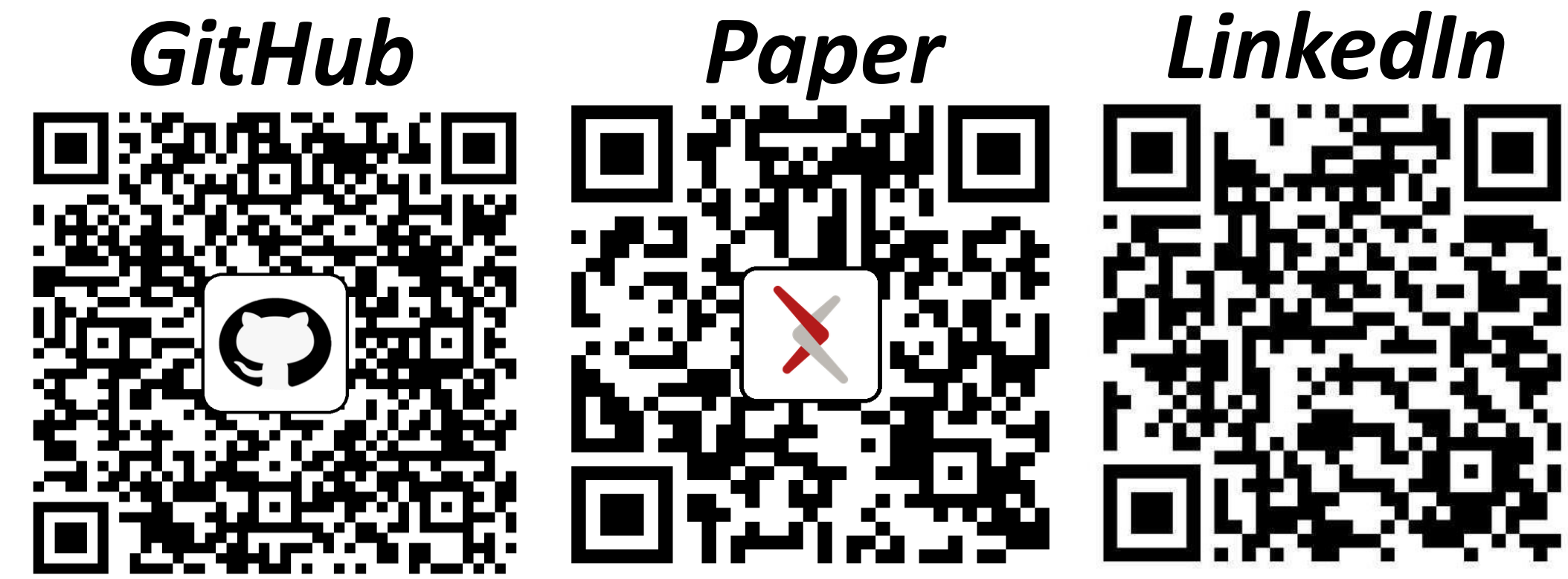
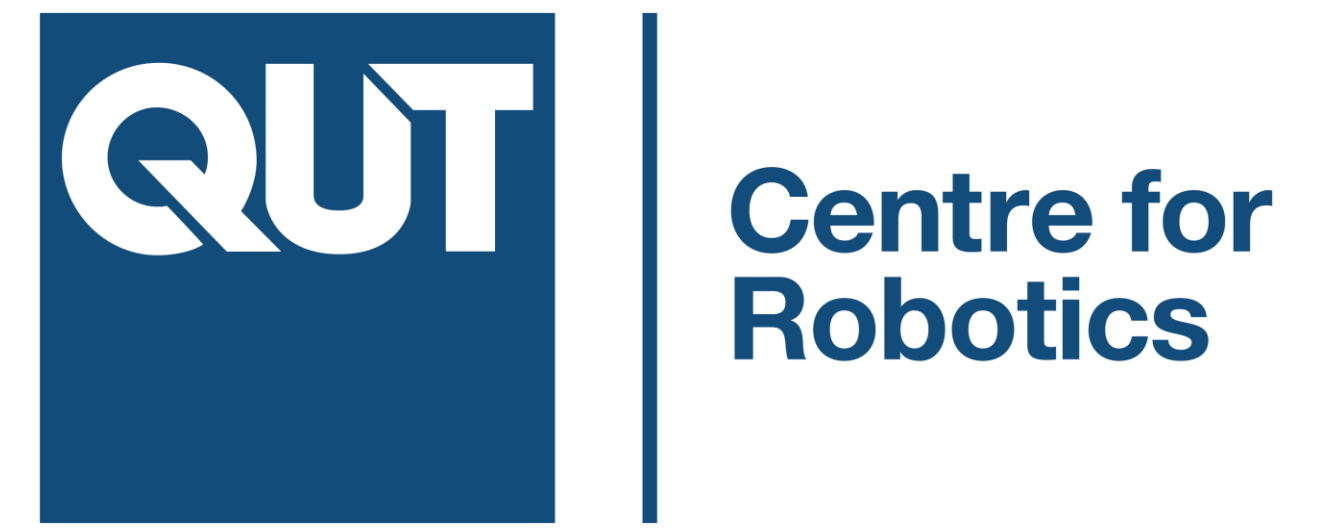


