

SeqLoc: Visual Localization with an Image Sequence

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1 Motivation

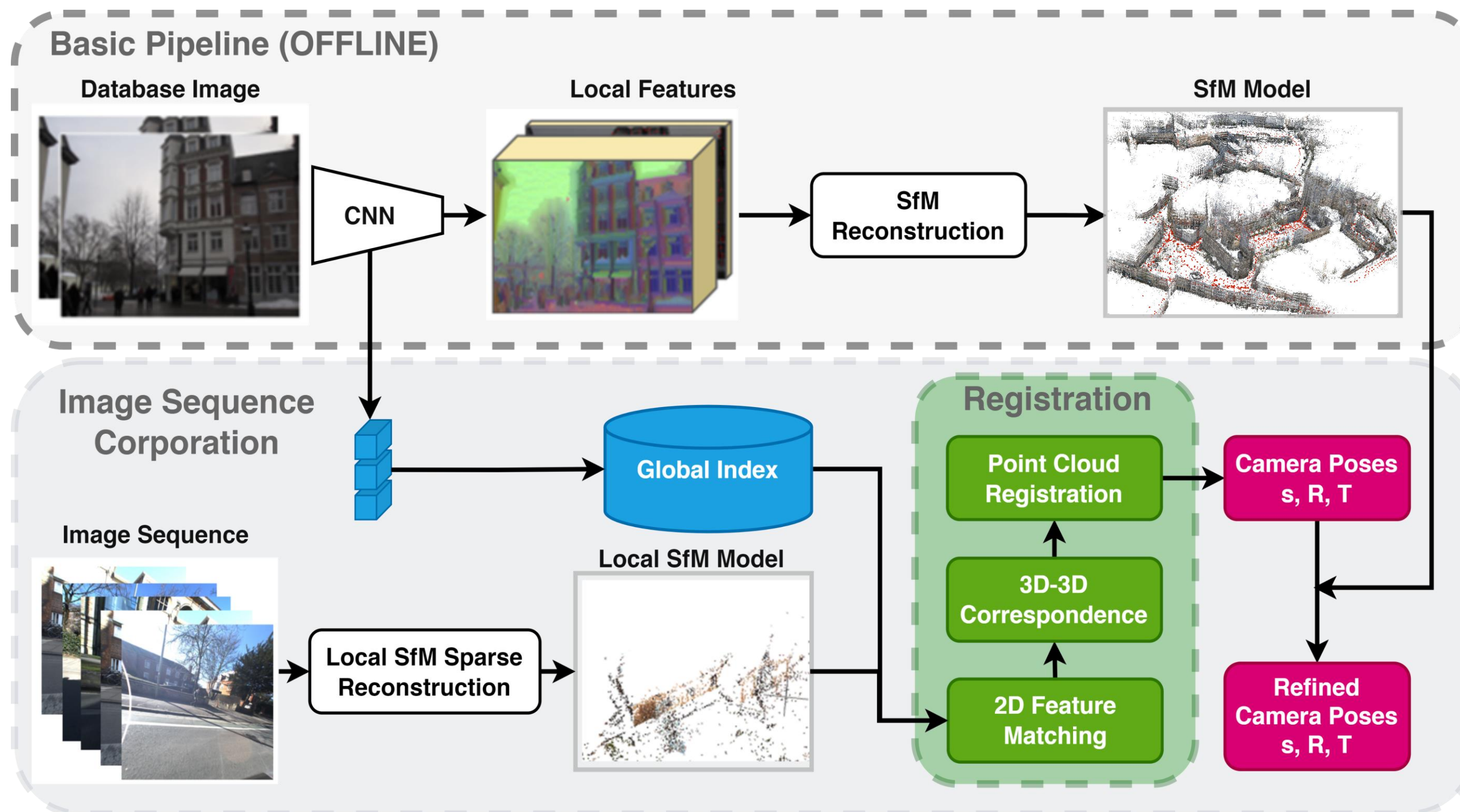
Our Goal

- Localizing a set of sensors (e.g., cameras) mounted to a moving vehicle (e.g., robot) in a 3D map of the environment
- Leveraging abundant information in image sequences to improve the robustness

