

Minku Kim

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Education

Oregon State University

Ph.D. Candidate in Robotics

Corvallis, OR

Sep 2025 – Current

University of Pennsylvania

M.S. in Mechanical Engineering and Applied Mechanics (4.0/4.0)

Philadelphia, PA

Aug 2023 – May 2025

- **Thesis:** Learning a Vision-Based Footstep Planner for Hierarchical Walking Control on Unstructured Terrain

Chung-Ang University

B.S. in Mechanical Engineering with honors

Seoul, Korea

Mar 2017 – Feb 2023

Research Experience

Dynamic Robotics and Artificial intelligence Laboratory

Graduate Research Assistant - Prof. Alan Fern

Corvallis, OR

August 2025 – Current

- Working on applying off-policy RL for hybrid offline-online learning with human demonstration data and human-in-the-loop interventions to efficiently train policies for skill learning and sim-to-real transfer

Figueroa Lab, GRASP Lab

Graduate Research Assistant - Prof. Nadia Figueroa

Philadelphia, PA

Mar 2025 – Current

- Developed a real-time GPU-accelerated system for 6D pose tracking and shape estimation using RGB-D input, combining Active Shape Model (ASM), ADMM optimization, and Stein Variational Gradient Descent (SVGD) for robust performance
- Developed a novel multi-view transformer-based framework for real-time 3D object detection and 6DOF pose estimation and shape modeling with differentiable rendering from RGB-D inputs

Janus Intelligent Robots Lab, GRASP Lab

Graduate Research Assistant - Prof. Antonio Loquercio

Philadelphia, PA

Dec 2024 – April 2025

- Conducted research on robust sim-to-real transfer using *Isaac-Sim* for end-to-end RL locomotion on the *Unitree Go2* quadrupedal robot and created deployment tools to support real-world experimentation

Dynamic Autonomy and Intelligent Robotics Lab, GRASP Lab

Graduate Research Assistant - Prof. Michael Posa

Philadelphia, PA

Jan 2024 – May 2025

- Designed a vision-based hierarchical controller for the *Agility Robotics Cassie* bipedal robot, integrating a high-level RL footstep planner with a low-level operational space controller
- Built a full-stack RL pipeline in *Drake* for training, sampling, and hardware deployment, and benchmarked against a vision-based MPC footstep planner, demonstrating improved velocity tracking and success rates across diverse terrains in simulation

Integrated Systems Design Lab

Research Intern - Prof. Hae-Jin Choi

Seoul, Korea

Aug 2022 – Jan 2023

- Constructed a data acquisition pipeline in MATLAB to collect and analyze real performance data from an electric vehicle (EV) reducer testbed using 3-axis accelerometers and current sensors
- Developed a real-time fault diagnosis model with 98% detection, utilizing feature extraction methods such as Wavelet Packet Decomposition, Mel-Frequency Cepstral Coefficients and STFT spectrogram

Artificial Intelligence for Mechanical Systems Lab

Undergraduate Research Assistant - Prof. Woonchul Nam

Seoul, Korea

June 2021 – Apr 2022

- Implemented a hybrid vision-based UAV control system integrating a one-stage detection algorithm and a Siamese network to track moving drones in visually complex environments
- Designed a custom loss function that improved small object detection by 5% and optimized the model using quantization and pruning to achieve 30 fps real-time performance

- Built a terrain recognition algorithm for a wearable device using a stereo camera, employing a point cloud semantic segmentation model for ground classification in dense forest environments

Teaching Experience

ESE 650: Learning in Robotics

Graduate Teaching Assistant - Prof. Pratik Chaudhari

Philadelphia, PA

Jan 2025 – May 2025

- Assisted in teaching a course of 120 students, including grading assignments and holding 3hr/week office hours, and creating a SLAM assignment using the KITTI Odometry Dataset

MEAM 510: Design of Mechatronic System

Graduate Teaching Assistant - Prof. Mark Yim, Dr. Jessica Weakly

Philadelphia, PA

Aug 2024 – Dec 2024

- Assisted in teaching and managing a course of 100+ students, including leading recitation sessions, grading assignments and holding 3hr+/week office hours

Chung-Ang University Artificial Intelligence Association

Mentor

Seoul, Korea

Apr 2021 – Sep 2021

- Mentored 10+ basic track students in Machine Learning, Deep Learning and Computer Vision

Publications

MV-DETR: Multiview Object Detection with Transformers and Shape-Aware 6D Pose Estimation

2025

In preparation for IEEE/CVF Conference on Computer Vision and Pattern Recognition

Ho Jin Choi[†], Minku Kim[†] and Nadia Figueroa.

