Ukcheol Shin

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Research Interests

My research aims to develop **a robust physical AI that can perceive, understand, and navigate the dynamic world under challenging conditions, including adverse weather (rain, snow, fog, dust), extreme lighting (over-exposed, low-light), and complex terrains (mountains, caves)**, with a specific interest in 3D geometry, semantic understanding, thermal vision, self-supervised learning, deep reinforcement learning, and vision-language navigation/manipulation.
I am interested in the following areas, but also open to other explorable/challenging domains.

- **Spatial/Semantic Understanding In-the-Wild**
  - Self-supervised 3D Geometry (Depth, Optical flow, Scene flow, Odometry, Object pose, SLAM)
  - Thermal Perception in Adverse Conditions (Rainy, Snowy, Dusty, Over-exposed, Low-lighted Conditions)
  - Vision-Language Understanding in Adverse Conditions
  - Continual Learning/Domain Adaptation in the Wild
- **Scalable Representation Learning**
  - Learning from Self-supervision (Image, Video, Action, Language)
  - Learning from Multi-modal Sensor Data (RGB, NIR, Event, Thermal camera, LiDAR, RADAR)
  - Foundation Model for Multi-modal Sensors
- **Robust Robot Learning**
  - Deep Reinforcement Learning for Robotics/Sensors (Legged Robot, Manipulator, Camera)
  - Multi-modal Sensor Fusion for Robust Spatial/Semantic Perception
  - Vision-Language Navigation/Manipulation

Research Experiences

Carnegie Mellon University — United States
Postdoctoral Associate, CMU Robotics Institute (RI) (Advisor: Jean Oh) — Aug.2023 - Current
- Research topics: Self-supervised 3D Geometry, Autonomous Driving, Reinforcement Learning, VLN/VLM.

Korea Advanced Institute of Science and Technology — Korea
Graduate Student Researcher, Robotics and Computer Vision Lab (Advisor: In So Kweon) — Sep.2017 - Aug.2023
- Research topics: Self-supervised 3D Geometry, Sensor Fusion, Robot Vision, Deep Learning.

Seoul National University of Science and Technology — Korea
Research Intern, Embedded System Lab (Advisor: Byoung Wook Choi) — Jan.2015 - Feb.2017
- Research topics: Embedded Linux, Real-time Operating System, Real-time Ethernet, Robotics.

Education

Korea Advanced Institute of Science and Technology — Korea
Ph.D. in Electrical Engineering, Advisor: In So Kweon, GPA: 3.80/4.30 — Sep.2019–Aug.2023
- Dissertation: "Self-supervised 3D Geometric Perception in Adverse Real-world Environments"

Korea Advanced Institute of Science and Technology — Korea
M.S. in Electrical Engineering, Advisor: In So Kweon, GPA: 3.74/4.30 — Sep.2017–Aug.2019
- Thesis: "Noise-Aware Camera Exposure Control for Robust Robot Vision"

Seoul National University of Science and Technology — Korea
B.S. in Electrical and Information Engineering, GPA: 4.20/4.50 — Mar.2011–Feb.2017
- Project: "Real-Time Ethernet Protocol based Omni Directional Mobile Robot"

Publications

- **33. Learning Fault-tolerant Quadrupedal Locomotion in Rough Terrains**
  - Mincheol Kim, **Ukcheol Shin***, Jung-Yup Kim* (*Equal Corresponding)
  - IEEE Transactions on Robotics (**T-RO**, working-in-progress), 2025

- **32. MIRAGE: Multispectral Image Benchmark for RGB-Thermal Infrared Image Translation**
  - DongGuw Lee, Hyunsoo Jang, Tai Hyoung Rhee, **Ukcheol Shin**, Ayoung Kim
  - IEEE/CVF International Conference on Computer Vision (**ICCV**, under-review), 2025

- **31. MrGS: Multimodal Radiance Fields with 3D Gaussian splatting for RGB-Thermal Novel View Synthesis**
  - Minseong Kweon, JangHyun Kim, **Ukcheol Shin***, Jinsun Park* (*Equal Corresponding)
  - IEEE/CVF International Conference on Computer Vision (**ICCV**, under-review), 2025

- **30. SF-VO: Self-Supervised Few-Shot Adaptation for Visual Odometry**
  - Junhee Lee, Inha Lee, Jean Oh, **Ukcheol Shin***, Kyungdon Joo* (*Equal Corresponding)
  - IEEE/CVF International Conference on Computer Vision (**ICCV**, under-review), 2025