Quantile Transfer for Reliable Operating Point Selection in Visual Place Recognition

Dhyey Manish Rajani

Michael Milford

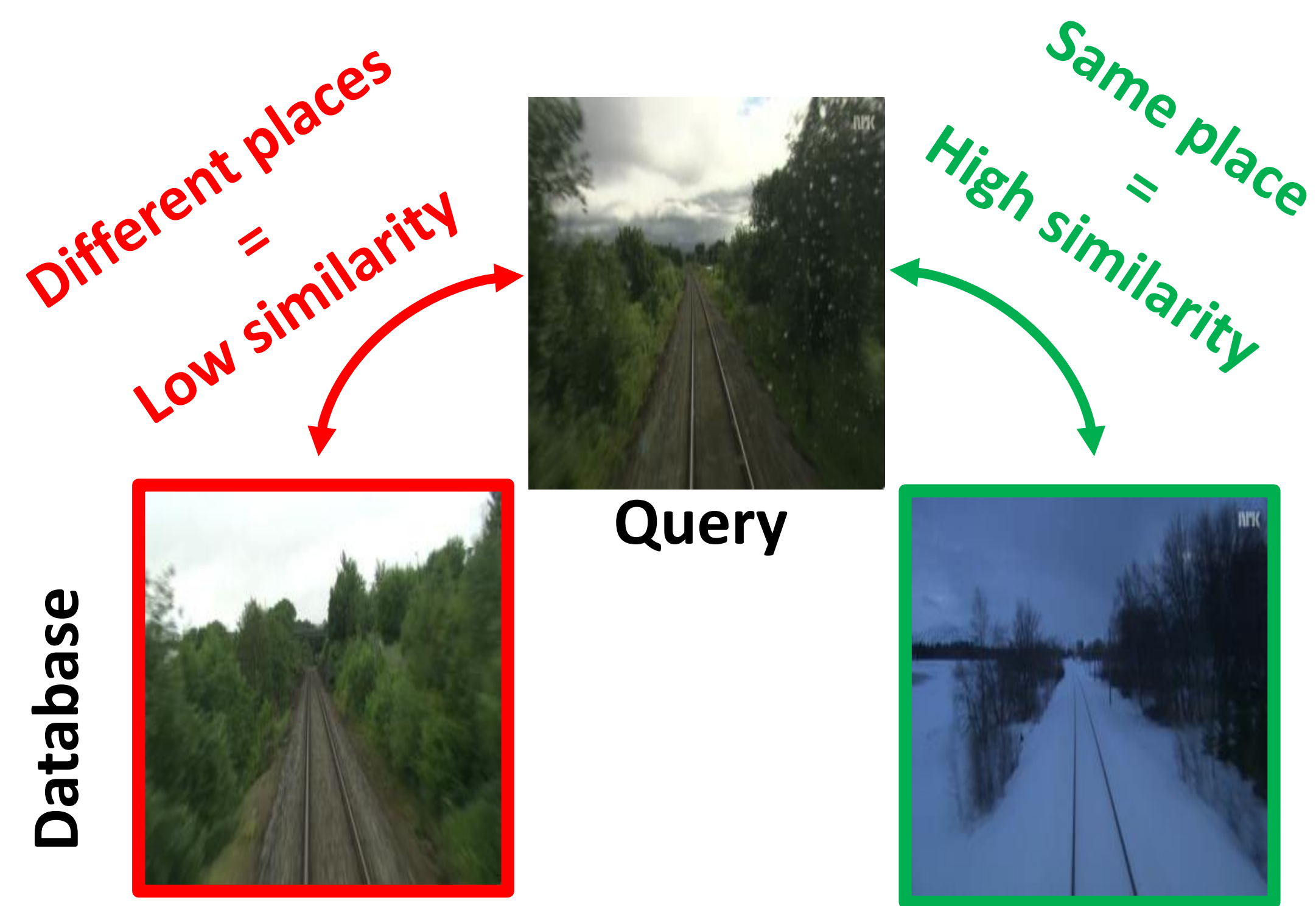
