Wooju Lee

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Summary

Ph.D. candidate in Electrical Engineering at KAIST, specializing in geometric computer vision and robust localization for autonomous systems. Developed cross-view geo-localization models and integrated them with SLAM to achieve precise global pose estimation without relying on GPS or loop closures. This work improved long-term localization accuracy and enabled flexible navigation, contributing to the deployment of autonomous vehicles in the real world. Research interests include, but are not limited to:

- **Geo-localization:** Cross-view pose optimization, cross-view image retrieval, and visual place recognition
- **Domain robustness:** Domain generalization, sensor fusion, and adversarial training
- **Image recognition:** Image classification, object detection, and segmentation

Projects

- **Development of autonomous driving technology for unstructured environment** *Jul. 2023 - Present*
  Supported by Hanwha Aerospace [GitHub]
  - Developed a cross-view geo-localization method for global pose estimation in GPS-denied environments.
  - Inspired by a PID controller, the pose estimation method was designed to be robust to large initial pose errors.
  - Proposed a DNN-based pose estimator to improve pose consistency over existing LM-based optimization methods.
  - Achieved **SOTA** with a mean position error of 0.43m in **real-world experiments** on **autonomous vehicles.**
  - Integrated cross-view geo-localization with SLAM for precise global pose estimation without GPS or loop closures.
  - Exploring geometric algebra to enhance the robustness and mitigate translation-rotation accuracy trade-offs.
- **Development of Robust AI Technology for Dynamic Real-World Situations** *Mar. 2022 - Dec. 2023*
  Supported by IITP, which is a government-affiliated organization [GitHub]
  - Developed a domain generalization for object detection, improving robustness to out-of-distribution data.
  - Proposed object-based data augmentation and contrastive learning for domain generalization in object detection.
  - Achieved **SOTA** performance with 21.8mAP on the KITTI-C dataset, which includes adverse weather and blur.
  - Validated the model in **real-world autonomous vehicle applications**.

Publications

C=Conference, J=Journal, *=Equal contribution

[C.1] **W. Lee**, J. Park, D. Hong, C. Sung, Y. Seo, D. Kang, and H. Myung, "PIDLoc: Cross-view pose optimization network inspired by PID controllers," accepted to CVPR, 2025, [GitHub]

[C.2] **W. Lee***, D. Hong*, H. Lim, and H. Myung, "Object-aware domain generalization for Object Detection," in AAAI, 2024, **Oral**, [Pull requests], [GitHub].

[C.3] I. Lee, **W. Lee**, and H. Myung, "Domain generalization with vital phase augmentation", in AAAI, 2024, [GitHub].

[C.4] C. Sung, W. Kim, J. An, **W. Lee**, H. Lim, H. Myung, "Contextrast: Contextual contrastive learning for semantic segmentation", in CVPR, 2024, [GitHub].

[C.5] **W. Lee** and H. Myung, "Parametric surround modulation improves the robustness of the deep neural networks", in RITA, 2023.

[C.6] **W. Lee** and H. Myung, "Adversarial attack for asynchronous event-based data", in AAAI, 2022.

[J.1] S. Noh, **W. Lee**, and H. Myung, "Sample-efficient and occlusion-robust reinforcement learning for robotic manipulation via multimodal fusion dualization and representation normalization", in Neural Networks, 2025.

[J.2] A. J. Lee, S. Song, H. Lim, **W. Lee**, and H. Myung, "$(LC)^2$: LiDAR-camera loop constraints for cross-modal place recognition", in IEEE RA-L, 2023, [GitHub].

[J.3] D. Noh, C. Sung, T. Uhm, **W. Lee**, H. Lim, and H. Myung.,"X-MAS: Extremely large-scale multi-modal sensor dataset for outdoor surveillance in real environments", in IEEE RA-L, 2023.

Education

- **Korea Advanced Institute of Science and Technology (KAIST)** *Mar. 2021 - Present*
  Ph.D candidate in Electrical Engineering, Advisor: Prof. Hyun Myung Daejeon, Republic of Korea
- **Korea Advanced Institute of Science and Technology (KAIST)** *Mar. 2019 - Feb. 2021*
  M.S. in Robotics Program, Advisor: Prof. Hyun Myung Daejeon, Republic of Korea
- **Korea University** *Mar. 2013 - Feb. 2019*
  B.S. in Mechanical Engineering Seoul, Republic of Korea

Skills

- Python3, Pytorch, ROS, Docker, Git, AWS

Honors and Awards

- **AFCV'21 Best Paper Award** *May 2021*
  Asian Federation of Computer Vision (AFCV)
  ◦ W. Lee and H. Myung, "Surround modulation-inspired neural network for robust image classification", in KROC, 2021.