NAVER LABS Mapping & Localization Challenge

세종대학교 RCV 연구실

김지원, 김태주, 황유진

NAVER LABS Mapping & Localization Challenge

Place Recognition

DB

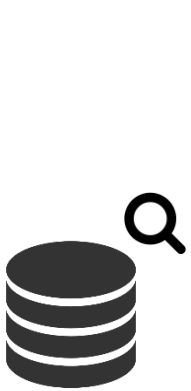
Query

NetVLAD

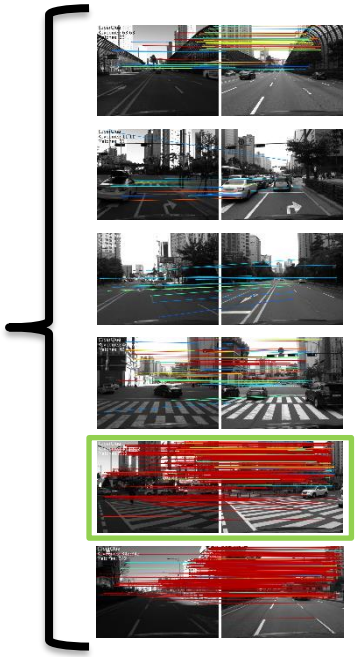
Global Descriptor

NetVLAD

Global Descriptor

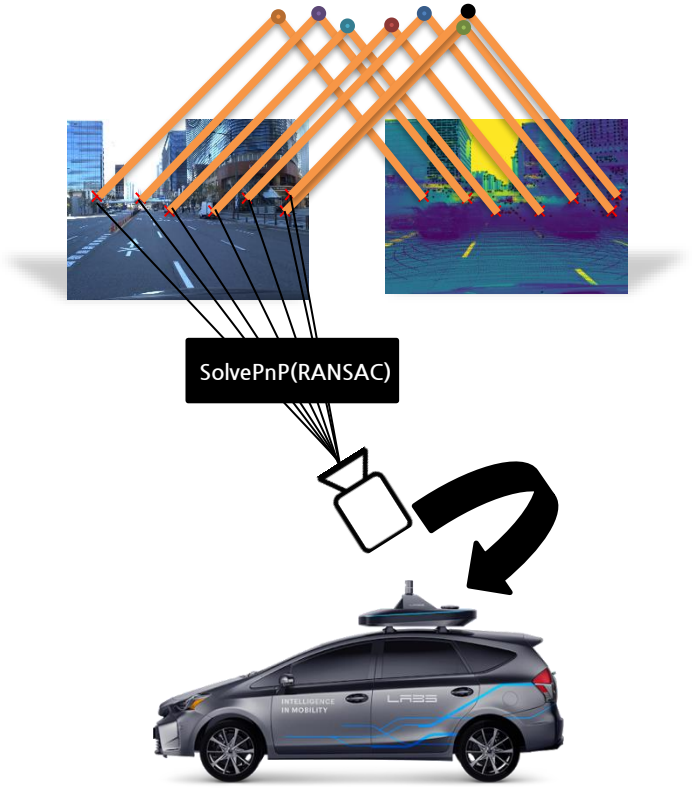


NN Search



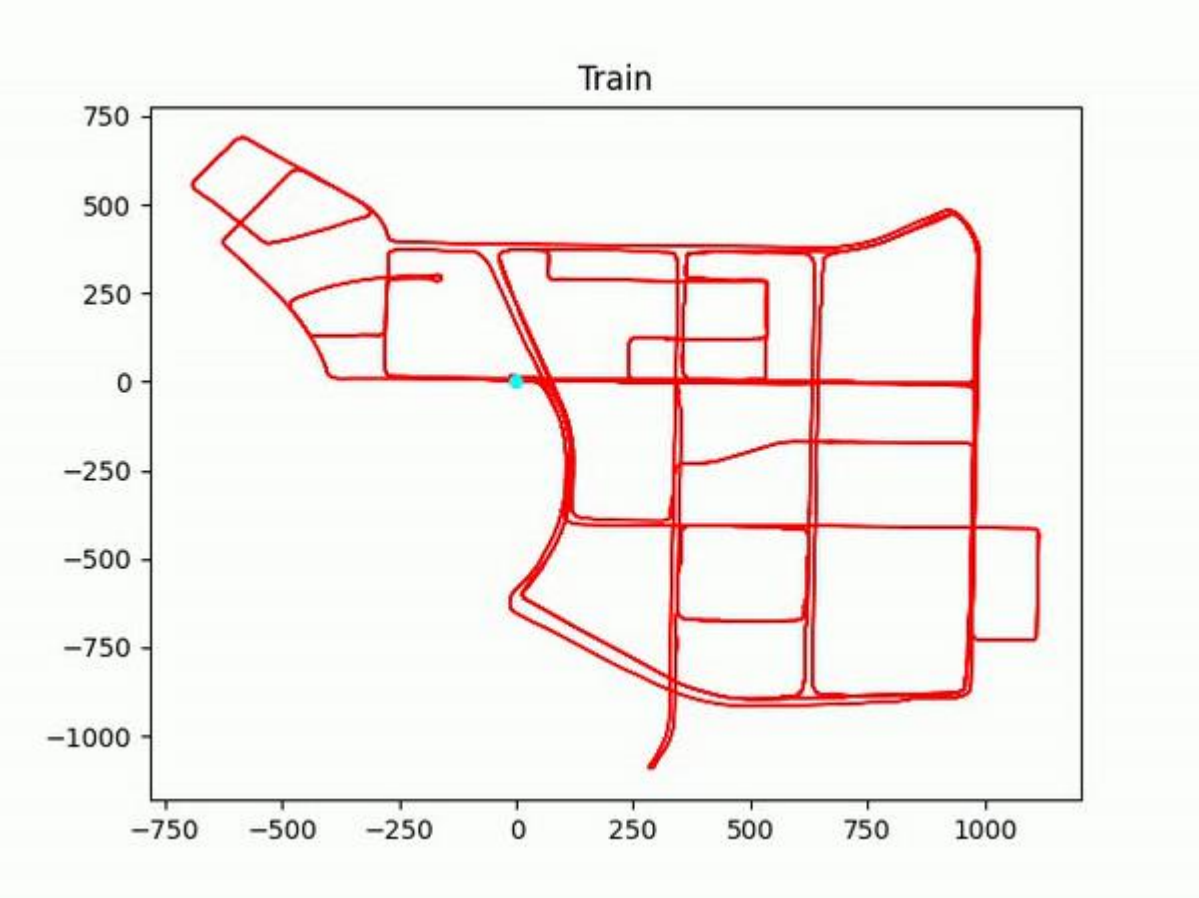
Re-ranking

Pose Estimation



NAVER LABS Mapping & Localization Challenge

주어진 판교/여의도 아웃도어 데이터셋을 Train(90%)/Validation(10%) 으로 나누어 평가