Tobias Fischer



dhyeymanish.rajani@hdr.qut.edu.au

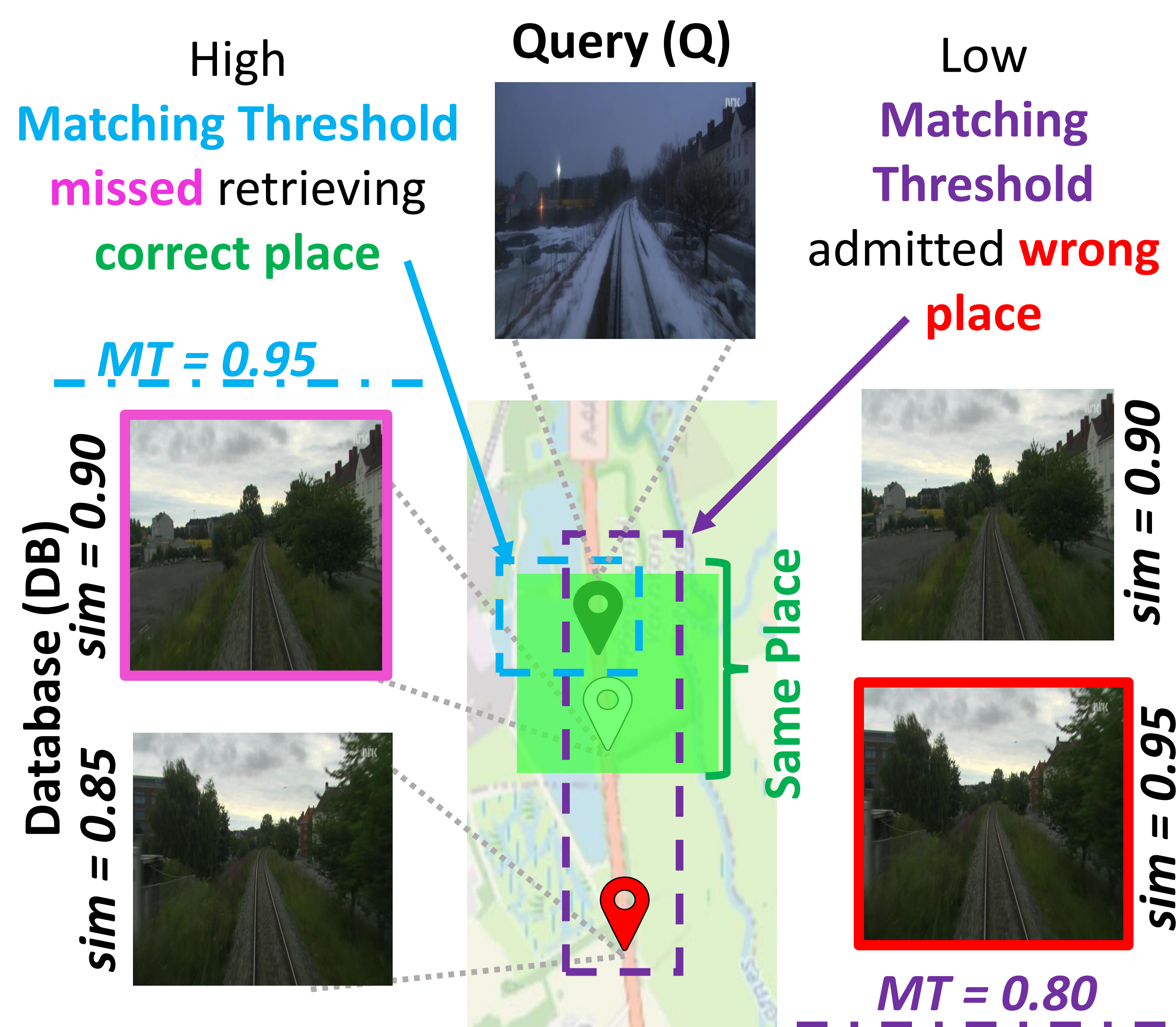
Visual Place Recognition (VPR)