Our Solution

- Local reconstruction**^[1] in the sequence
- Simple and efficient **generation of 3D-3D** correspondence from *Superglue*^[2]
- Solving **localization by point cloud** registration (*TEASER++*^[3])
- Joint optimization** with image sequence constraints

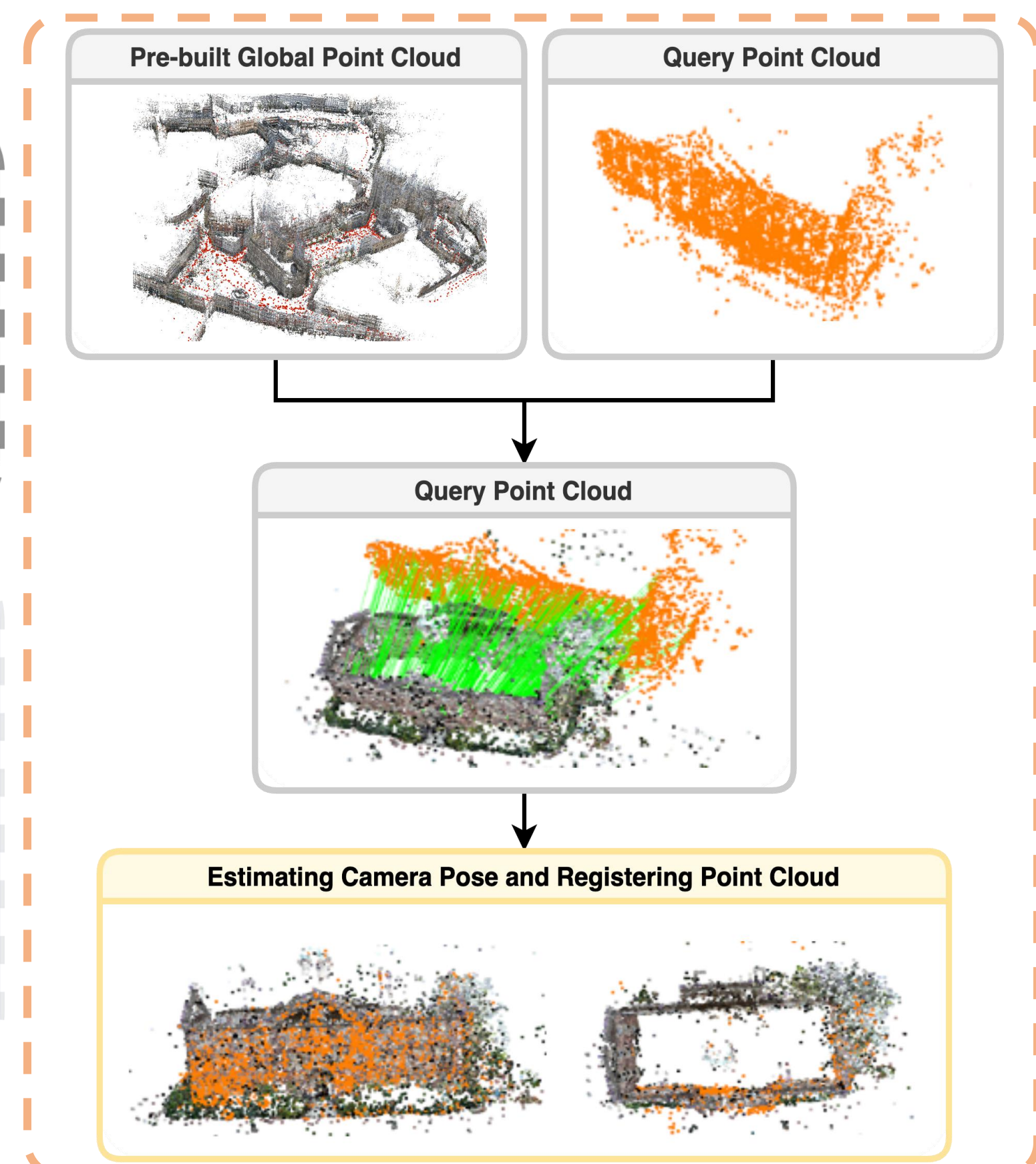