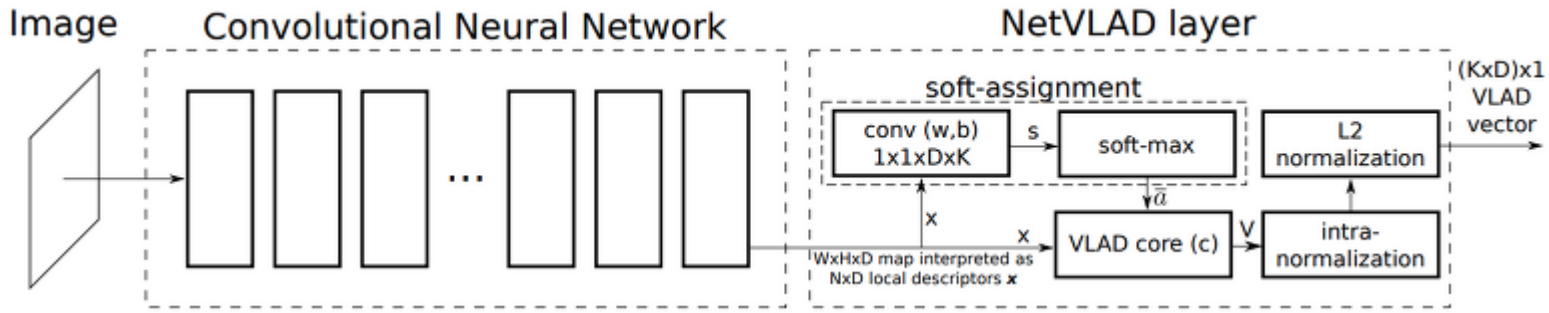


	Pangyo	Yeouido
Total	48107	86275
DB	43297	77647
Query	4810	8628

Place Recognition

Place Recognition

Global Descriptor **NetVLAD** : CNN architecture for weakly supervised place recognition For Top-10



(a) Mobile phone query

(b) Retrieved image of same place

[1] https://github.com/Nanne/pytorch-NetVlad

Place Recognition

Global Descriptor **NetVLAD** : CNN architecture for weakly supervised place recognition For Top-10