- **29. VPOcc: Exploiting Vanishing Point for 3D Semantic Occupancy Prediction**
  - Junsu Kim*, Junhee Lee*, **Ukcheol Shin**, Jean Oh, Kyungdon Joo (*Equal Contribution)
  - IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**, under-review) (**Oral**), 2025
  - Received **Samsung Humantech Paper Award (Silver Prize)**

- **28. All-day Depth Completion via Thermal-LiDAR Fusion**
  - Janghyun Kim, Minseong Kweon, Jinsun Park*, **Ukcheol Shin*** (*Equal Corresponding)
  - IEEE Transactions on Intelligent Vehicles (**T-IV**, under-review), 2025

- **27. Deep Depth Estimation from Thermal Image: Dataset, Benchmark, and Challenges**
  - **Ukcheol Shin**, Jinsun Park
  - IEEE Transactions on Intelligent Vehicles (**T-IV**, under-review), 2025

- **26. Flow4D: Leveraging 4D Voxel Network for LiDAR Scene Flow Estimation**
  - Jaeyeul Kim*, Jungwan Woo*, **Ukcheol Shin**, Jean Oh, Sunghoon Im (*Equal Contribution)
  - IEEE Robotics and Automation Letters (**RA-L**), 2025
  - Received **1st Place Award** at CVPR 2024 Autonomous Driving Workshop "Scene Flow Challenge"

- **25. Bridging Spectral-wise and Multi-spectral Depth Estimation via Geometry-guided Contrastive Learning**
  - **Ukcheol Shin**, Kyunghyun Lee, Jean Oh
  - IEEE International Conference on Robotics and Automation (**ICRA**) (**Oral**), 2025
  - Received **Samsung Humantech Paper Award (Honourable Mention)**

- **24. FIReStereo: Forest InfraRed Stereo Dataset for UAS Depth Perception in Visually Degraded Environments**
  - Devansh Dhrafan*, Yifei Liu*, Andrew Jong, **Ukcheol Shin**, Yao He, Tyler Harp, Yaoyu Hu, Jean Oh, Sebastian Scherer (*Equal Contribution)
  - IEEE Robotics and Automation Letters (**RA-L**), 2025

- **23. Unpaired Shadow Removal: Enhancing Attention to Shadow Areas via Dropkey**
  - Jaewon Yang, **Ukcheol Shin**, Donghyeon Cho
  - International Conference on Electronics, Information and Communications (**ICEIC**), 2025

- **22. Exploiting Cross-modal Cost Volume for Multi-sensor Depth Estimation**
  - Janghyun Kim, **Ukcheol Shin**, Seokyong Heo, Jinsun Park
  - Asian Conference on Computer Vision (**ACCV**), 2024

- **21. Density-aware Domain Generalization for LiDAR Semantic Segmentation**
  - Jaeyeul Kim*, Jungwan Woo*, **Ukcheol Shin**, Jean Oh, Sunghoon Im (*Equal Contribution)
  - IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**) (**Oral**), 2024

- **20. Self-supervised Visual Odometry from Monocular Thermal Images: Exploration and Discussion**
  - **Ukcheol Shin**, Seho Park, Jean Oh
  - International Conference on Ubiquitous Robots (**UR**), 2024

- **19. Learning to Control Camera Exposure via Reinforcement Learning**
  - **Ukcheol Shin***, Kyunghyun Lee*, Byeong-Uk Lee (*Equal Contribution)
  - IEEE/CVF Conference on Computer Vision and Pattern Recognition (**CVPR**), 2024

- **18. Complementary Random Masking for RGB-T Semantic Segmentation**
  - **Ukcheol Shin**, Kyunghyun Lee, In So Kweon, Jean Oh
  - IEEE International Conference on Robotics and Automation (**ICRA**) (**Oral**), 2024

- **17. Learning Quadrupedal Locomotion with Impaired Joints Using Random Joint Masking**
  - Mincheol Kim, **Ukcheol Shin**, Jung-Yup Kim
  - IEEE International Conference on Robotics and Automation (**ICRA**) (**Oral**), 2024

- **16. Stable Surface Regularization for Fast Few-Shot NeRF**
  - ByeongIn Joung, Byeong-Uk Lee, Jaesung Choe, **Ukcheol Shin**, Minjun Kang, Taeyeop Lee, In So Kweon, Kuk-Jin Yoon
  - International Conference on 3D Vision (**3DV**), 2024

