

Research Portfolio

Younghun Cho
Ph.D.
CEE KAIST

Profile

Education



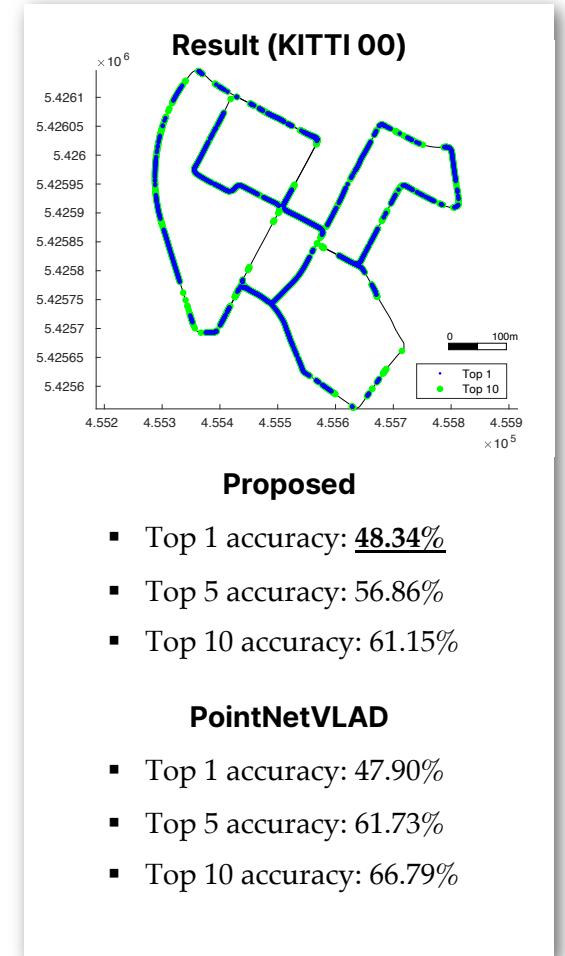
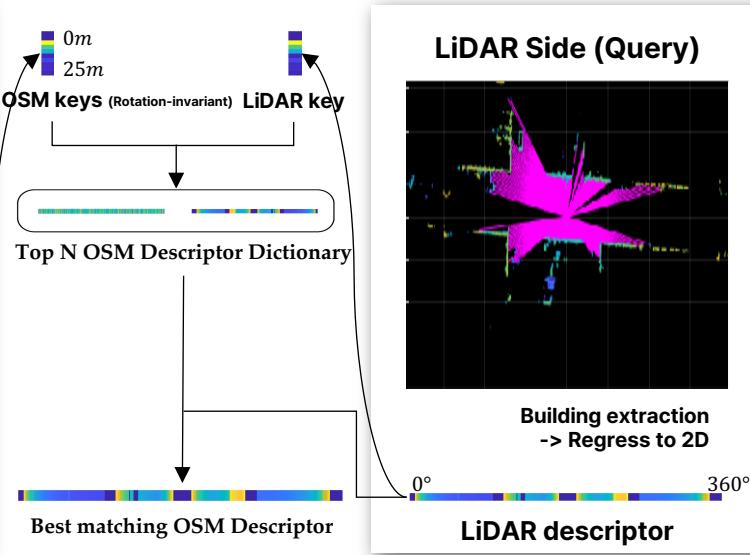
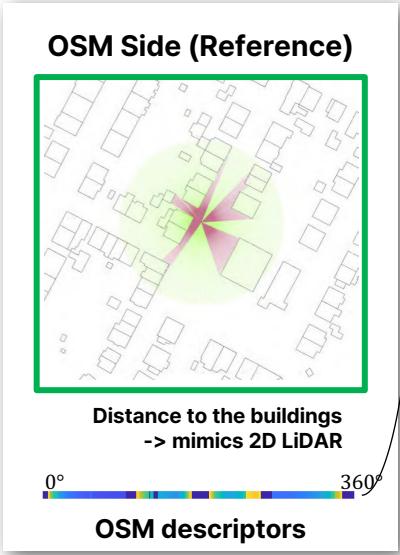
Ph.D.	IRiS Lab., CEE, KAIST (Advisor: Prof. Jee-Hwan Ryu), 2020~2024
M.S.	IRAP Lab. (Currently RPM Lab., SNU), CEE, KAIST (Advisor: Prof. Ayoung Kim), 2018~2020
B.S.	Dept. of Civil and Environmental Engineering, KAIST, 2014~2018
High School	Ulsan Science High School (Early Graduation), 2012~2014