NetVLAD로 추출한 DB(Train)의 GT를 기준으로 계산한 QR(Validation) Place Recognition의 성능

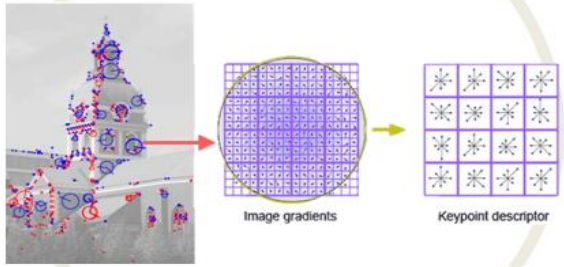
Dataset	Metric	recall@1	recall@5	recall@10
Pangyo	0.5m / 2.0°	28.42	34.38	35.7
	1.0m / 5.0°	96.404	97.83	97.88
	5.0 / 10.0°	100.0	100.0	100.0
Yeouido	0.5m / 2.0°	32.08	36.64	39.88
	1.0m / 5.0°	86.6	89.11	90.16
	5.0 / 10.0°	100.0	100.0	100.0

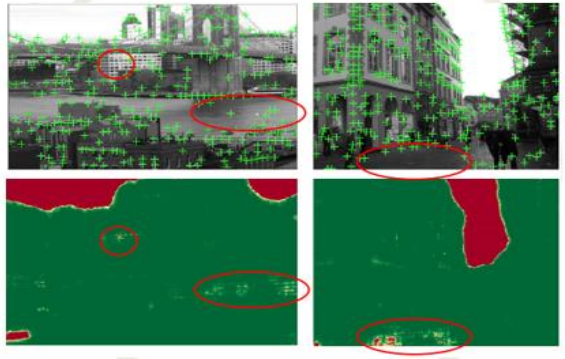
판교 기준으로 Train set에서 Validation의 0.5m 이내인 GT는 전체의 38.47%(Upper Bound) 만 존재

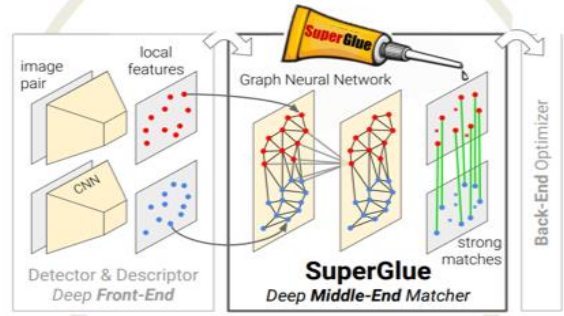
[1] https://github.com/Nanne/pytorch-NetVlad