- **15. Empirical Study: Monocular Depth Estimation from RGB, NIR, Thermal Image in Adverse Weather Conditions**
  - **Ukcheol Shin**, Soonmin Hwang, Jean Oh
  - International Conference on Information and Communication Technology Convergence (**ICTC**) (**Oral**), 2023

- **14. Joint Self-supervised Learning and Adversarial Adaptation for Monocular Depth Depth Estimation from Thermal Image**
  - **Ukcheol Shin**, Kwanyong Park, Kyunghyun Lee, Byeong-Uk Lee, In So Kweon
  - Machine Vision and Applications (**MVA**), 2023

- **13. Deep Depth Estimation from Thermal Images**
  - **Ukcheol Shin**, Jinsun Park, In So Kweon
  - IEEE/CVF Conference on Computer Vision and Pattern Recognition (**CVPR**), 2023

- **12. Self-supervised Monocular Depth Estimation from Thermal Images via Adversarial Multi-spectral Adaptation**
  - **Ukcheol Shin**, Kwanyong Park, Byeong-Uk Lee, Kyunghyun Lee, In So Kweon
  - IEEE/CVF Winter Conference on Applications of Computer Vision (**WACV**) (**Oral**), 2023
  - Received **Best Student Paper Award** in WACV 2023

- **11. UDA-COPE: Unsupervised Domain Adaptation for Category-level Object Pose Estimation**
  - Taeyeop Lee, Byeong-Uk Lee, Inkyu Shin, Jaesung Choe, **Ukcheol Shin**, In So Kweon
  - IEEE/CVF Conference on Computer Vision and Pattern Recognition (**CVPR**), 2022

- **10. DRL-ISP: Multi-objective Deep Camera ISP with Deep Reinforcement Learning**
  - **Ukcheol Shin***, Kyunghyun Lee*, In So Kweon (*Equal contribution)
  - IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**) (**Oral**), 2022

- **9. Maximizing Self-supervision from Thermal Image for Effective Self-supervised Learning of Depth and Ego-motion**
  - **Ukcheol Shin**, Kyunghyun Lee, Byeong-Uk Lee, In So Kweon
  - IEEE Robotics and Automation Letters (**RA-L** and **IROS**) (**Oral**), 2022

- **8. MS-UDA: Multi-spectral Unsupervised Domain Adaptation for Thermal Image Semantic Segmentation**
  - Yeong-Hyeon Kim, **Ukcheol Shin**, Jinsun Park, In So Kweon
  - IEEE Robotics and Automation Letters (**RA-L**), 2021

- **7. Self-supervised Depth and Ego-motion Estimation for Monocular Thermal Video using Multi-spectral Consistency Loss**
  - **Ukcheol Shin**, Kyunghyun Lee, Seokju Lee, In So Kweon
  - IEEE Robotics and Automation Letters(**RA-L** and **ICRA**) (**Oral**), 2021

- **6. An Efficient Asynchronous Method for Integrating Evolutionary and Gradient-based Policy Search**
  - Kyunghyun Lee, Byeong-Uk Lee, **Ukcheol Shin**, In So Kweon
  - Neural Information Processing Systems (**NeurIPS**) (**Oral**), 2020

- **5. Vehicular Multi-camera Sensor System for Automated Visual Inspection of Electric Power Distribution Equipment**
  - Jinsun Park, **Ukcheol Shin**, Gyumin Shim, Kyungdon Joo, Francois Rameau, Junhyeok Kim, Dong-Geol Choi, In So Kweon
  - IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**) (**Oral**), 2019

- **4. Camera Exposure Control for Robust Robot Vision with Noise-aware Image Quality Assessment**
  - **Ukcheol Shin**, Jinsun Park, Gyumin Shim, Francois Rameau, In So Kweon
  - IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**) (**Oral**), 2019

- **3. Performance Evaluation of Real-time Mechanisms on Open Embedded Hardware Platforms**
  - **Ukcheol Shin**, Byoung Wook Choi
  - Journal of Institute of Control, Robotics, and Systems (**ICROS**), 2017

- **2. Development and Control of an Omnidirectional Mobile Robot on an Ethercat Network**
  - Raimarius Delgado, **Ukcheol Shin**, Chang Hwi Hong, Byoung Wook Choi
  - International Journal of Applied Engineering Research (**IJAER**), 2016