- Task:** given a query image, retrieve the most similar image from a geo-tagged database.
- Use:** enables localization where GPS/GNSS is denied or degraded.

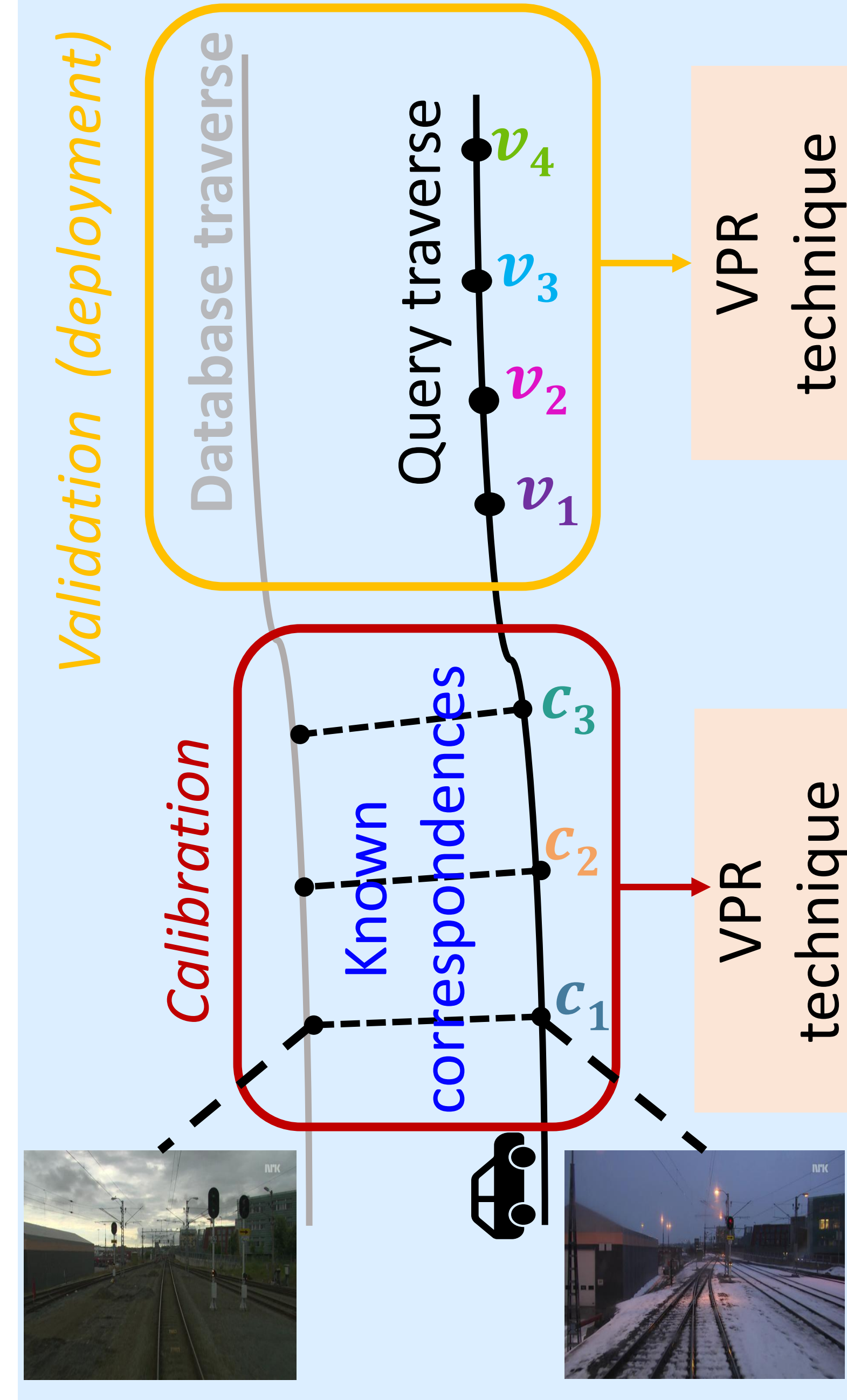


Motivation

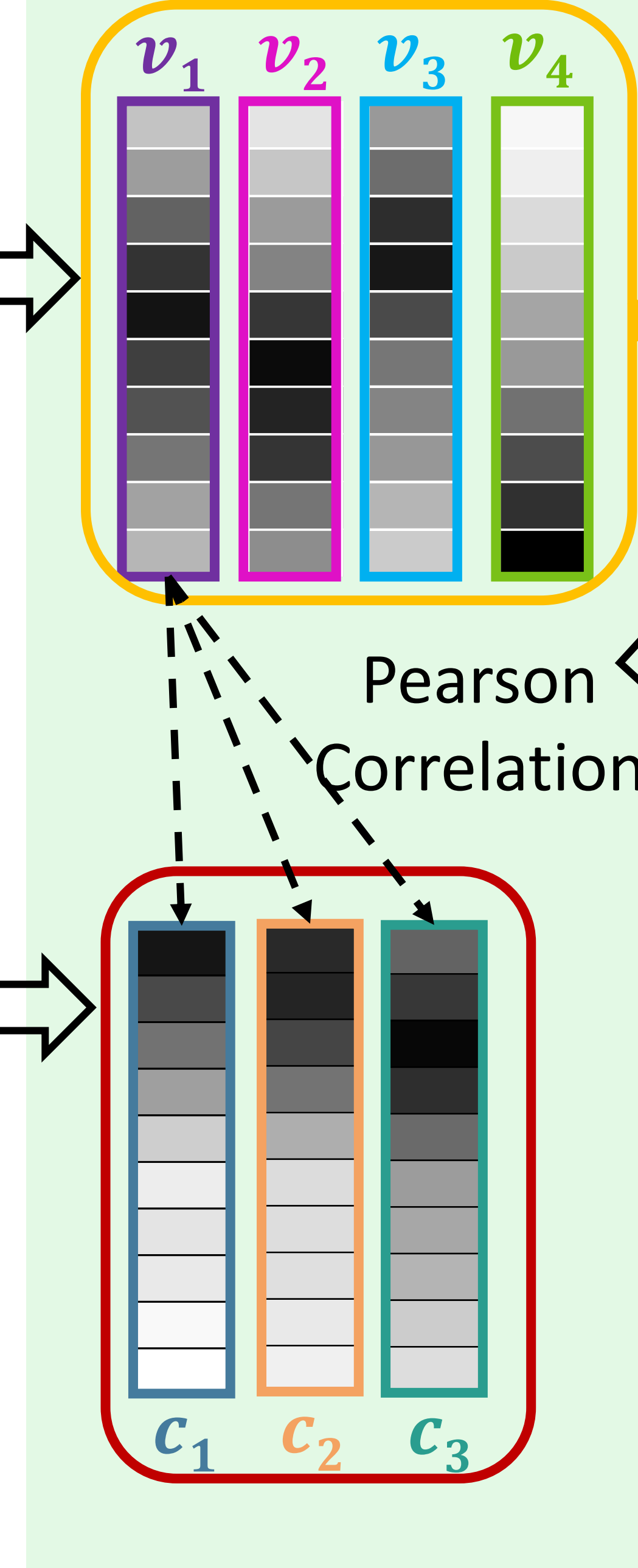
- Matching threshold (MT):** similarity score above which images are classified as **same place**, and below as **different places**.
- Limitation:** Hand-picked **offline**; by retrospectively tuning over datasets; **Unadaptable** to changes in conditions or viewpoints.



