SeungHyeok **Back**

Ph.D Student · Roboticist

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Education

Gwangju Institute of Science and Technology (GIST) — *Gwangju, Republic of Korea*

Ph.D Course in School of Integrated Technology (Robotics Program) — *Mar. 2018 - PRESENT*

Advisor: Prof. Kyoobin Lee

University of California, Berkeley — *Berkeley, United States*

Summer Session Extension — *Jul. 2015 - Aug. 2015*

Gwangju Institute of Science and Technology (GIST)) — *Gwangju, Republic of Korea*

B.S. in Mechanical Engineering, Connective Minor in History-Sociology — *Mar. 2014 - Feb. 2018*

Advisor: Prof. Hyo-sung Ahn

Research Interests

Robot Vision	Amodal Perception, Instance Segmentation in Clutter, RGB-D Fusion, 6D Object Pose Estimation
Unseen Object	Instance Segmentation, Grasping, and Placement of Unseen Objects
Sim2Real	Synthetic Datasets for Segmentation, 6D Object Pose Estimation, and Robotic Manipuation

Awards & Honors

2023	**Gold Prize**, **29th Samsung Humantech Paper Award**, Samsung Electronics Co. Ltd, **Top 0.7%**	*$10,000*
2022	**Best Robot Vision Paper Award**, Asian Federation of Computer Vision (AFCV) at KROC 2022	
2022	**Bronze Prize**, **28th Samsung Humantech Paper Award**, Samsung Electronics Co. Ltd, **Top 5%**	*$5,000*
2022	**Outstanding Paper Award**, The 37th Korea Robotics Society Annual Conference	
2021	**Outstanding Paper Award**, 2021 ICROS-KROC Honam Joint Conference	
2021	**Outstanding Paper Award**, The 16th Korea Robotics Society Annual Conference	
2021	**Outstanding Paper Award**, The 36th ICROS Annual Conference, Undergrad. Sec. (co-author)	
2020	**4th Place**, **DREAM AI Healthcare Hackathon**, GIST-NVIDIA	*$2,500*
2020	**National R&D Real Challenge Program**, Korea Institute of Human Resources Development (KIRD)	*$3,000*
2017	**President's Award**, GIST Innovative Convergence Technology Contest (Track 1)	
2017	**Dean's Award**, GIST Innovative Convergence Technology Contest (Track 2)	

Projects

Occluded Object Dataset — *National Information Society Agency (S. Korea)*

Project Leader — *Jul. 2022 - Present*

- Development of large-scale, multi-camera occluded datasets, labeling tools, and calibration methods [Code]
- A 6d object pose estimation dataset in clutter with 200 objects, 1,050 scenes, 4 cameras, and 25 environments.
- Fast-moving object-hand pose estimation dataset, consisting of 50 objects, 1,000 scenes, 8 cameras, and 20 subjects.
- A dataset for object-in-gripper segmentation and pose estimation, comprising 20 objects, 8 grippers, 160 scenes, and 3 cameras.

Robot in Unstructured Environments — *Ministry of Trade, Industry and Energy (S. Korea)*

Software Development Leader — *Mar. 2020 - Present*

- Amodal instance segmentation of unknown objects in cluttered environments using only synthetic data. [Video]
- Open-source projects focused on robotic grasping algorithms [Code] and point cloud processing [Code] in the ROS
- CLIP-based zero-shot instance segmentation for human-robot collaboration.

Robotic IKEA Furniture Assembly from Assembly Manuals

Ministry of Science and ICT (S. Korea)

Project Leader

Apr. 2019 - Mar. 2020

- A competition of AI-robot systems for assembly of IKEA furniture from assembly manuals [Video]
- Assembly sequence generation using OCR, segmentation and image-CAD matching [Video]
- Sim-to-real transfer of instance segmentation and 6D object pose estimation for furniture part grasping [Code]

Publications

* indicates equal contribution

Object Poses in Clutter: A large-Scale dataset for occluded object understanding

Work In Progress

Seunghyeok Back, Joosoon Lee, heeseon Noh, Kangmin Kim, Sangbeom Lee, Geonhyup Lee, Raeyoung Kang, Kyoobin Lee

[Code]

E3-MaskRefiner: Fast and accurate refinement of instance segmentation with explicit error estimation

Work In Progress

Seunghyeok Back, Sungho Shin, Joosoon Lee, Kyoobin Lee

D'oh! Dynamic object handling dataset for robust hand-object pose estimation

Work In Progress

Raeyoung Kang*, Joosoon Lee*, **Seunghyeok Back**, Geonhyup Lee, heeseon Noh, Kangmin Kim, Sangbeom Lee, Kyoobin Lee