Place Recognition

Local Descriptor | **Re-ranking** : SIFT, R2D2, SuperPoint | For Top-1





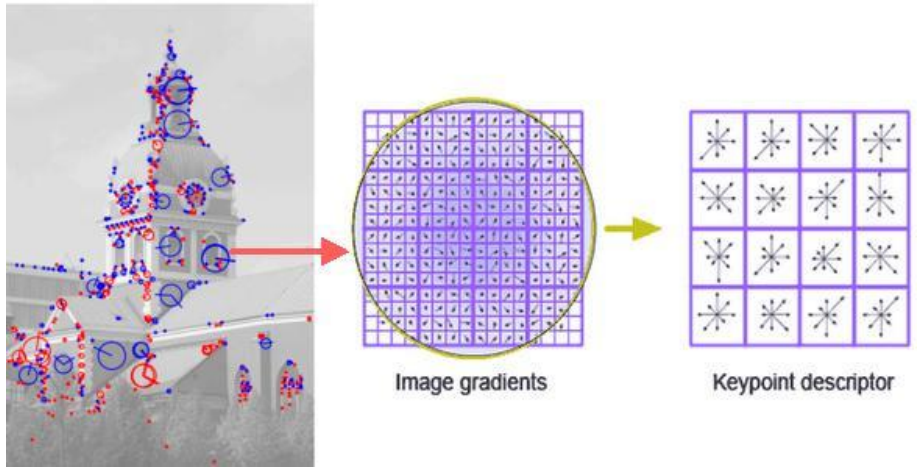


SIFT & BFMatcher | **R2D2 & DeepMatching** | **SuperPoint & SuperGlue**

가장 적합한 Local Descriptor 선정을 위해 SIFT, R2D2, SuperPoint를 실험

Place Recognition