Selected Publications

- STheReO: Stereo Thermal Dataset for Research in Odometry and Mapping (2022, IROS)
Seungsang Yun, Minwoo Jung, Jeongyun Kim, Sangwoo Jung, Younghun Cho, Myung-Hwan Jeon, Giseop Kim, and Ayoung Kim
- OpenStreetMap-based LiDAR Global Localization in Urban Environment without a Prior LiDAR Map (2022, RA-L w/ ICRA)
Younghun Cho, Giseop Kim, Sang-min Lee, and Jee-Hwan Ryu
- Mulran: Multimodal range dataset for urban place recognition (2020, ICRA)
Giseop Kim, Yeong Sang Park, Younghun Cho, Jinyong Jeong, and Ayoung Kim
- The road is enough! Extrinsic calibration of non-overlapping stereo camera and LiDAR using road information (RA-L, 2019)
Jinyong Jeong, Younghun Cho, and Ayoung Kim

Research Experience

LiDAR Descriptor Localization

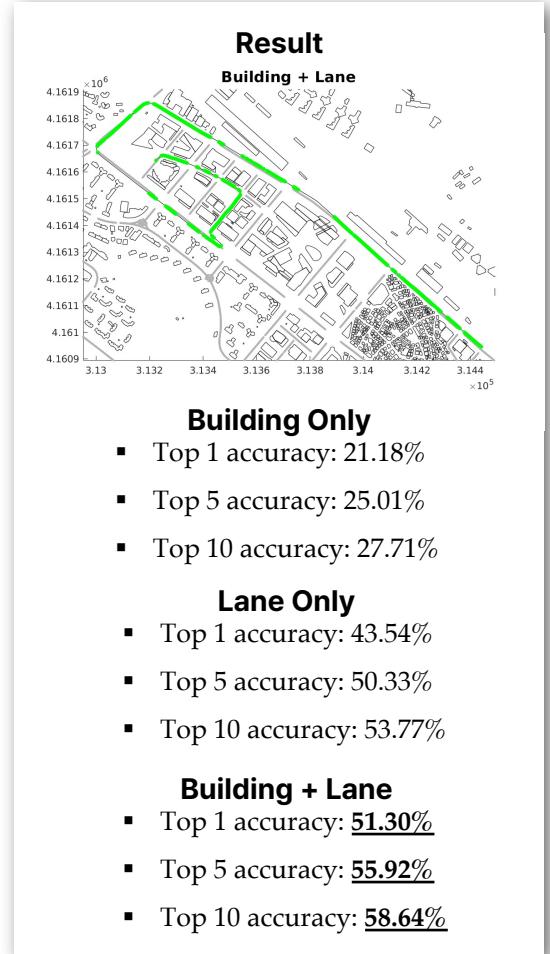
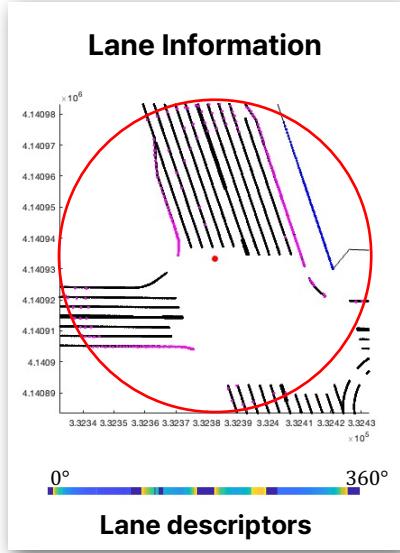
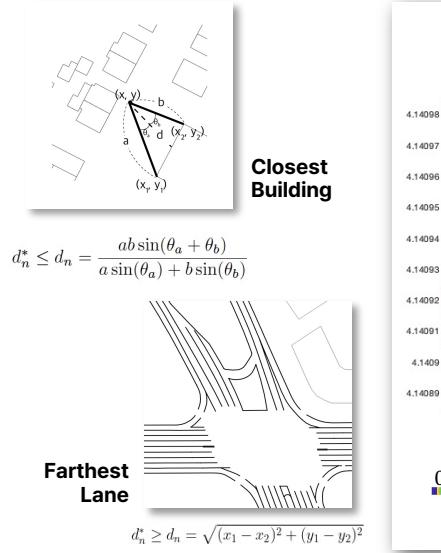
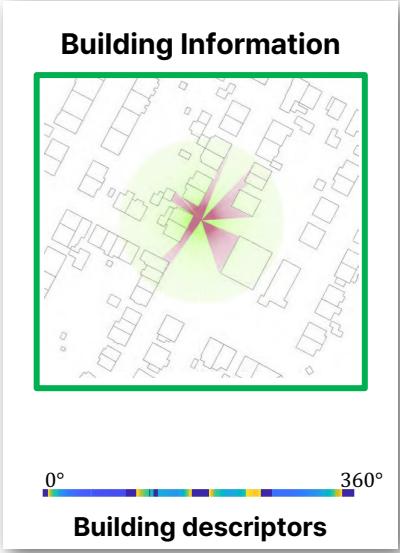
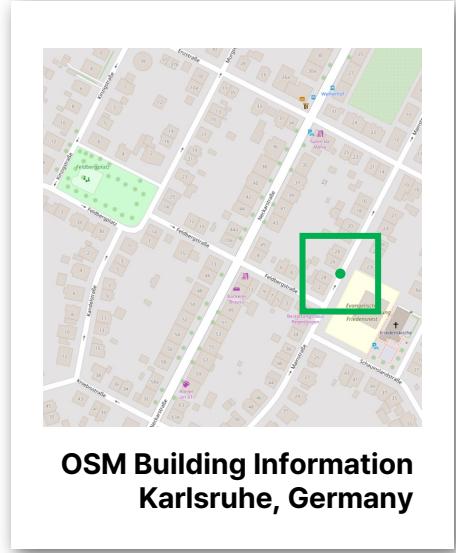


