

# Image Matching Challenge 2023

8th Place Solution



Alexander  
Veicht



Felix  
Yang



Andri  
Horat



Deep  
Desai



Philipp  
Lindenberg

# Our pipeline make use of rotation prediction, ensembles and PixSfM as well as Hierarchical-Localization.

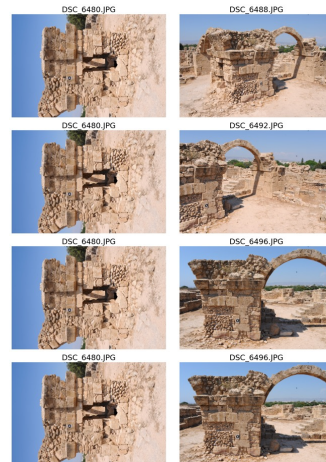
## Rotations

DIOAD



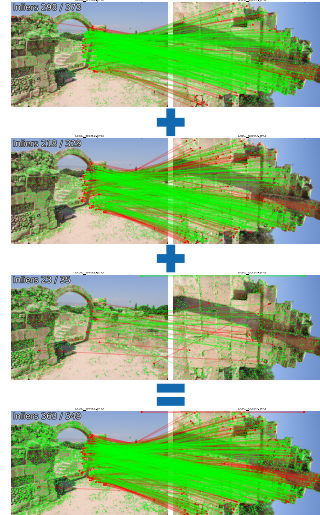
## Retrieval

NetVLAD



## Ensemble

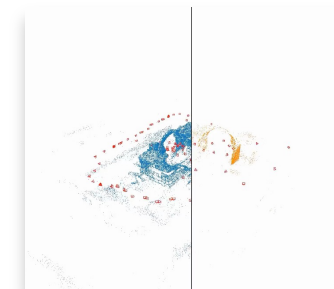
LightGlue



## SfM

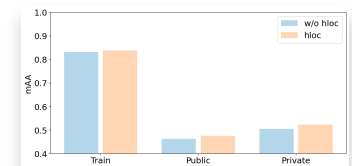
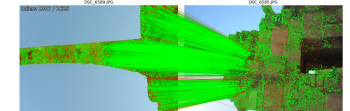
PixSfM

