduction to robot control theory> (Grad.)**, Teaching Assistant

Military Service: Served and discharged from Korean Army as a sergeant (2011-2013)