- **1. Implementation and Performance Analysis of an Ethercat Master on the Latest Real-time Embedded Linux**
  - Raimarius Delgado, Chang Hwi Hong, **Ukcheol Shin**, Byoung Wook Choi
  - International Journal of Applied Engineering Research (**IJAER**), 2015

Skills

- **Programming Language:** C, C++, Python, Matlab
- **ML/CV/RO Library:** Pytorch, OpenCV, ROS
- **Embedded Linux:** Linux Programming, Device Driver, Real-time Operating System, Embedded System.
- **Deep Learning:** 3D Geometry, Self-supervised Learning, Domain Adaptation, Reinforcement Learning
- **Sensors:** RGB Camera, NIR Camera, Thermal Camera, Motor, Wheel Encoder, IMU, LiDAR

Invited Talk

- **ACCV Workshop on "Multispectral Imaging for Robotics and Automation"** Dec. 2024
  Title: Visual Perception from Thermal Image: Dataset, Benchmark, and Challenges [Link]
- **KAIST** Sep. 2024
  Title: How to do AI research: Goal and mindset
- **Hanyang University** Aug. 2024
  Title: Spatial Perception from Thermal Image in Adverse Weather and Lighting Conditions
- **Hanyang University** May 2024
  Title: Self-supervised Spatial Perception in Adverse Weather and Lighting Conditions
- **Seoul National University (SNU)** Feb. 2024
  Title: Robust Semantic and Spatial Perception in Adverse Weather and Lighting Conditions
- **Gwangju Institute of Science and Technology (GIST)** Sep. 2023

Title: Robust Geometric Perception in Adverse Weather and Lighting Conditions

- **Ulsan National Institute of Science and Technology (UNIST)** July 2023
  Title: Robust Geometric Perception in Adverse Weather and Lighting Conditions
- **Pusan National University** July 2023
  Title: Robust Visual Perception from Thermal Spectrum Band in Challenging Conditions

Academic Activities

- Journal Reviewer 2021–Current
  T-NNLS, T-IV, T-ITS, T-CYB, T-OMM, RA-L, NPL, PR, Sensors
- Conference Reviewer 2021–Current
  NeurIPS, ICML, ICLR, AAAI, CVPR, ICCV, ECCV, ACCV, WACV, ICRA, IROS, RSS
- **Program Organizer** May 2025
  ICRA 2025 Workshop on "Thermal in Robotics" [Link]
- **Program Organizer** Oct. 2025
  ICCV 2025 Workshop on "Multispectral Imaging for Robotics and Automation" (Under-review)

Awards and Honors

- **Silver Prize**, 31th HumanTech Paper Award, Samsung Electronics Co., Ltd ($7,000). Feb. 2025
- **1st Place Award**, CVPR 2024 Autonomous Driving Workshop "Argoverse Scene Flow Challenge" June. 2024
- **Honorable Mention**, 29th HumanTech Paper Award, Samsung Electronics Co., Ltd ($2,000). Feb. 2023
- **Best Student Paper Award**, IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)
  - Out of 1577 submitted papers, one of the 3 best paper award. [Link] Jan. 2023
- **KAIST Scholarship**, Scholarship for the Ph.D. program Sep. 2019 - Aug. 2023
- **KAIST Government Scholarship**, Scholarship for the M.S. program Sep. 2017 - Aug. 2019
- **Graduation with Honors (Top 3%)**, SNUST in Electrical and Information Engineering Feb 2017
- **Honorable Mention**, All-semester Design Based Learning (ADBL) Capstone Contest June 2016
- **Second Prize**, Robot Open Academy Feb 2016
- **Grand Prize**, All-semester Design Based Learning (ADBL) Capstone Contest Dec 2015
- **Military Service**, Army Sergeant, Honorable discharge Feb. 2013 - Nov. 2014
- **Scholarship for Academic Excellence**, Scholarship for the entire B.S. program 2011-2012, 2015-2016

Research Projects

- **Development of Simulation Technology for Advanced Fully Automated Driving Algorithm** (2023 - Now)
  - Partners: CMU, KETI, MORAI.
  - My role: Research Director
  - Objective: Develop a social navigation algorithm that considers surrounding traffic and object status to enable safe and efficient navigation in complex environments.
- **Embeded AI based Fully Autonomous Driving Software and Maas Technology Development** (2023 - Now)
  - Partners: CMU, KETI, SpringCloud.
  - My role: Research Director

  - Objective: Develop lightweight 3D detection, tracking, and planning algorithms for embedded autonomous driving software.