Shared  
Cameras

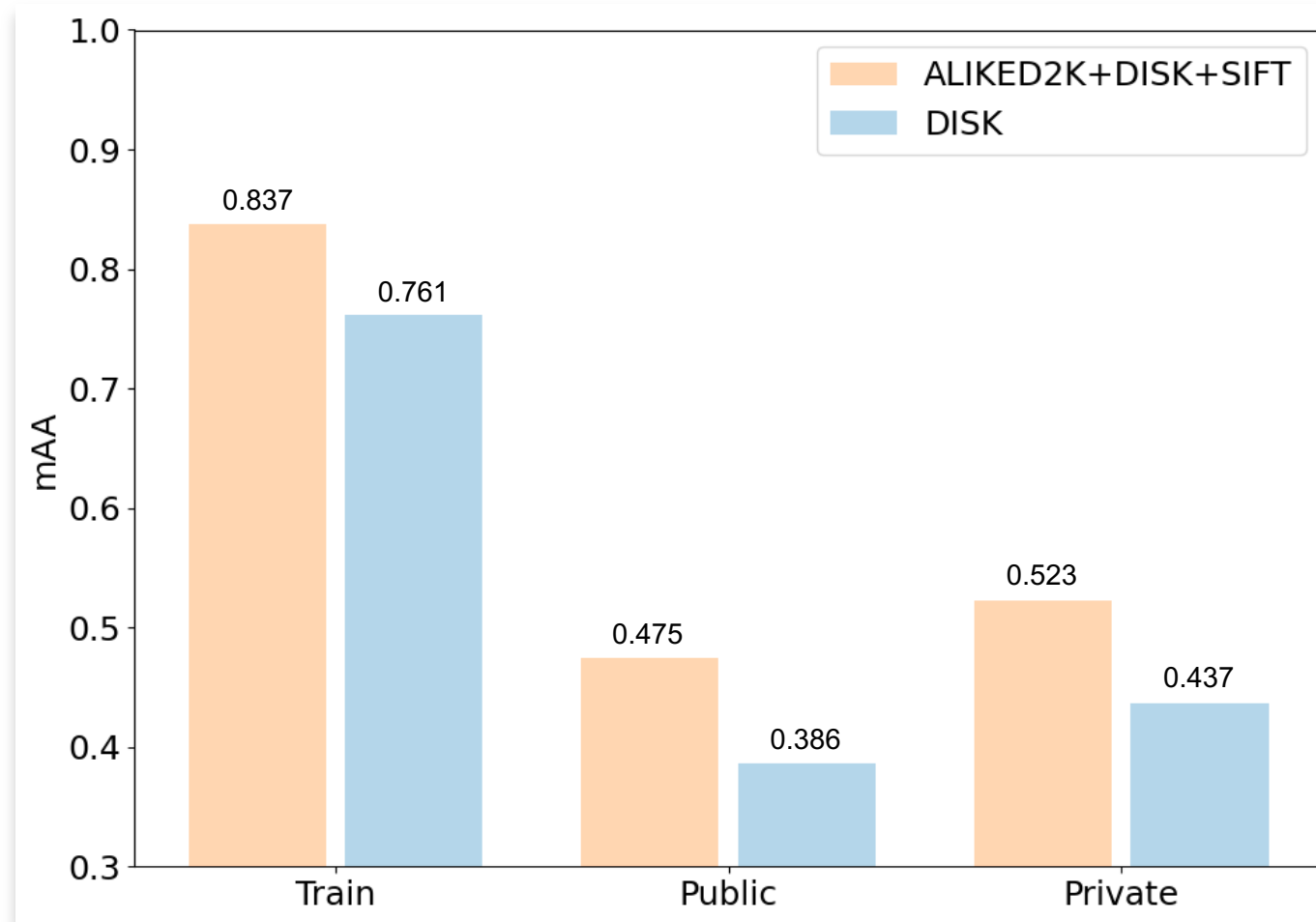


## Postprocessing

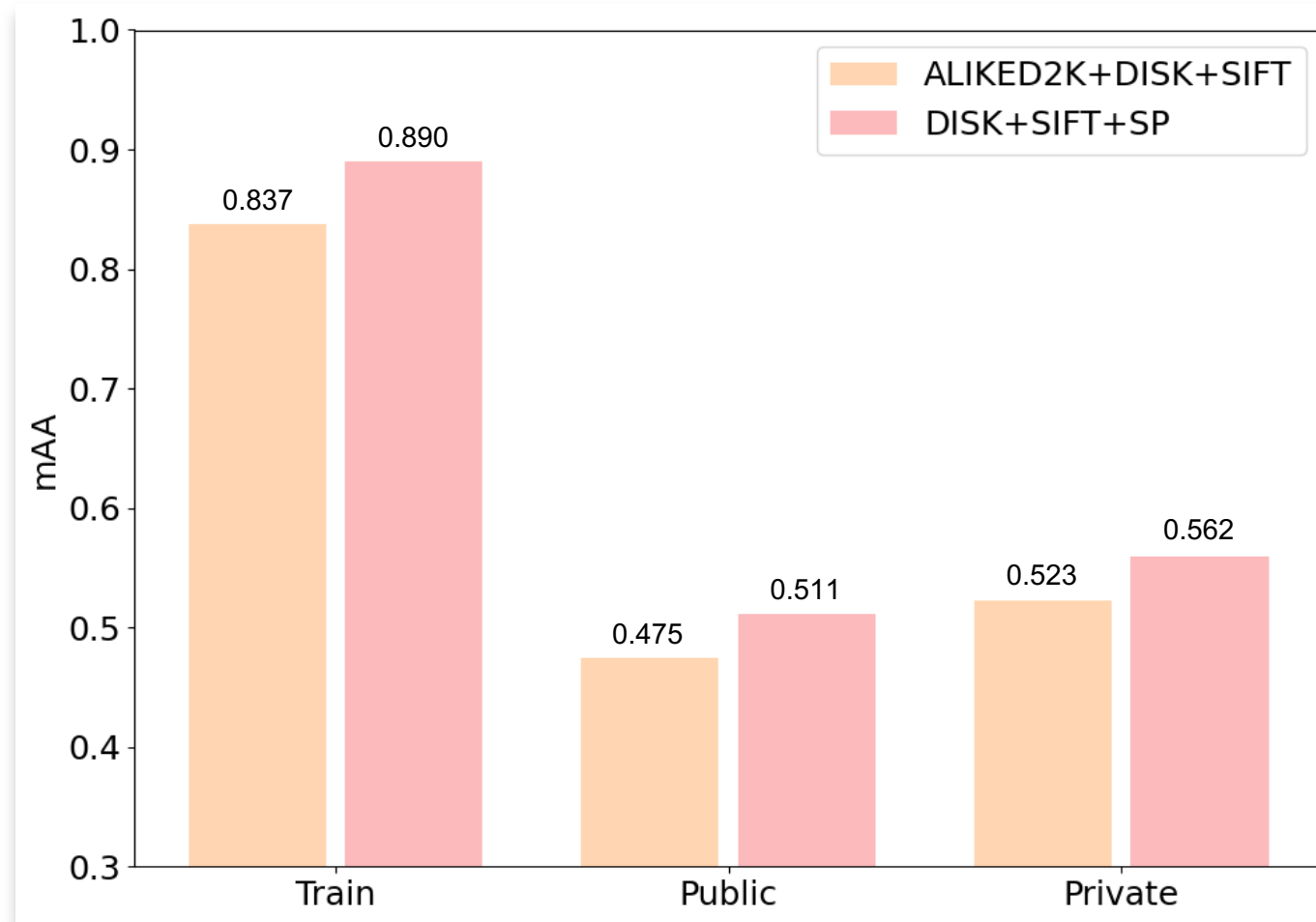
hloc



We place 8th (0.523) with a novel matcher LightGlue while matching 2nd (0.562) when using SuperPoint.