SIFT & BFMatcher

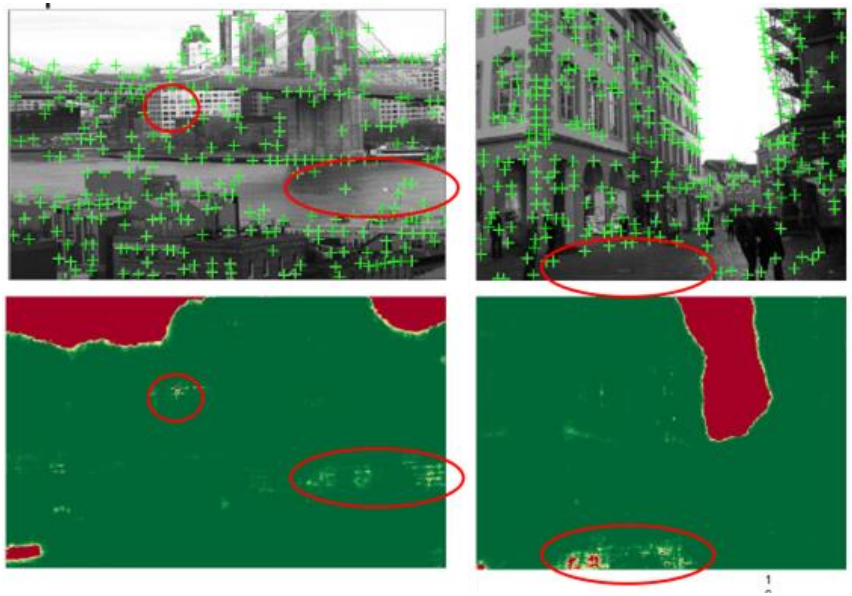


도로 표지판에 매칭 포인트 多

표지판 매칭으로 인한 노이즈 발생

Place Recognition

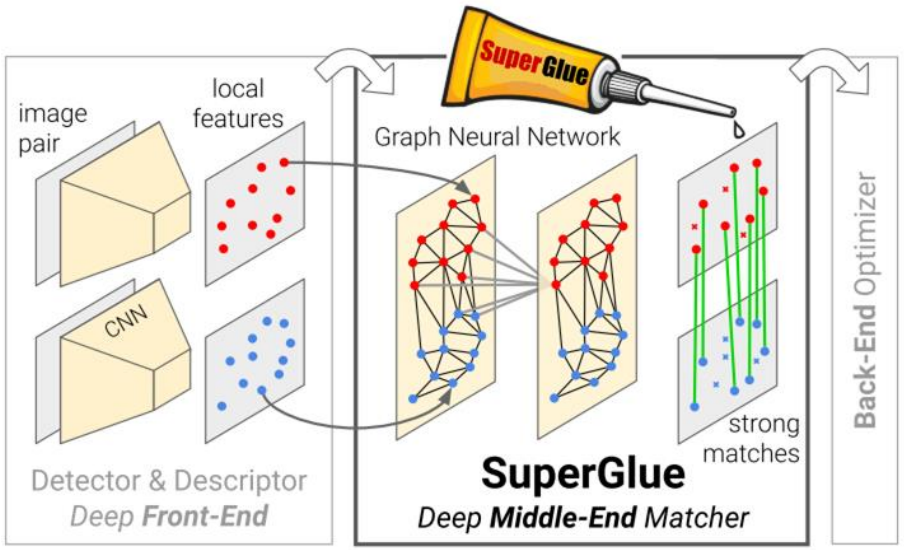
R2D2 & ~~DeepMatching~~
BFMatcher

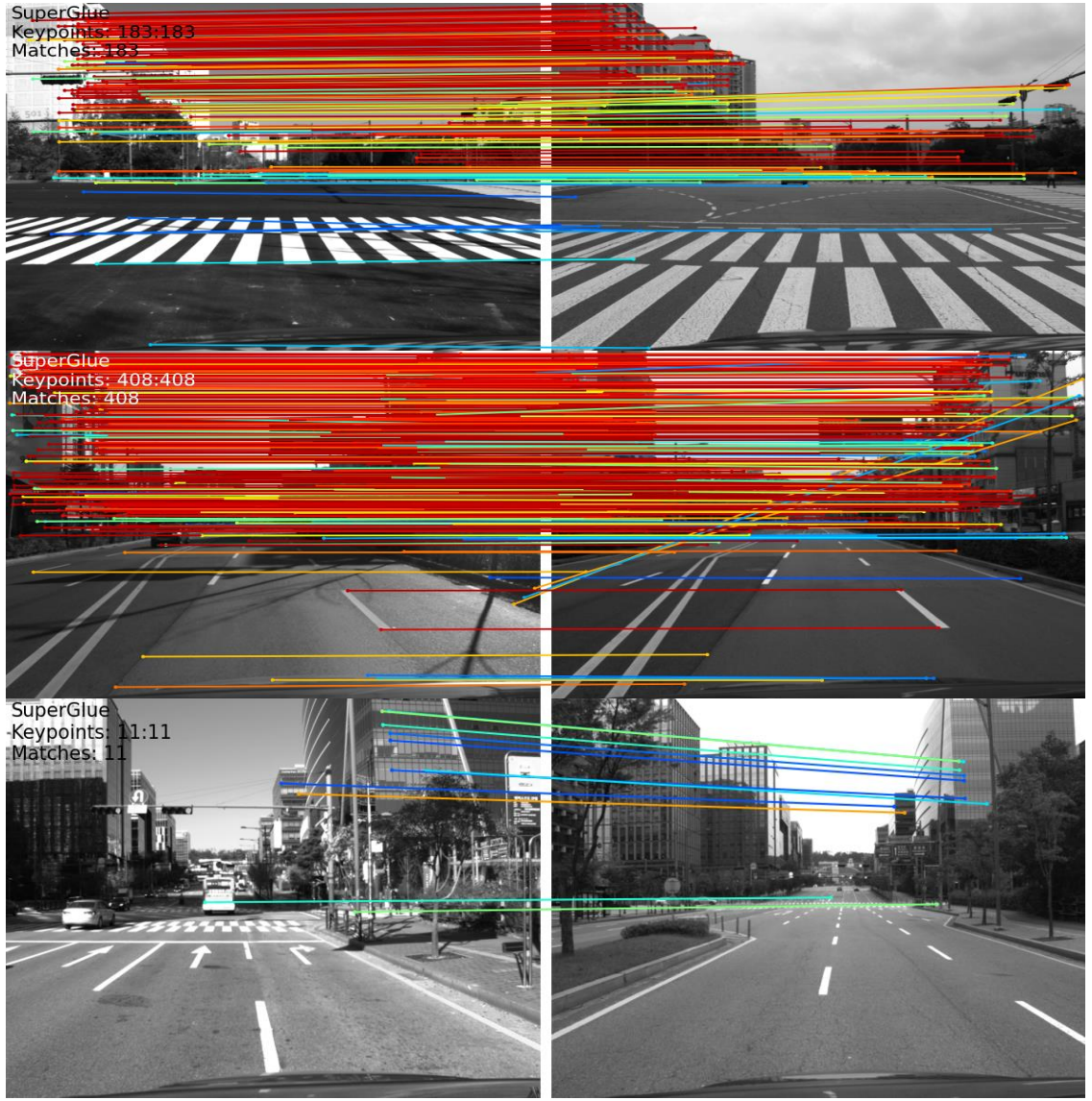


적합한 매칭 알고리즘을 찾지 못함

Place Recognition

SuperPoint & SuperGlue