Contributions

- The first LiDAR kidnapped localization using OpenStreetMap
- Comparable performance using prior LiDAR map / deep learning
- Light-weighted data (3 MB vs 18GB for same area.)
- Code is available on <https://github.com/dudgnsrj/OSM-Descriptor-Localization>

Research Experience

LiDAR Descriptor Localization



Contributions

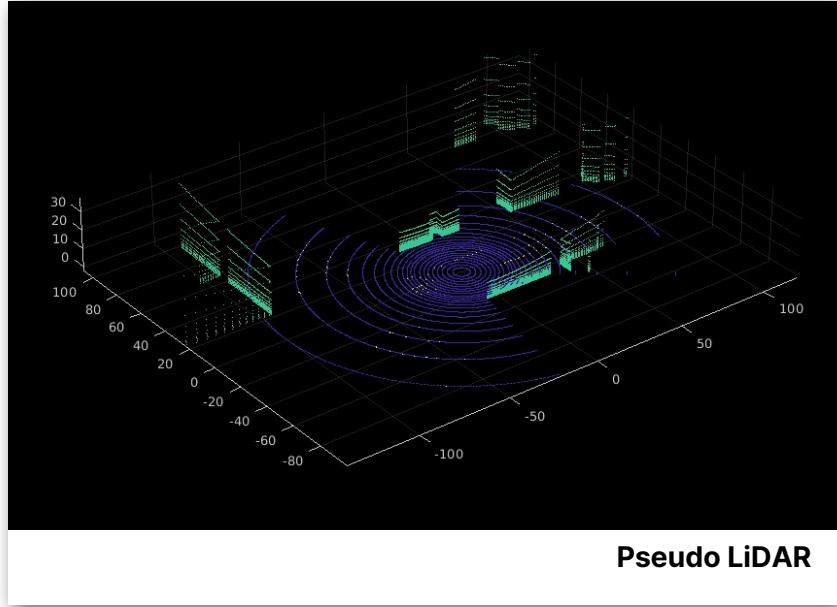
- Better result by adding lane information
- Localization success on place where using building / lane solely fails