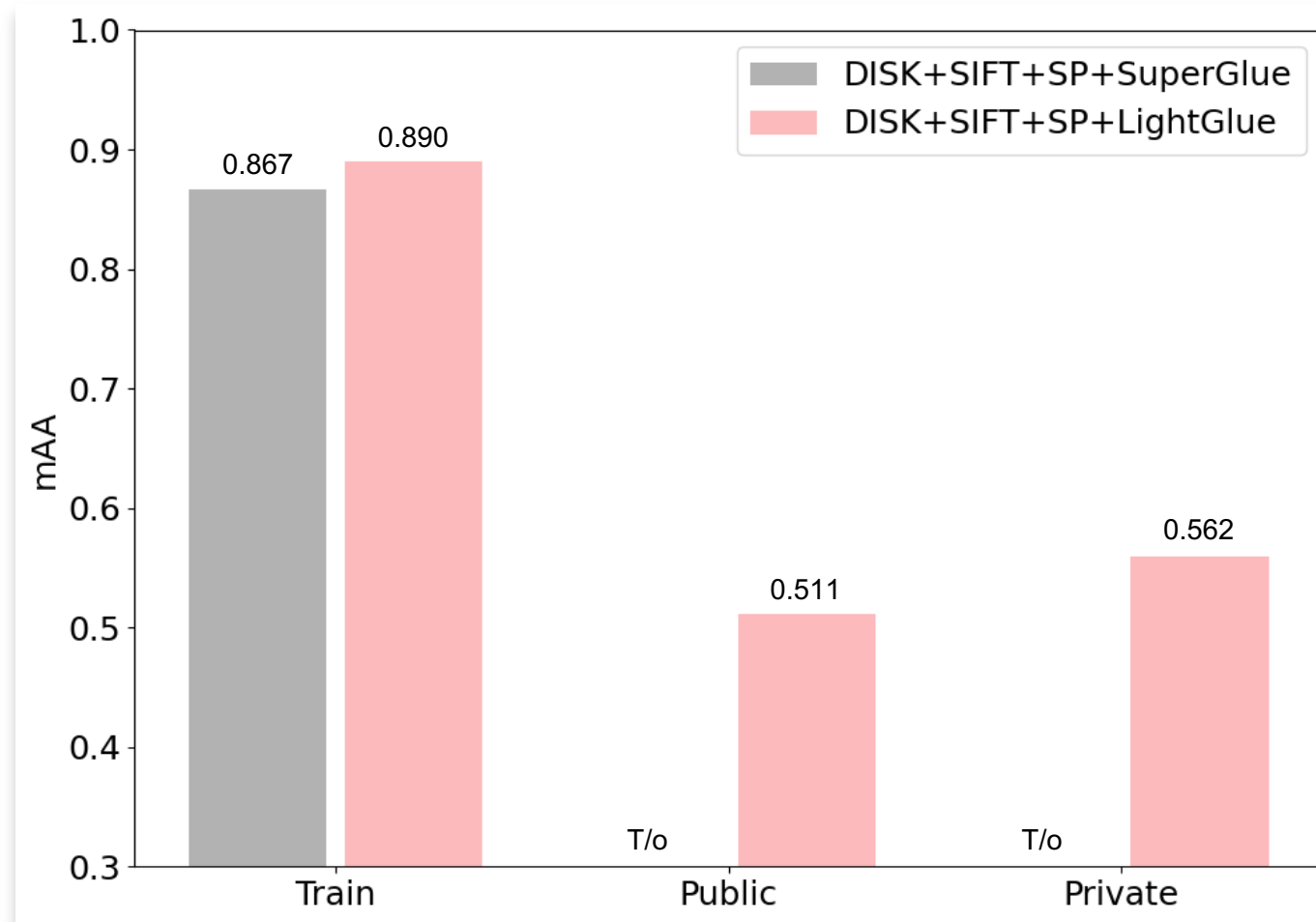


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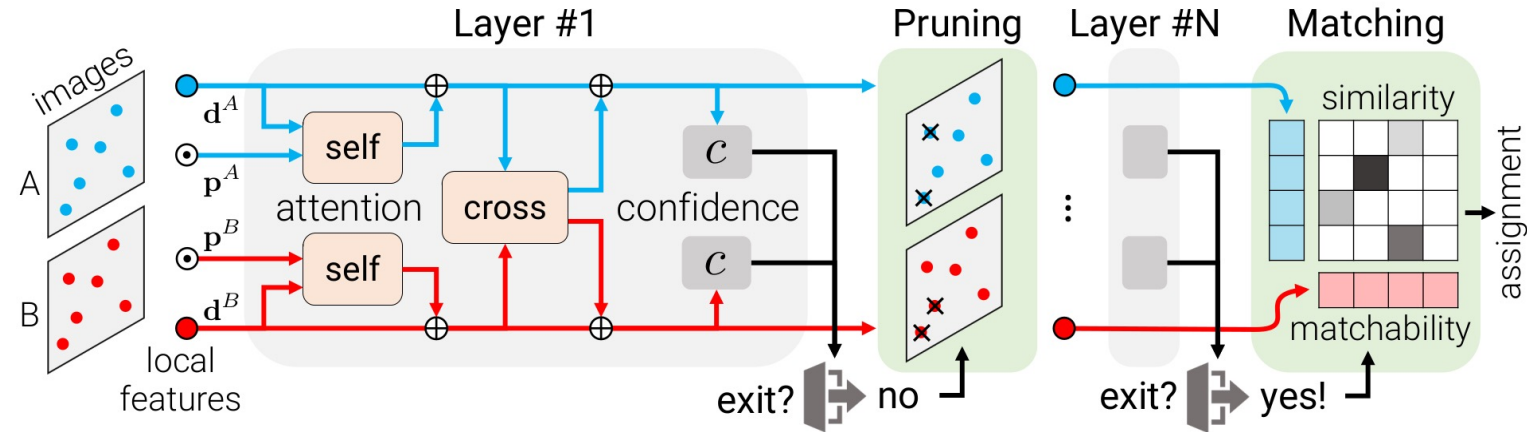




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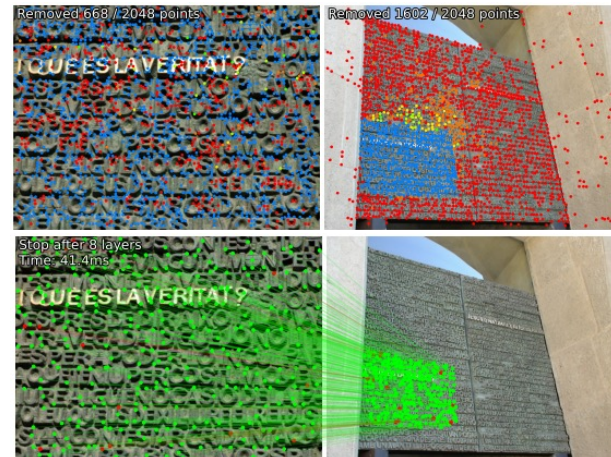
# LightGlue: Local Feature Matching at Light Speed.