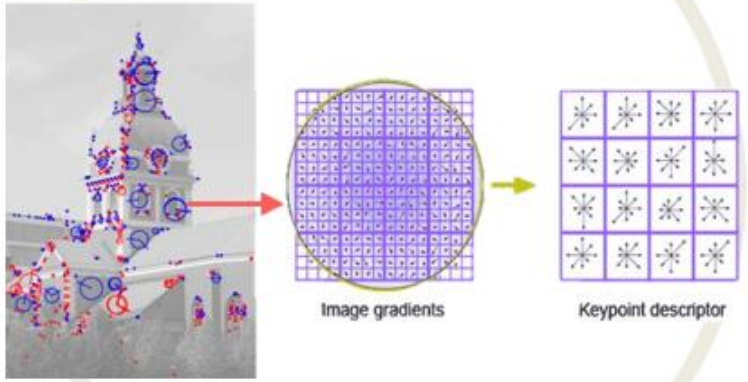


CVPR2020에서 SuperPoint 매칭을 위한 SuperGlue 알고리즘이 발표

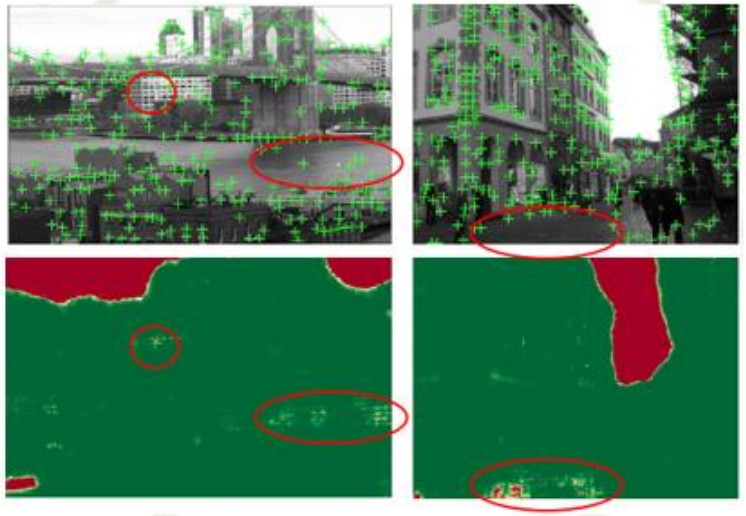
정확도 높은 매칭이 가능

Place Recognition

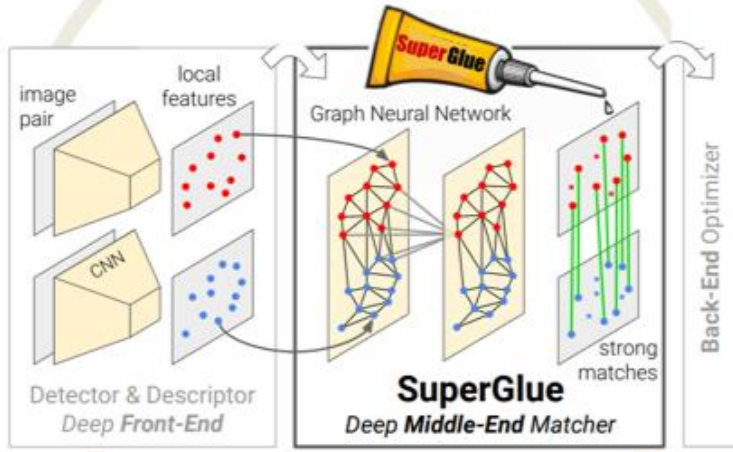
Local Descriptor | **Re-ranking** : SIFT, R2D2, SuperPoint | For Top-1