Limitation

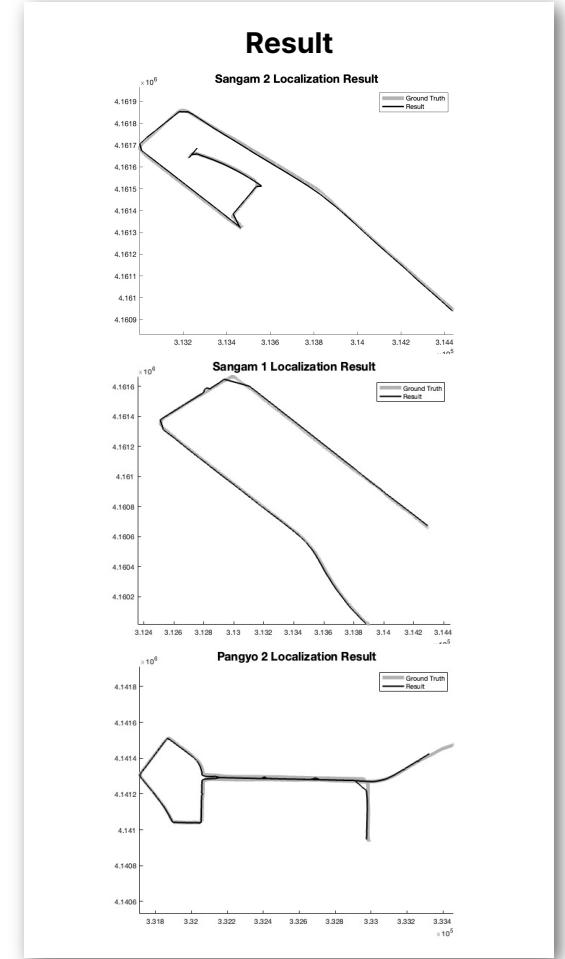
- HD-level lane information is not available on OpenStreetMap

Research Experience

LiDAR Descriptor Localization



- Assume infinite height (Template)
- Contains canonical information
 - Building
 - Ground
 - Lane
- Average intensity applied
 - From real dataset
- Same sensor configuration applied
 - Number of rays
 - Elevation, azimuth