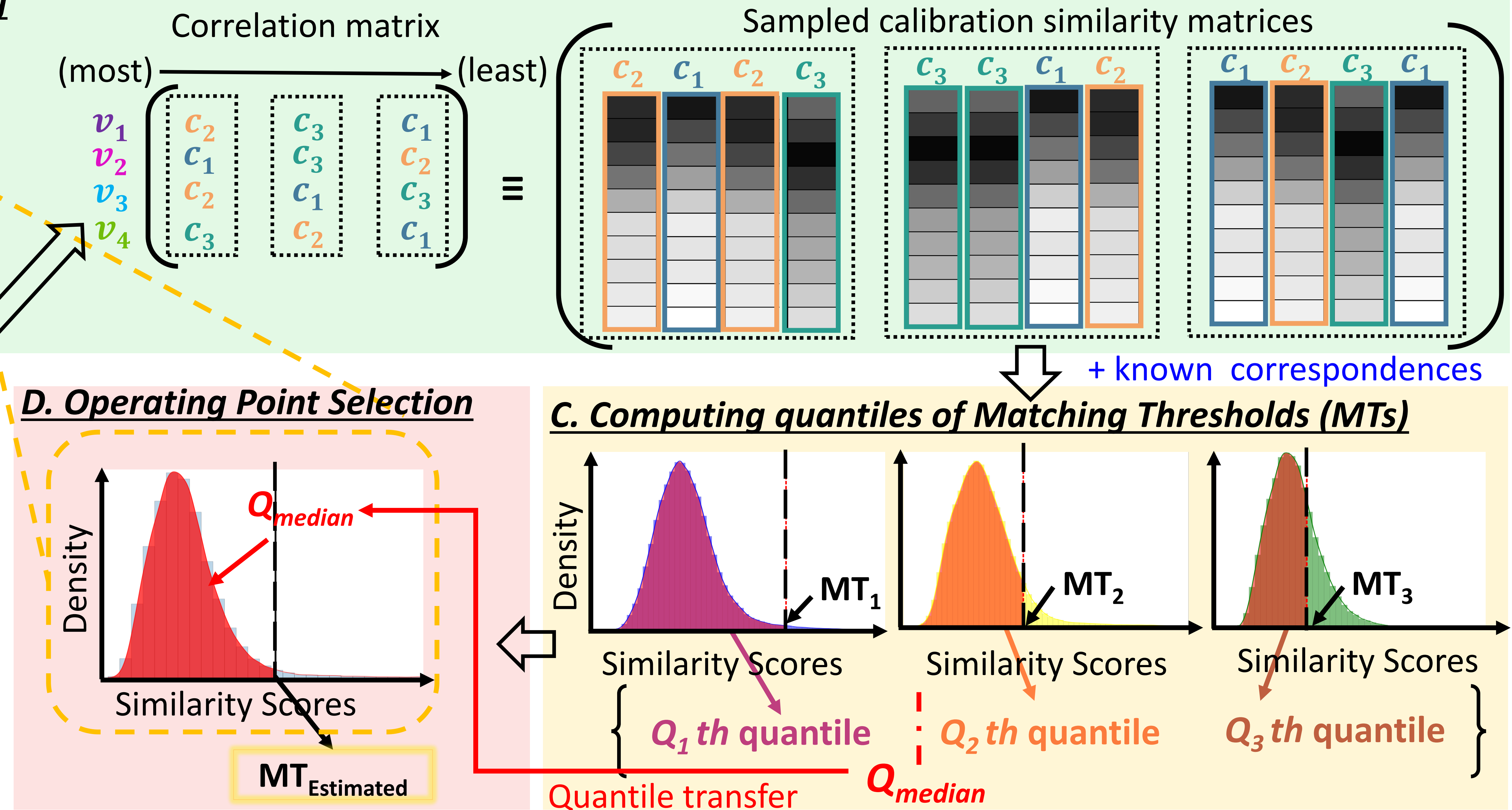
A. Calibration data



B. Adaptive Sampling



Methodology



Experimental Setup

Baselines:

- Schubert et al.[1]:** robust normal fit on validation (deployment) similarities; threshold selected from the fit.
- Schubert et al. (w/ calib.):** same fit on the calibration similarities (same data as ours).