SIFT & BFMatcher



R2D2 & DeepMatching



SuperPoint & SuperGlue

Place Recognition : Result

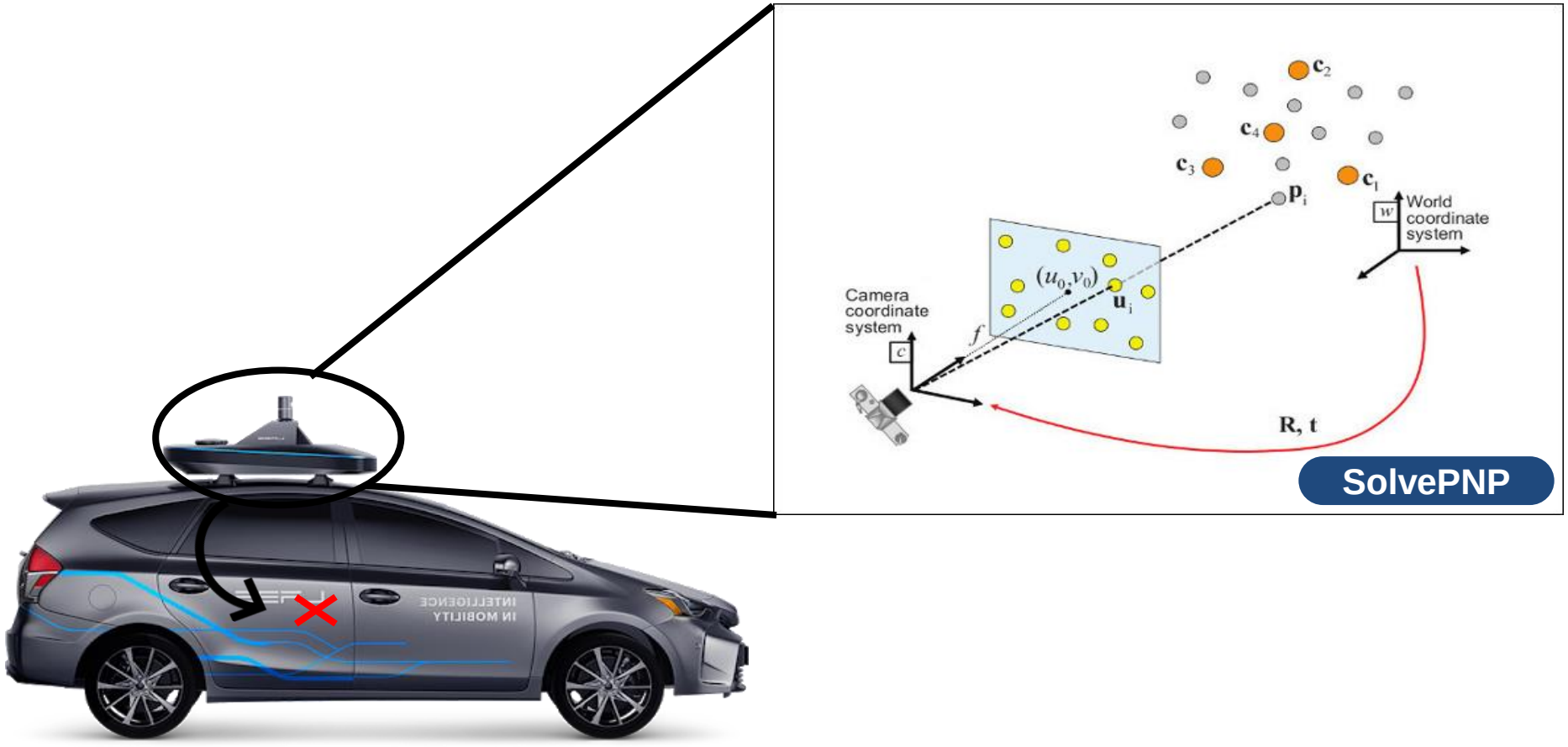
Place Recognition : Result

Pose Estimation

Pose Estimation

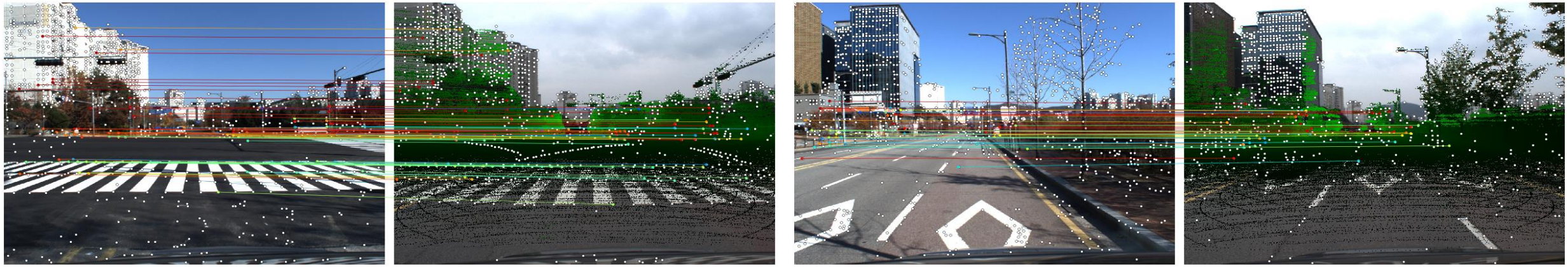
PnP algorithm

SolvePnP : Estimate the orientation of a 3D object in a 2D image



An Efficient Algebraic Solution to the Perspective-Three-Point Problem

Pose Estimation



투영(Projection)한 DB 이미지에서 QR-DB 매칭 키포인트(2D)에 대응되는 3D 라이다 포인트 파싱

2D-3D 대응점으로 PnP 알고리즘 수행하여 QR의 Pose를 계산

Pose Estimation

PnP algorithm

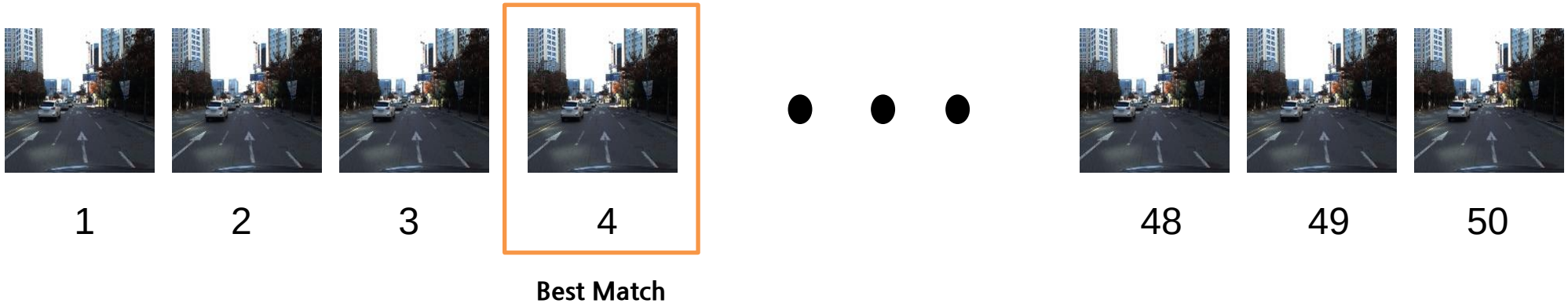
SolvePnP : Estimate the orientation of a 3D object in a 2D image

Dataset	Metric	recall@1	recall@5	recall@10
Pangyo	0.5m / 2.0°	99.792	-	-
	1.0m / 5.0°	100.0	-	-
	5.0 / 10.0°	100.0	-	-
Yeouido	0.5m / 2.0°	98.71	-	-
	1.0m / 5.0°	99.51	-	-
	5.0 / 10.0°	100.0	-	-