Easy: 60 FPS



Difficult: 25 FPS

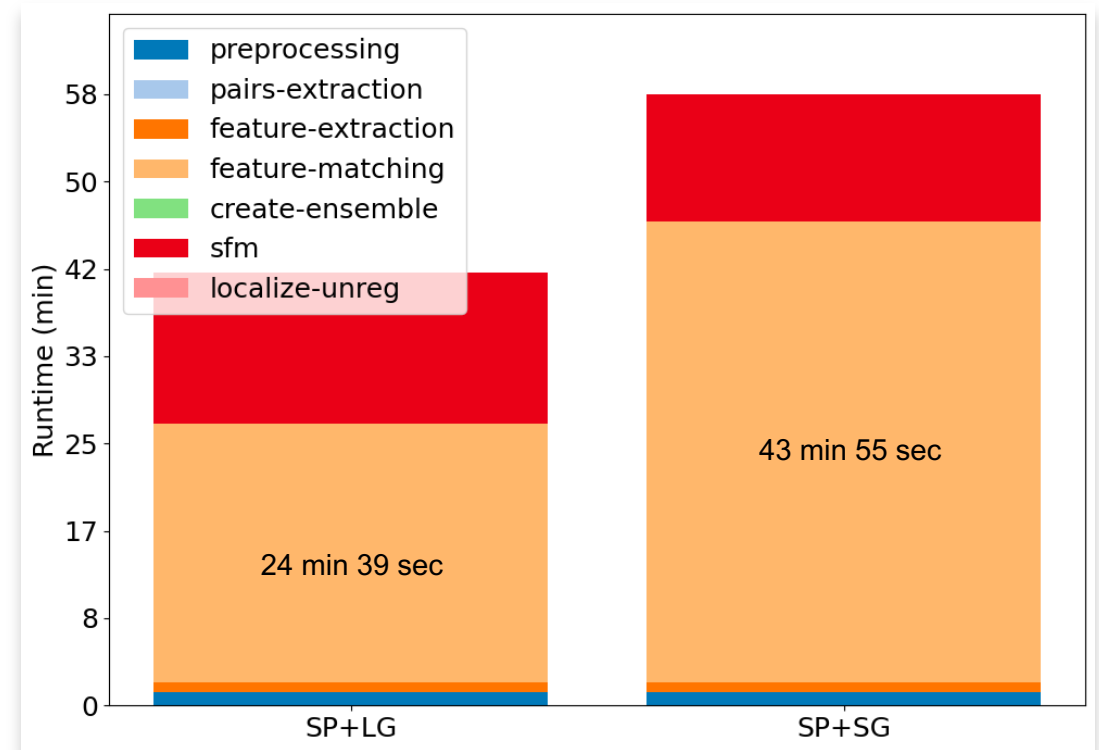
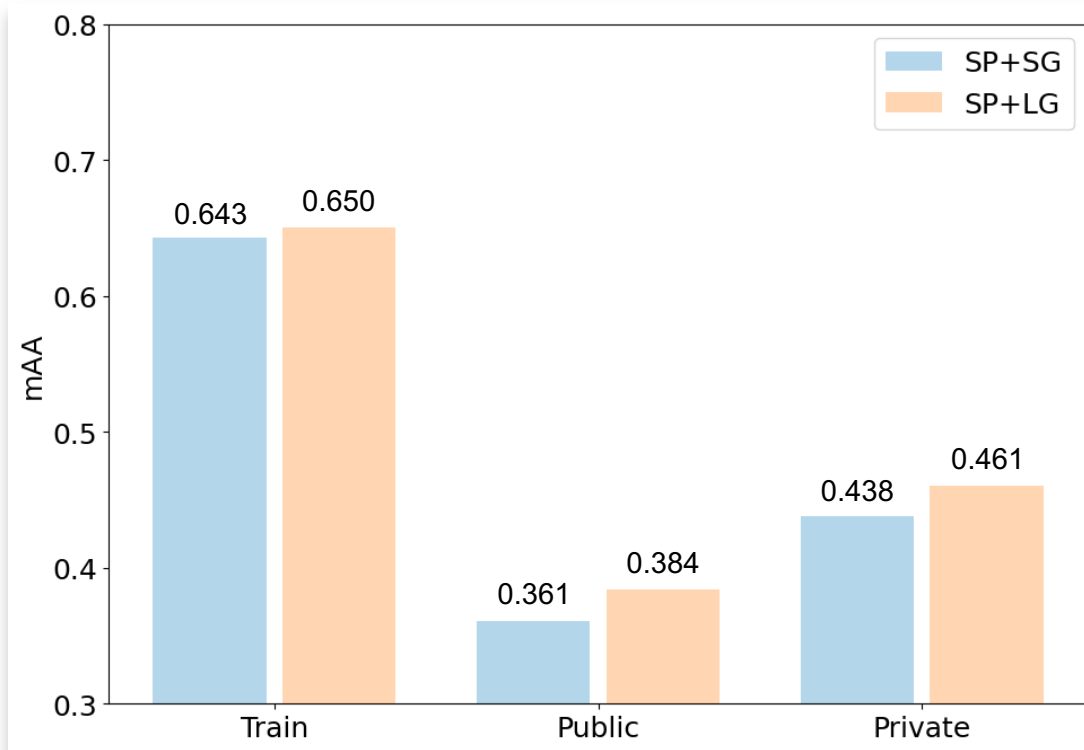