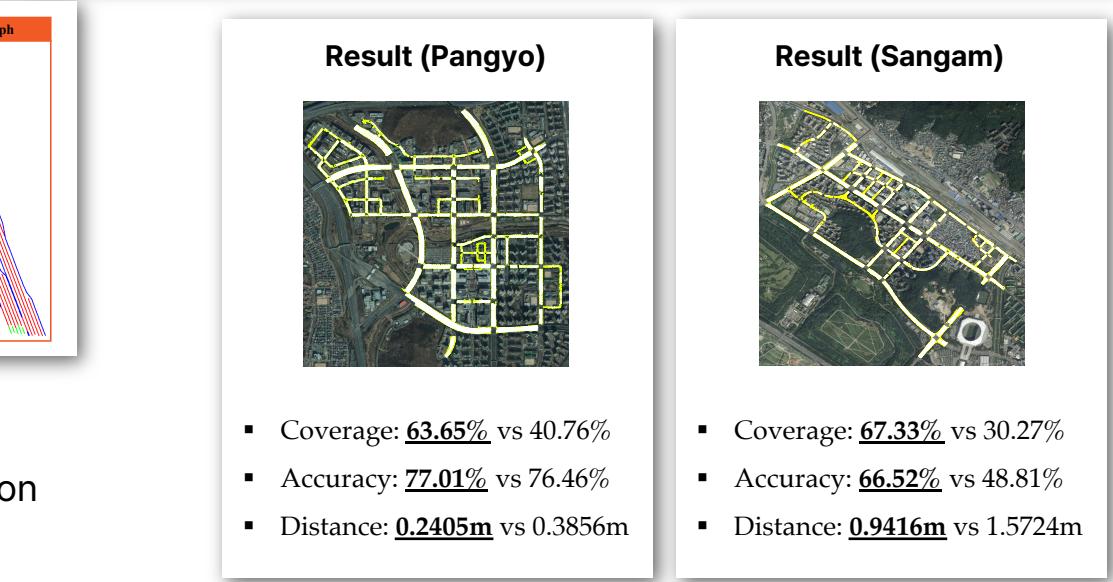
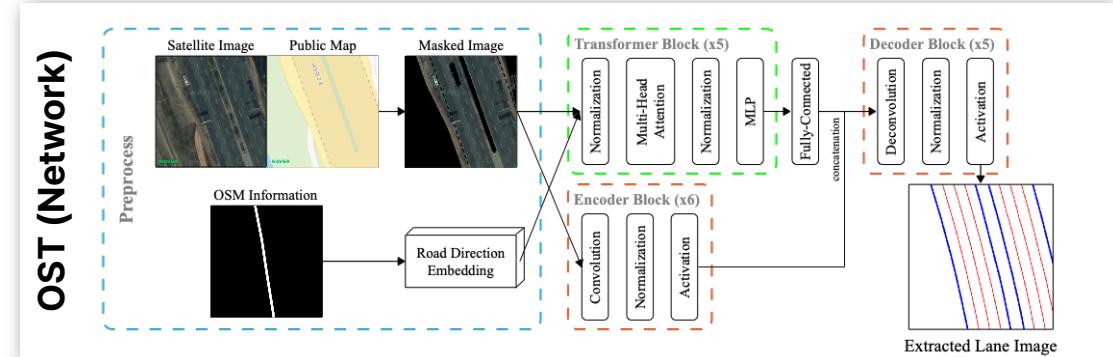
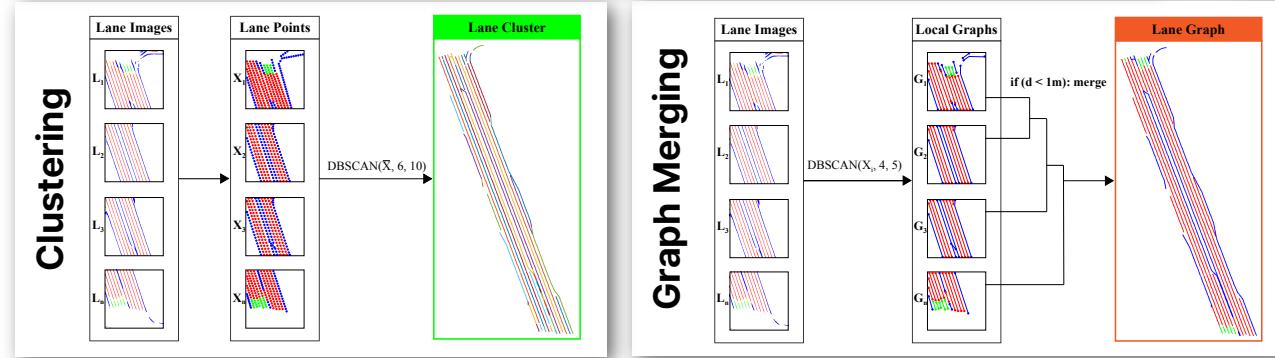
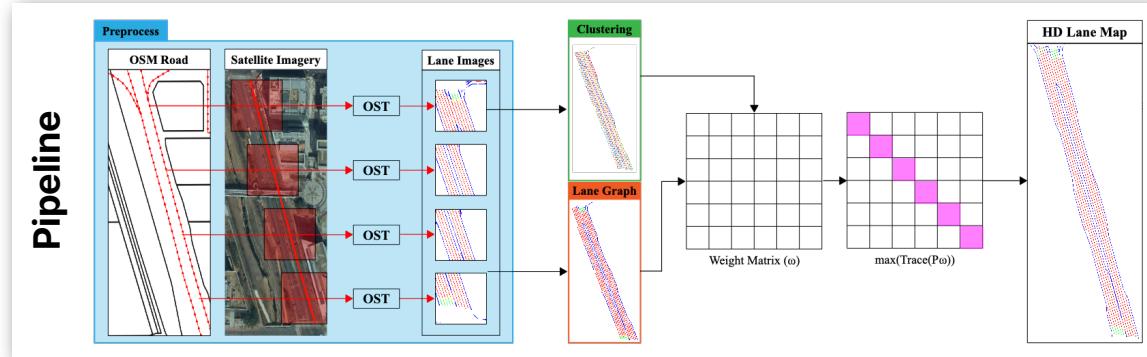