[Code]

Learning to place unseen objects stably based on a large-scale simulation

Under review

Sangjun Noh*, Taewon Kim*, Raeyoung Kang*, **Seunghyeok Back**, Raeyoung Kang, Seongho Bak, Kyoobin Lee

- Gold Prize, 29th Samsung Humantech Paper Award (Top 0.7% paper)

[Website]

Unseen object amodal instance segmentation via hierarchical occlusion modeling

2022 IEEE International Conference on Robotics and Automation (ICRA)

Seunghyeok Back, Joosoon Lee, Taewon Kim, Sangjun Noh, Raeyoung Kang, Seongho Bak, Kyoobin Lee

- Bronze Prize, 28th Samsung Humantech Paper Award (Top 5% paper)
- Outstanding Paper Award, 2021 ICROS-KROC Honam Joint Conference

[Website] [Paper] [Code]

Segmenting unseen industrial components in a heavy clutter using rgb-d fusion and synthetic data

2020 IEEE International Conference on Image Processing (ICIP)

Seunghyeok Back, Jongwon Kim, Raeyong Kang, Seungjun Choi, Kyoobin Lee

[Paper] [Video] [Code]

Fusing RGB and depth with self-attention for unseen object segmentation

2021 21st International Conference on Control, Automation and Systems (ICCAS)

Joosoon Lee*, **Seunghyeok Back***, Taewon Kim, Sungho Shin, Sangjun Noh, Raeyoung Kang, Jongwon Kim, Kyoobin Lee

[Paper]

Automatic detection and identification of fasteners with simple visual calibration using synthetic data

2020 25th IEEE International Conference on Emerging Technologies and Factory Automation (ETFA)

Sangjun Noh*, **Seunghyeok Back***, Raeyoung Kang, Sungho Shin, Kyoobin Lee

[Paper]

Robust skin disease classification by distilling deep neural network ensemble for the mobile diagnosis of Herpes zoster

IEEE Access (2021)

Seunghyeok Back*, Seongju Lee*, Sungho Shin, Yeonguk Yu, Taekyeong Yuk, Saepomi Jong, Seungjun Ryu, Kyoobin Lee

[Paper]

Intra- and inter-epoch temporal context network (IITNet) using sub-epoch features for automatic sleep scoring on raw single-channel EEG

Biomedical Signal Processing and Control, (2020)

Hogeon Seo*, **Seunghyeok Back***, Seongju Lee*, Deokhwan Park, Tae Kim, Kyoobin Lee

[Paper] [Code]

SleePyCo: Automatic sleep scoring with feature pyramid and contrastive learning

Under Review

Seongju Lee, Yeonguk Yu, **Seunghyeok Back**, Hogeon Seo, Kyoobin Lee

[Arxiv]

Pilot study of a single-channel EEG seizure detection algorithm using machine learning

CHILDS NERVOUS SYSTEM (2021)

Seungjun Ryu, **Seunghyeok Back**, Seongju Lee, Hyeon Seo, Chanki Park, Kyoobin Lee, Dong-Seok Kim

[Paper]

Patents

Hierarchical occlusion module and unseen object instance segmentation system — *Applied (US/JP/KR)*

Kyoobin Lee, **Seunghyeok Back**, Joosoon Lee, Taewon Kim, Raeyoung Kang, Sangjun Noh, Seongho Bak — *2022*

Apparatus and method identifying the size of the target object — *Registered (KR), Applied (US)*

Kyoobin Lee, **Seunghyeok Back**, Sungho Shin, Sangjun Noh, Raeyoung Kang — *2021*

Planning system for component assembly — *Applied (PCT/KR)*

Kyoobin Lee, **Seunghyeok Back**, Sungho Shin, Joosoon Lee, Seongju Lee, Raeyoung Kang, Taekyeong Yuk, Seongho Bak — *2021*

Method for optimizing sleep — *Registered (KR)*

Hogeon Seo, Kyoobin Lee, **Seunghyeok Back**, Munsang Kim, Tae Kim — *2020*

Transferred to ReDWit. Co.

Teaching Experiences

Teaching Assistant — *GIST*

Deep Learning (RT5101-01, Spring) — *Mar. 2020 - June. 2020*

Teaching Assistant — *GIST*

Deep Learning (RT5101-01, Spring) — *Mar. 2019 - June. 2019*

Teaching Assistant — *STAR-MOOC*

Hands on Deep Learning (Online Lecture) — *2019*