- **AI System for Traffic and Hit-and-Run Accidents with Multi-Band Images** (2022 - 2023)
  - Partners: KAIST, Miru Systems.
  - My role: Research Director
  - Objective: Develop multi-band sensor system (Visible, NIR, LWIR) and video analysis algorithms (object detection, super-resolution, video summarization, anomaly detection) for traffic and hit-and-run accidents.

- **Real-time Masking/Unmasking System for Personal Information in Public CCTV Services** (2021 - 2023)
  - Partners: KAIST, Hanbat National University, Miru Systems, Hanulsoft, Datamaker, Deajeon Transportation Corporation, Telecommunications Technology Association (TTA).
  - My role: Research Director
  - Objective: Develop deep stenography algorithm to mask/unmask personal information (faces, car license plates).

- **SWIR Camera based Navigation for UAV in Indoor Environments** (2021 - 2023)
  - Partners: KAIST, University of Picardy Jules Verne (UPJV), University of Burgundy.
  - My role: Research Director, Research Associate
  - Objective: Develop data-driven Structure-from-Motion or SLAM algorithms for SWIR camera.
  - Related to the publications ([7], [9], [12]).

- **Automated Visual Inspection System for Electric Power Distribution Equipment** (2017 - 2021)
  - Partners: Five Labs in KAIST, Korea Electric Power Corporation (KEPCO), NexChal.
  - My role: Research Associate(2017-2020), Research Director (2020-2021)
  - Objective: Develop vehicular multi-camera sensor system (8 color cameras, 2 thermal cameras, 6 motors, 1 GPS/IMU), its control algorithm, and perception models (detection, segmentation) for automated visual inspection from a moving vehicle. Also, integrate all developed hardware and software with Robot Operating System (ROS) platform in vehicle platform.
  - Related to the publications ([4], [5]).

- **Real-Time Embedded Linux and Device Driver Development for Mobile Robot** (2016 - 2017)
  - Partners: Seoul National University of Science and Technology, KIST.
  - My role: Research Associate
  - Objective: Develop real-time device driver (motor, encoder, LRF, IMU) and I2C based control system.
  - Related to the publications ([1], [2], [3]).

- **Real-Time Ethernet Protocol Development for Low-power Embedded System** (2015 - 2016)
  - Partners: Seoul National University of Science and Technology, KIST.
  - My role: Research Assistant
  - Objective: Develop real-time embedded system (Xenomai) and real-time ethernet protocol (EtherCAT) for real-time distributed motor control.
  - Related to the publications ([1], [2], [3]).

Teaching

- **Teaching Assistant** at KAIST Spring 2021
  Advanced Topics in Deep Learning for Robotics and Vision (EE898)
  - I created course materials for the "Continual Learning" section. [File]
- **Teaching Assistant** at KAIST Spring 2020

Advanced Topics in Deep Learning for Robotics and Vision (EE898)

- I created course materials for the "Reinforcement Learning" section. [File]

- **Teaching Assistant** at KAIST Fall 2019
  SK Hynix-KAIST Machine Learning Course

  - I created course materials for "Visual Localization" and taught the topic to SK Hynix engineers. [File]

- **Teaching Assistant** at KAIST Fall 2019
  Electronics Design Lab. <Network of Smart Things> (EE405C)

- **Teaching Assistant** at KAIST Spring 2018
  Programming Structures for Electrical Engineering (EE209)

Representative Research Achievement

- **1. Deep Depth Estimation from Thermal Images**
  - **Ukcheol Shin**, Jinsun Park, In So Kweon
  - IEEE/CVF Conference on Computer Vision and Pattern Recognition (**CVPR**), 2023
  - **Role: First Author (FA)**
  *As the first author, I developed the idea, created the vehicular sensor system, acquired the dataset, refined the dataset, developed the monocular and stereo depth unified network, conducted experiments, and wrote the paper.
  - Summary:
  * This paper proposed **the first large-scale thermal stereo dataset for depth estimation acquired under various environmental changes**, such as day, night, and rain in urban, campus, residential, and road environments.
  * Additionally, I developed a vehicular sensor system based on RGB stereo, NIR stereo, thermal stereo, LiDAR stereo, and GPS/IMU and performed calibration, time synchronization, and ROS-based system integration for heterogeneous sensors.
  * I analyzed the performance of monocular and stereo depth estimation models based on thermal images and proposed a monocular and stereo depth unified network, demonstrating its excellence.
  * Since its release, **the dataset has been downloaded over 400 times and is being used for research at renowned universities and companies**, including Caltech, CMU, TUM, Oxford Univ., Tsinghua Univ., KAIST, Google, and Hyundai.