- **Contributions**
 - 6-DoF localization
 - Compatibility

Sequence	Pangyo 2	Sangam 1	Sangam 2	Average
Max error (m)	24.8973	33.8400	31.6968	30.1447
Mean error (m)	5.6232	13.6540	5.9641	8.4138
Median error (m)	5.1362	9.7922	5.9384	6.9556
Min error (m)	0.0564	1.0496	0.2386	0.4482

Research Experience

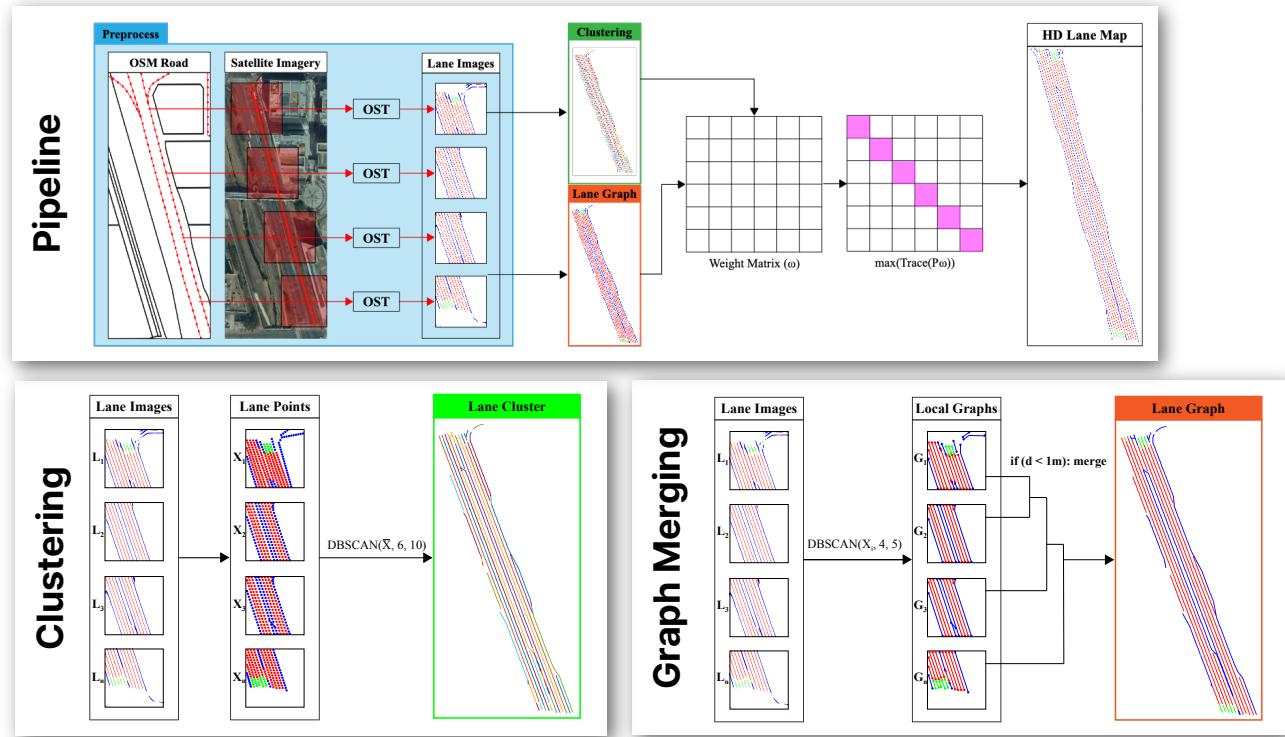
HD Lane Map Construction without visiting



- Contributions**
 - Global-scaled HD Lane Map without Visit for Data Collection
 - Novel Network to Extract Lanes from Satellite Image

