Seunghwan Um

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Research Statement

I'm a PhD student at Robotics Innovatory, Sungkyunkwan University, South Korea, under the supervision of Prof. Hyouk Ryeol Choi. My research focuses on designing a versatile robotic gripper for logistics.
Recently, my research interest has focused on developing robotic systems capable of interacting with unstructured environments during grasping or manipulation. Specifically, I am exploring ***"physically intelligent gripper designs"*** and developing ***"learning-friendly grippers"*** that facilitate policy learning in imitation and reinforcement learning.

Education

- **Sungkyunkwan University (SKKU)** — *Mar. 2022 - Present*
  Ph.D in Mechanical Engineering — Suwon, Republic of Korea
- **Hanyang University (ERICA)** — *Mar. 2018 - Feb. 2022*
  B.S in Mechanical Engineering — Ansan, Republic of Korea

Publications

J=Journal, C=Conference, S=In Submission, P=Patent, T=Thesis

[J.6] **PALM-Gripper: Integrated Gripper with Parallel Adaptable Mechanism for Shelf Picking in Logistics**
Seunghwan Um, Yeong Gwang Son, Juyong Hong, Chun Soo Kim, et al. and Hyouk Ryeol Choi*.
*IEEE/ASME Transactions on Mechatronics (**TMECH**), 2026.*

[J.5] **Toward Reliable Bin-Picking: Collision-Aware Robotic Design and Control Strategy for Heavily Cluttered Environment**
Seunghwan Um, Yeong Gwang Son, Jaeyoon Shim, Hyouk Ryeol Choi*
*IEEE Robotics and Automation Practice (**RA-P**), 2026, The paper was invited for publication.*

[J.4] **Plug-and-Play Shape Matching Module for Zero-Shot Mesh-Free Grasp Refinement on Unknown Objects**
Juyong Hong, Yeong Gwang Son, Seunghwan Um, Hyouk Ryeol Choi*.
*IEEE Robotics and Automation Letters (**RA-L**), 2025.*

[J.3] **Corner-Grasp: Multi-Action Grasp Detection and Active Gripper Adaptation for Grasping in Cluttered Environments**
Yeong Gwang Son, Seunghwan Um, Juyong Hong, Tat Hieu Bui, Hyouk Ryeol Choi*.
***ArXiv**, 2025.*

[J.2] **Development of Adaptive Gripper Enhancing Power Grasp Range and Linearity**
Issac Rhee, Chun Soo Kim, Heeyeon Jeong, Seunghwan Um, and Hyouk Ryeol Choi* et al.
***IEEE Access**, 2024.*

[J.1] **ReC-Gripper: A Reconfigurable Combined Suction and Fingered Gripper for Various Logistics Picking and Stowing Tasks**
Seunghwan Um, Heeyeon Jeong, Chun Soo Kim, Issac Rhee, and Hyouk Ryeol Choi*
*IEEE Robotics and Automation Letters (**RA-L**), Presented in ICRA 2024.*

[C.1] **Overcoming Heavy Clutter: Utilizing the Hybrid Grasping Network and Gripper**
Seunghwan Um, Yeong Gwang Son, Tat Hieu Bui, Ho Sang Jung, and Hyouk Ryeol Choi*
*IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**), 2024*
Workshop: Benchmarking via Competitions in Robotic Grasping and Manipulation ***[Best Extended Abstract]***

Patents

[P.3] **Hybrid Gripper Capable of Bin Picking and Shelf Picking**.
Seunghwan Um, Heeyeon Jeong, Chun Soo Kim, Issac Rhee, and Yoon Haeng Lee.
Korean Intellectual Property Office, Patent No. 10-2023-0076248. Publication Date: 2024.12.23.

[P.2] **Adaptive Gripper Capable of Parallel Motion**.
Issac Rhee, Chun Soo Kim, Seunghwan Um, Heeyeon Jeong, and Yoon Haeng Lee.
Korean Intellectual Property Office, Patent No. 10-2023-0077512. Registration Date: 2023.12.06.

[P.1] **Suction Gripper Capable of Translational and Rotational Movements**.
Chun Soo Kim, Issac Rhee, Seunghwan Um, Heeyeon Jeong, and Yoon Haeng Lee.
Korean Intellectual Property Office, Patent No. 10-2023-0093340. Registration Date: 2023.10.18.

Honors and Awards

- **Samsung Humantech Paper Award** *Feb. 2025*
  Samsung Electronics Co., Ltd. [Samsung Humantech]
- **9th Robotic Grasping of Manipulation Competition - Picking in Clutter** *May. 2024*
  IEEE, IEEE RAS [RGMC 2024]
- **KSME Student Creative Design Competition** *Oct. 2021*
  The Korean Society of Mechanical Engineers (KSME) [YouTube]
- **Creative and Intelligent Robot Contest** *Sep. 2021*
  Daejeon Metropolitan City, Chungnam National University [YouTube]

Experience

- **CarbonSix** *Oct 2024 - Nov 2024*
  Researcher Gangnam-daero, Seocho-gu, Seoul, Republic of Korea
  ◦ Designed direct teaching device with gravity compensation function.
- **AIDIN ROBOTICS - Cobot Solution Team** *May 2022 - Present*
  Researcher Anyang-si, Gyeonggi-do, Republic of Korea
  ◦ Designed grippers for shelf-picking solutions, contributing to efficient logistics automation.
- **Korea Institute of Industrial Technology (KITECH)** *Oct 2021 - Dec 2021*
  Research Student Ansan-si, Gyeonggi-do, Republic of Korea
  ◦ Designed and developed control systems for a 2-DoF manipulator, enhancing its performance and accuracy.
- **Wall Climbing Car (WCC) [Undergraduate Project]** *Dec 2020 - Oct 2021*
  Team Leader Ansan-si, Gyeonggi-do, Republic of Korea
  ◦ Designed a wall-climbing car's propeller frame and control system.

Projects

- **Development of a K-Logistics Humanoid Robot Integrated with a High-Sensitivity Robotic Hand Based on a Multimodal AI Foundation Model** *Sep 2025 - Present*
  *Participating organizations: AIDIN ROBOTICS, **SKKU**, KETI, CJ Logistics* Republic of Korea
  ◦ **Research Objective**: Automation of contact-rich manipulation tasks using a humanoid robot equipped with a high-sensitivity robotic hand.
  ◦ Development of a teleoperation system for constructing multimodal datasets incorporating force information
  ◦ Design of force-control strategies and learning-based policies capable of handling contact-rich interactions
- **Development of Smart Vision System and All-in-One Universal Gripper for Multi-Various Random Piece Picking** *May 2022 - 2024*
  *Participating organizations: **SKKU**, AIDIN ROBOTICS, KITECH, CJ Logistics* Republic of Korea
  ◦ **Research Objective**: Developing robotic picking system including a gripper and vision system for piece picking in a logistics environment.
  ◦ Designing an integrated gripper capable of various grasping strategy for a shelf environment among logistics environments
  ◦ Researching grasping strategy that can pick objects while avoiding external constraints in a shelf environment

Grant

- **BK21 Research Encouragement Scholarship** *Fall. 2024*
- **Brain Hanyang, Academic Excellence Scholarship** *Spring. 2018*