2 Method Overview



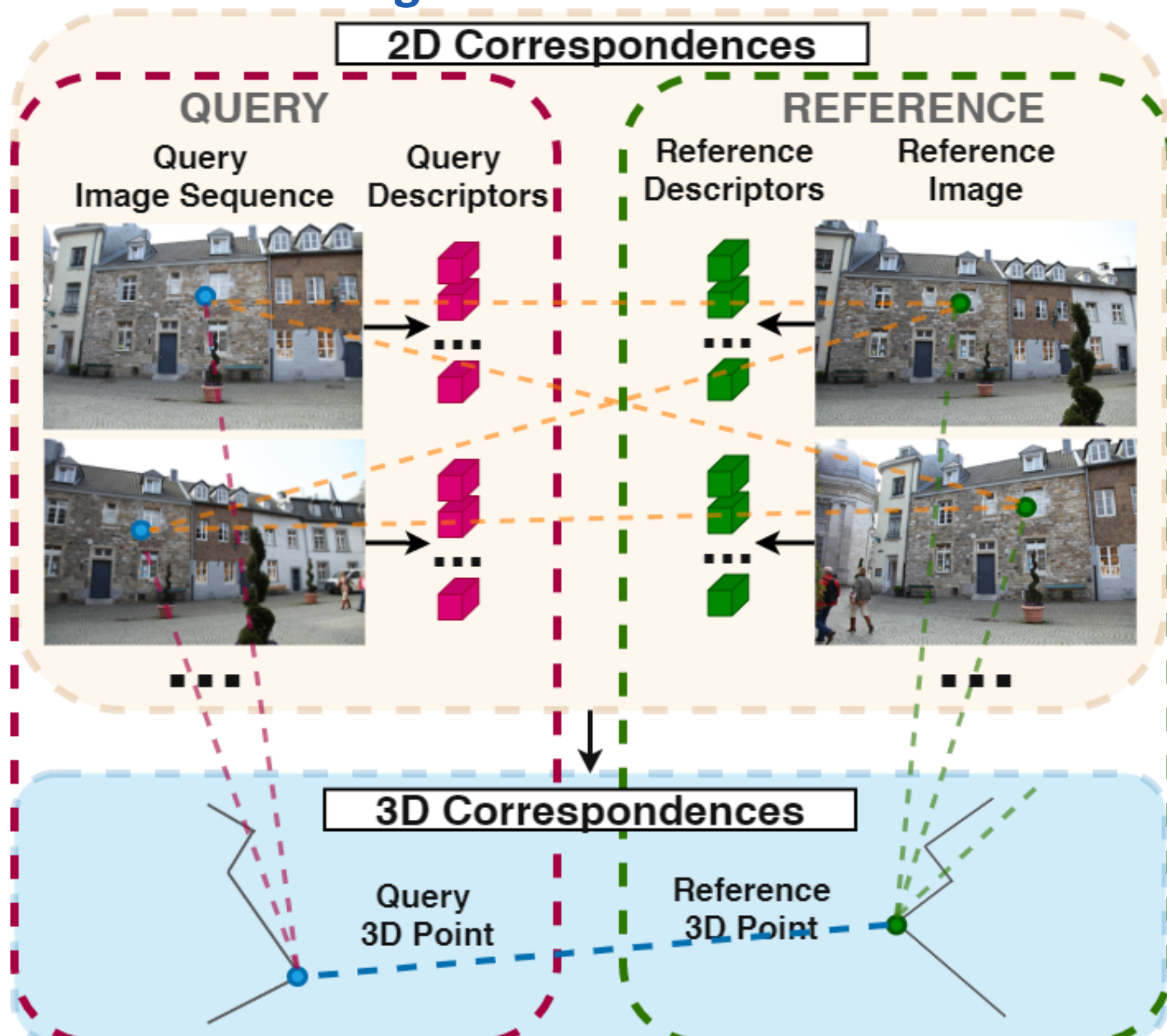
4 Pose Refinement

- Point cloud registration(PCR) localization accuracy @11cm
- Pose refinement based on reprojection error
- PCR + SBA: PCR + single image BA refinement
- PCR + GBA: PCR + global BA with sequence constraint