Research Experience

HD Lane Map Construction without visiting



- **Contributions**
 - Global-scaled HD Lane Map without Visit for Data Collection
 - Novel Network to Extract Lanes from Satellite Image

	Edge 1	Edge 2	Edge 3	...	Edge m
Cluster 1	$\omega(1,1)$	$\omega(1,2)$	$\omega(1,3)$		$\omega(1, m)$
Cluster 2	$\omega(2,1)$	$\omega(2,2)$	$\omega(2,3)$		$\omega(2, m)$
Cluster 3	$\omega(3,1)$	$\omega(3,2)$	$\omega(3,3)$		$\omega(3, m)$
:					
Cluster n	$\omega(n, 1)$	$\omega(n, 2)$	$\omega(n, 3)$		$\omega(n, m)$

Hungarian Algorithm

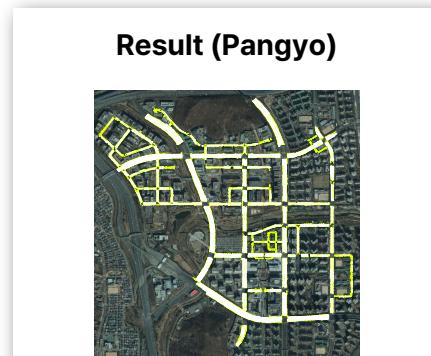
: Bipartite graph optimization

$$\max_{P} \sum_{x,y} TR(P\omega), P: \text{permutation matrix}$$

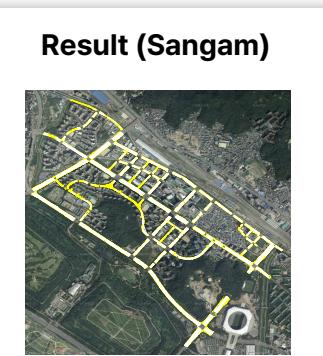
In this problem, connect cluster-edge pair with maximum intersection

∴ we can assign a point to multiple cluster and overcome disadvantages of both method

= Select cluster-edge pair without selecting each cluster and edge multiple times



Result (Pangyo)



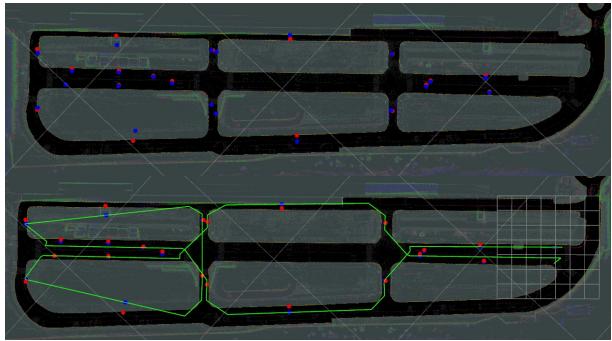
Result (Sangam)

- Coverage: 63.65% vs 40.76%
- Accuracy: 77.01% vs 76.46%
- Distance: 0.2405m vs 0.3856m
- Coverage: 67.33% vs 30.27%
- Accuracy: 66.52% vs 48.81%
- Distance: 0.9416m vs 1.5724m

Other Experience

Autonomous Driving Competition (MOLIT)

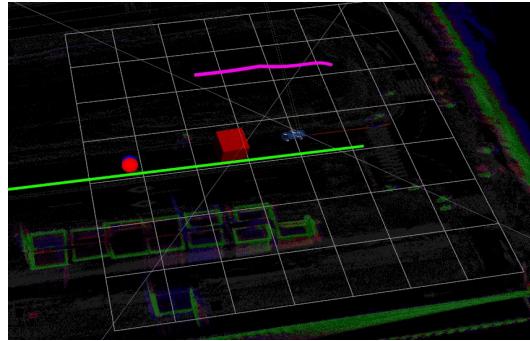
Global Path Planning



Calculate a optimal global path considering

- 1) Checkpoints to pass
- 2) Fastest lap time

Local Path / Behavior Planning



Calculate a optimal motion considering

- 1) Mission (pedestrian, vehicle, object)
- 2) Path considering traffic lights (V2X)

- **Contributions**

- Mainly contributed in planning (global, local, motion, behavior)
- Served as team leader and handled whole system