PnP 알고리즘을 통해서 추정한 Pose는 0.5m 이내에서 99%의 성능을 나타냄

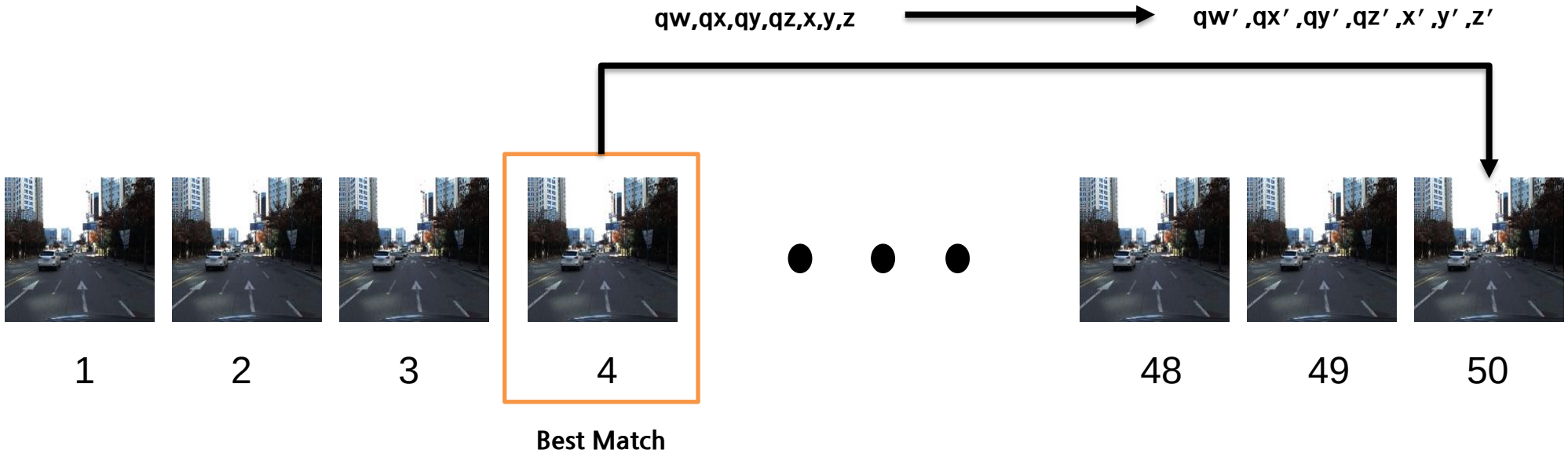
Visual Odometry

Visual Odometry



키포인트 매칭이 가장 많은 QR에서 Pose를 계산

Visual Odometry



키포인트 매칭이 가장 많은 QR에서 Pose를 계산
이후 Visual Odometry를 통해 최종 QR의 Pose를 추정

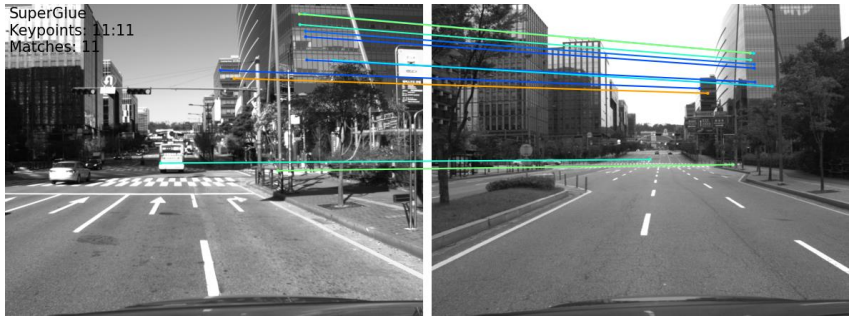
Visual Odometry

1번째 QR

40번째 QR

41번째 QR

50번째 QR



Best Match

Conclusion

Conclusion

QR

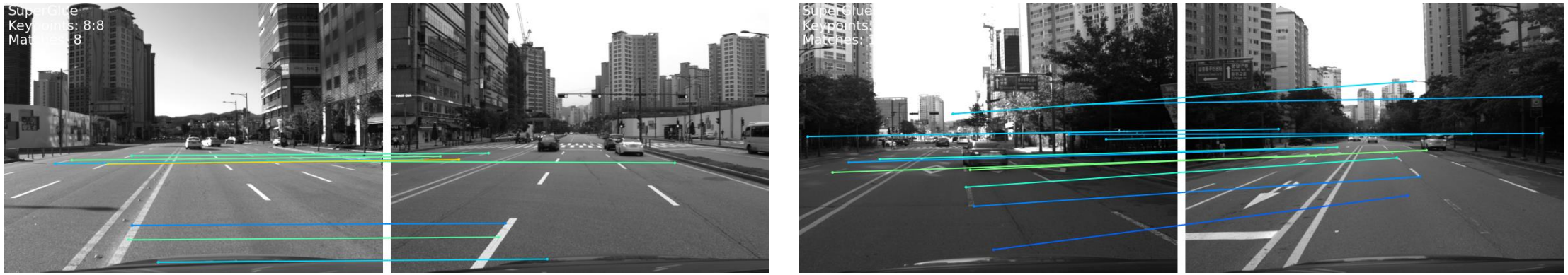
DB(Re-ranking)

QR

DB(Re-ranking)

DB(상행)의 경로와 일치하지 않는 QR(하행)가 존재

Conclusion



DB(상행)-QR(하행)에 대한 매칭 성능 저하 발생

QR에 대응되는 DB가 존재하는 경우 해결가능한 문제

Thank you for attention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GitHub

Visit to our GitHub! : https://github.com/sejong-rcv/SejongRCV-Outdoor