Set to constant	To be optimized
P^i : 3D structure of global map K^i : Camera intrinsics $\sum T_i$: Center coordinate of the sequence	(R^i, T^i) : Poses from PCR R_i^j : Relative motion in the sequence R^{center} : Orientation of the sequence frame



3 Point Cloud Registration

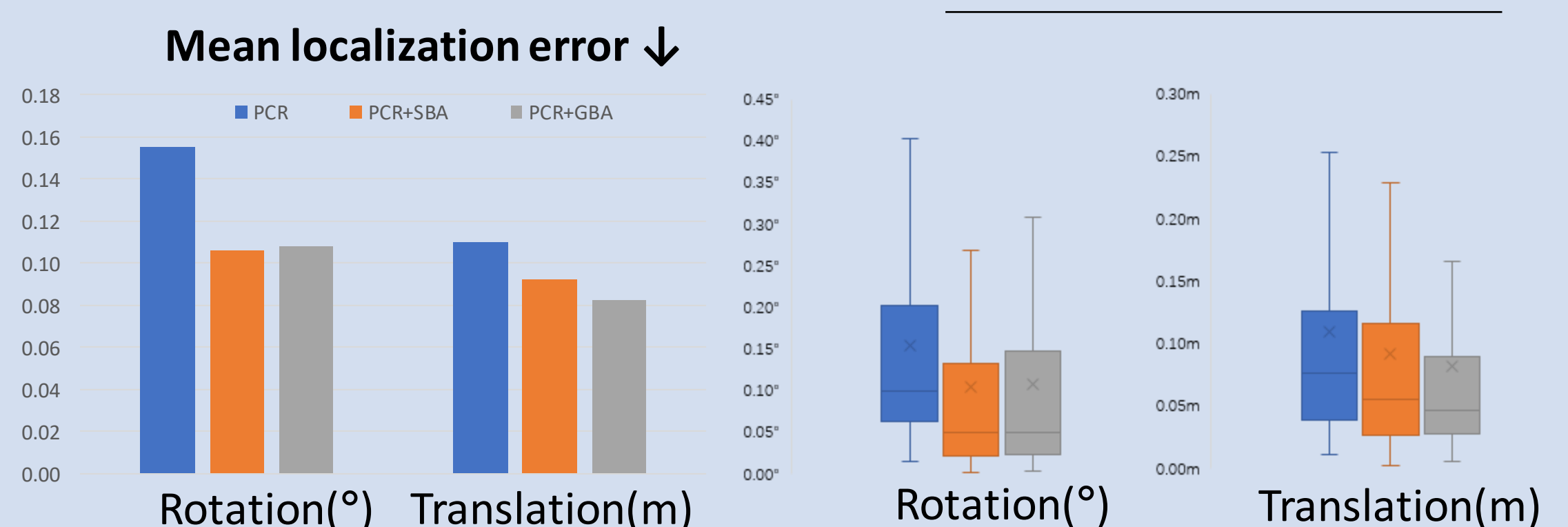


5 Experimental Results

Localization error of 20+ random sequences
Number of images per sequence: (3~10)
Global Map: Aachen-Day-Night (4K+ images)
With GBA: Localization Error ↓ @ 3cm

Recall of (0.25m, 5°) ↑

HLoc	PCR+GBA
98.1%	99.07%



[1] Sarlin, Paul-Edouard, et al. "From coarse to fine: Robust hierarchical localization at large scale." *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*. 2019.
 [2] Sarlin, Paul-Edouard, et al. "Superglue: Learning feature matching with graph neural networks." *Proceedings of the IEEE/CVF conference on computer vision and pattern recognition*. 2020.
 [3] Yang, Heng, Jingnan Shi, and Luca Carlone. "Teaser: Fast and certifiable point cloud registration." *IEEE Transactions on Robotics* 37.2 (2020): 314-333.