Dynamic-ASM6D: Real-time 6D Object Pose and Shape Estimation via Active Shape Models and ADMM

2025

In Equivariant Systems: Theory and Applications in State Estimation, Artificial Intelligence and Control workshop at RSS 2025

In IEEE-RAS TC Virtual Poster Session and Networking Event 2025

In preparation for IEEE Transactions on Robotics (T-RO)

Ho Jin Choi[†], Yi-Hsuan Cheng[†], Minku Kim[†] and Nadia Figueroa.

Learning a Vision-Based Footstep Planner for Hierarchical Walking Control

2025

In IEEE-RAS 24th International Conference on Humanoid Robots (Humanoids) [Oral Presentation]

Minku Kim, Brian Acosta, Pratik Chaudhari and Michael Posa.

Projects

Comparative Analysis of MPC, LQR and RL-Based Footstep Planners in Uneven Terrains

Philadelphia, PA

Mar 2024 – May 2024

Team Leader

- Implemented an MLP-based Reinforcement Learning footstep planner and Model Predictive Controller footstep planner and created *Cassie* simulation environment in Drake
- Benchmarked velocity tracking and success rates of RL, LQR and MPC controllers across varied terrain

Optimization-based Estimation of Obstacles from Human Demonstration using Control Lyapunov Function and Control Barrier Functions

Philadelphia, PA

Oct 2023 – Dec 2023

Team Member

- Developed and presented a poster on CLF-CBF-QP optimization-based algorithm to estimate obstacle position and size from human demonstrations
- Leveraged Gaussian Mixture Models and Gaussian Mixture Regression to probabilistically learn parameters

Inverse-Kinematics Control for 7-DOF Manipulator

Philadelphia, PA

Oct 2023 – Dec 2023

Team Leader

- Created a vision-based pick-and-place algorithm for 7-DOF *Franka Emika Panda* manipulator
- Utilized inverse kinematics with gradient-based optimization and real-time perception feedback to pick and stack static and dynamically moving blocks

Mobile Wheeled-Robot for Autonomous Navigation

Team Leader

Philadelphia, PA

Oct 2023 – Dec 2023

- Implemented a PID motor control for a mobile robot using encoders, integrating Vive sensor, infrared (IR) detection circuit, and ToF sensors, with inter-chip communication via I2C protocol
- Achieved localization via Vive system, wall-following, and IR beacon detection for autonomous navigation

Chung-Ang University Artificial Intelligence (CUAI) Association

Team Leader

Seoul, Korea

Oct 2023 – Dec 2023

- Created a real-time logo detector and an automatic mosaic algorithm using object detection for Youtube videos, with a web crawling-based data collection pipeline
- Developed a multi-modal algorithm for emotion prediction using video detection, speech and tone recognition

CDIC Competition

Team Member

Seoul, Korea

Oct 2023 – Dec 2023

- Developed an AI-based surveillance mobile platform for real-time child safety in daycare centers
- Implemented a multi-modal detection model using real CCTV videos and audio to identify child abuse

X-Corps Research Festival

Team Leader

Seoul, Korea

Oct 2023 – Dec 2023

- Designed a mobile application for energy prosumers and a solar-tracking controller to optimize efficiency
- Developed a rooftop solar panel installation algorithm using semantic segmentation with an aerial image api
- Implemented an energy supply and demand, and price prediction model using metadata from KEPCO

Honors and Awards

Oregon State University College of Engineering (COE) Scholarship	2025
Penn Engineering Outstanding Research Award	2025
CUAI 4 th Advanced Track Excellent Completion	2022
CAU Winter Conference Da-Vinci Software Institute Excellence Award	2022
CAU Summer Conference Da-Vinci Software Institute Encouragement Award	2021
Academic Excellence Scholarship	2021

Technical Skills

Programming: Python, C/C++, MATLAB/Simulink, Git, Linux

Software/Frameworks: Pytorch, Tensorflow, OpenCV, ROS, LCM, Drake, MuJoCo, Isaac-Sim, Bazel, Docker, SLURM

Robotics: Legged Robot Control, Manipulation Control, Reinforcement Learning, Imitation Learning, Perception, Optimization

Voluntary and Extra-Curricular Activities

Mechanical Engineering and Applied Mechanics Mentorship Program

Mentor

Philadelphia, PA

July 2024 – Aug 2024

- Mentored incoming students on research opportunities, coursework, and work-study processes at Penn

Korean Graduate Student Association (KoGSA)

Treasurer

Philadelphia, PA

Oct 2023 – May 2025

- Organized 4+ events accommodating 50+ students each and authored grants to secure funding

Republic of Korea Army

Missile Command, 1100 Battalion, Air Defense

Namyangju, Korea

Sep 2018 - May 2020

- Served as a squad counselor and leader, completing military service with an honorable discharge