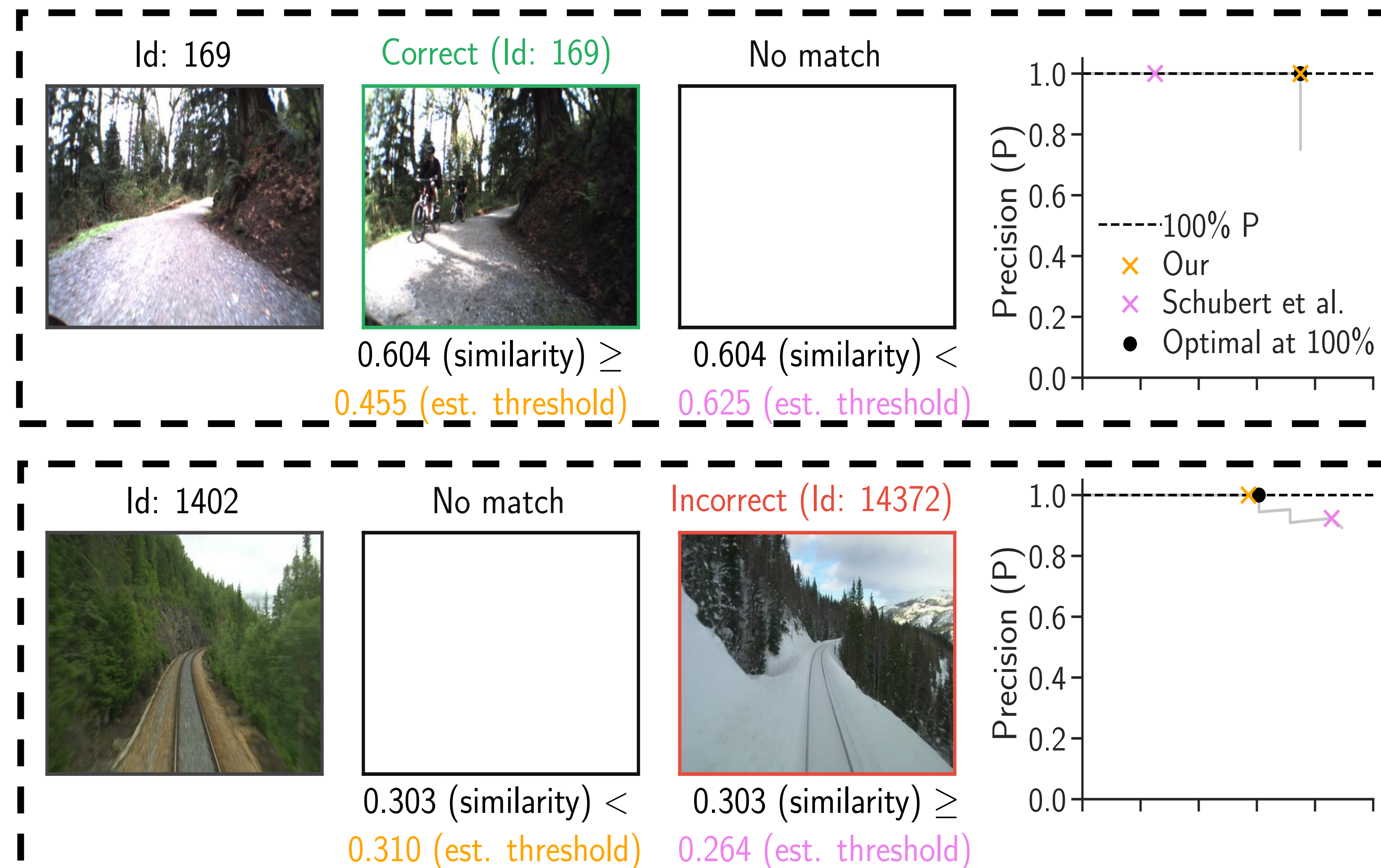
Metrics: We split each deployment traverse into fixed-length segments.

- %Segs (↑):** fraction of segments where the estimated threshold hits 100% precision.
- AvgR@100P (↑):** mean recall over those segments (segments that miss 100% precision contribute 0 recall).

Results

Across **7 SOTA VPR techniques** and **5 benchmark datasets**:

- VPR operates at 100% Precision in $\approx 2\times$ more cases (median)**
- Up to $\approx 30\%$ more correct matches retrieved at 100% Precision**



Dataset	Method	%Segs ↑	AvgR@100P ↑
SFU Mountain (DB:Dry; Q:Dusk)	Schubert et al. [1]	29.4	0.20
	Schubert et al. (w/ calib.)	14.1	0.08
	Ours	76.7	0.48
Oxford RobotCar (DB:Rain; Q:Dusk)	Schubert et al. [1]	22.3	0.15
	Schubert et al. (w/ calib.)	21.8	0.14
	Ours	35.0	0.18
Pittsburgh30k	Schubert et al. [1]	29.5	0.30
	Schubert et al. (w/ calib.)	29.9	0.30
	Ours	58.9	0.33
Nordland (DB:Winter; Q:Summer)	Schubert et al. [1]	14.1	0.08
	Schubert et al. (w/ calib.)	7.3	0.07
	Ours	19.8	0.11
Nordland (DB:Fall; Q:Summer)	Schubert et al. [1]	53.7	0.42
	Schubert et al. (w/ calib.)	50.5	0.41
	Ours	51.9	0.46
MSLS val	Schubert et al. [1]	3.7	0.04
	Schubert et al. (w/ calib.)	4.5	0.04
	Ours	53.1	0.19

References

[1] S. Schubert, P. Neubert, and P. Protzel, "Beyond ANN: Exploiting Structural Knowledge for Efficient Place Recognition," in IEEE International Conference on Robotics and Automation, 2021, pp. 5861–5867

Acknowledgement

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