Minku Kim

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🔗 https://min-ku.github.io/   in minkukim   ⌂ min-ku

Education

Oregon State University   *Corvallis, OR*
Ph.D. Candidate in Robotics   *Sep 2025–Current*

University of Pennsylvania   *Philadelphia, PA*
M.S. in Mechanical Engineering and Applied Mechanics (4.0/4.0)   *Aug 2023–May 2025*
  ○ **Thesis**: Learning a Vision-Based Footstep Planner for Hierarchical Walking Control on Unstructured Terrain

Chung-Ang University   *Seoul, Korea*
B.S. in Mechanical Engineering with honors   *Mar 2017–Feb 2023*

Research Experience

Dynamic Robotics and Artificial Intelligence Laboratory   *Corvallis, OR*
Graduate Research Assistant-Prof. Alan Fern   *Aug 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   *Philadelphia, PA*
Graduate Research Assistant-Prof. Nadia Figueroa   *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 6D pose estimation and shape modeling with differentiable rendering from RGB-D inputs

Janus Intelligent Robots Lab, GRASP Lab   *Philadelphia, PA*
Graduate Research Assistant-Prof. Antonio Loquercio   *Dec 2024–Apr 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   *Philadelphia, PA*
Graduate Research Assistant-Prof. Michael Posa   *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   *Seoul, Korea*
Research Intern-Prof. Hae-Jin Choi   *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   *Seoul, Korea*
Undergraduate Research Assistant-Prof. Woochul Nam   *Jun 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 *Philadelphia, PA*
Graduate Teaching Assistant-Prof. Pratik Chaudhari *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 *Philadelphia, PA*
Graduate Teaching Assistant-Prof. Mark Yim, Dr. Jessica Weakly *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 *Seoul, Korea*
Mentor *Apr 2021–Sep 2021*
- Mentored 10+ basic track students in Machine Learning, Deep Learning and Computer Vision

Publications

Humanoid Hanoi: Investigating Shared Whole-Body Control for Skill-Based Box Rearrangement 2026
Under review for RSS 2026
<u>**Minku Kim**</u>[†], Kuan-Chia Chen[†], Aayam Shrestha, Li Fuxin, Stefan Lee and Alan Fern

SAGE: Semantic And Geometric Estimation of 6D Object Pose from Multi-View Observations 2026
Under review for RSS 2026
<u>**Minku Kim**</u>[†], Ho Jin Choi[†] and Nadia Figueroa

ASM-6D: Real-Time 6D Object Pose and Shape Estimation via Active Shape Models and ADMM 2026
Under review for RSS 2026
Ho Jin Choi[†], <u>**Minku Kim**</u>[†] 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
Ho Jin Choi[†], Yi-Hsuan Cheng[†], <u>**Minku Kim**</u>[†] 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]
<u>**Minku Kim**</u>, Brian Acosta, Pratik Chaudhari and Michael Posa.

Projects

Comparative Analysis of MPC, LQR and RL-Based Footstep Planners in Uneven Terrains *Philadelphia, PA*
Team Leader *Mar 2024–May 2024*
- 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*
Team Member *Oct 2023–Dec 2023*
- 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
Team Leader

Philadelphia, PA
Oct 2023–Dec 2023

  - 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 4th 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 *Namyangju, Korea*

Missile Command, 1100 Battalion, Air Defense *Sep 2018-May 2020*

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