- **2. Joint Self-supervised Learning and Adversarial Adaptation for Monocular Depth Depth Estimation from Thermal Image**
  - **Ukcheol Shin**, Kwanyong Park, Kyunghyun Lee, Byeong-Uk Lee, In So Kweon
  - Machine Vision and Applications (**MVA**), 2023
  - **Role: First Author (FA)**
  * As the first author, I developed the idea, proposed a new training method combining adversarial learning and self-supervised learning methods, conducted experiments, and wrote the paper.
  - Summary:
  * This paper proposes **a novel training method for estimating relative depth maps from thermal images without GT labels, combining self-supervised learning methods using camera geometry and adversarial learning techniques between RGB and thermal image features.**
  * The proposed method demonstrated robust and superior depth estimation performance even in extremely low light and adverse weather conditions.
  * This paper is **an extended version of WACV 2023 Best Student Paper. The paper won one of the three Best Paper Awards among 1577 submitted papers.**

- **3. Learning to Control Camera Exposure via Reinforcement Learning**
  - **Ukcheol Shin***, Kyunghyun Lee*, Byeong-Uk Lee (*Equal Contribution)
  - IEEE/CVF Conference on Computer Vision and Pattern Recognition (**CVPR**), 2024
  - **Role: First Author (FA)**
  * As the first author, I developed the idea, created an experimental environment mimicking real-world lighting changes, conducted experiments, and wrote the paper.
  - Summary:

* This paper is **the first method that applies deep reinforcement learning to camera exposure control for rapid convergence and reward-aware adjustment**.
* It demonstrated significantly faster exposure control speed and stable convergence compared to existing algorithms under various changes such as sudden lighting changes, gradual lighting changes, and backlighting through indoor and outdoor experiments and vehicle driving experiments.

- **4. Self-supervised Depth and Ego-motion Estimation for Monocular Thermal Video using Multi-spectral Consistency Loss**
  - **Ukcheol Shin**, Kyunghyun Lee, Seokju Lee, In So Kweon
  - IEEE Robotics and Automation Letters(**RA-L** and **ICRA**) (**Oral**), 2021
  - **Role: First Author (FA)**
  * As the first author, I developed the idea, proposed a new training method utilizing paired RGB images to generate a self-supervision signal, conducted experiments, and wrote the paper.
  - Summary:
  * This paper proposes **the first self-supervised training method for learning depth and ego-motion from paired RGB and thermal images** in adverse real-world environments (e.g., extremely low light, heavy rain, heavy snow, fire, fog, smog, sandstorms) without GT labels.
  * The proposed methods have demonstrated excellent robustness and reliability in various weather and extreme lighting conditions.

- **5. Maximizing Self-supervision from Thermal Image for Effective Self-supervised Learning of Depth and Ego-motion**
  - **Ukcheol Shin**, Kyunghyun Lee, Byeong-Uk Lee, In So Kweon
  - IEEE Robotics and Automation Letters (**RA-L** and **IROS**) (**Oral**), 2022
  - **Role: First Author (FA)**
  * As the first author, I developed the idea, proposed a new self-supervision maximization method, conducted experiments, and wrote the paper.
  - Summary:
  * This paper proposes **the first method that maximizes the thermal image's self-supervisory signal by resolving inherent thermal image characteristics.**
  * As a result, **the method allows the network to be trained with thermal image solely in any adverse and hostile real-world environments**, such as extremely low light, heavy rain, heavy snow, and sandy dust, as well as in urban, residential, tunnel, and cave environments.

References

- **Prof. In So Kweon (M.S. and Ph.D. advisor at KAIST)**
  KEPCO Chair Professor, School of Electrical Engineering, KAIST
  Email: iskweon77@kaist.ac.kr

- **Prof. Jean Oh (Postdoc supervisor at CMU RI)**
  Associate Research Professor, Robotics Institute, CMU
  Email: hyaejino@andrew.cmu.edu

- **Prof. Jinsun Park (Co-worker)**
  Assistant Professor, School of Computer Science, Pusan University
  Email: jspark@pusan.ac.kr

- **Prof. Francois Rameau (Co-worker)**
  Assistant Professor, School of Computer Science, State University of New York (SUNY) in Korea
  Email: francoisbernar.rameau@stonybrook.edu