- Adaptive depth and width
- Maintain SG accuracy

Fast and accurate matching

Lindberger, Sarlin and Pollefeys: LightGlue: Local Feature Matching at Light Speed.

# LightGlue outperforms SuperGlue when paired with SuperPoint on all splits in terms of mAA and runtime.



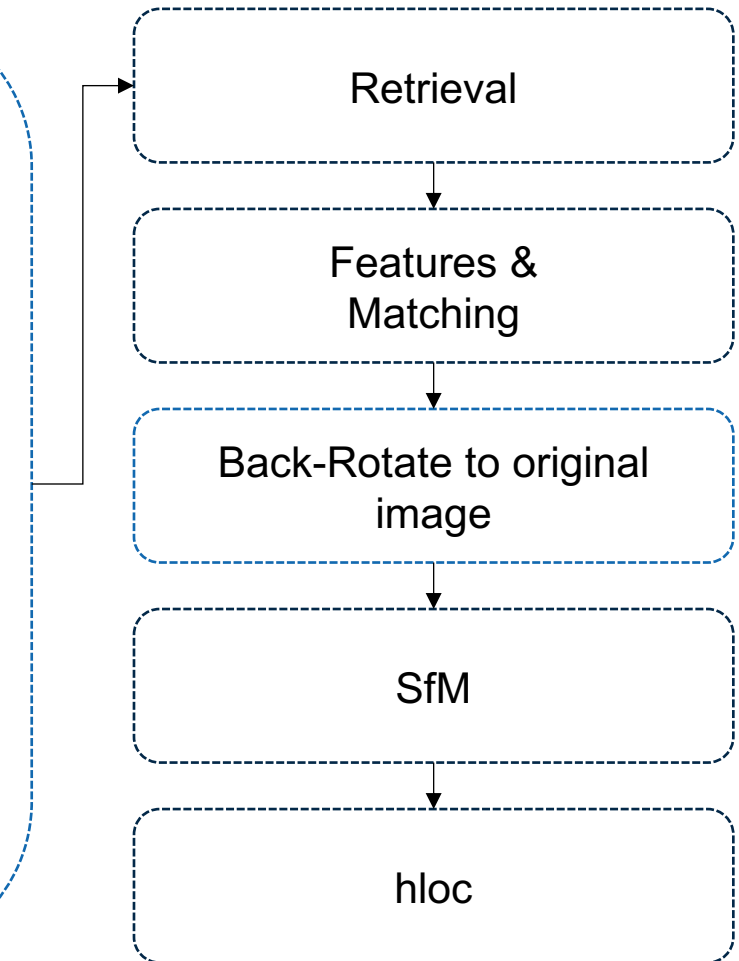
Sarlin et al.: SuperGlue: Learning Feature Matching with Graph Neural Networks. CVPR, 2020.

# Deep Image Orientation Angle Detection (DIOAD) is exclusively utilized for rotation prediction on the train set.

## DIOAD:

ViT based model trained to predict image rotations.

- Predict rotation angle of Image.
- Rotate images by closest multiple of 90 degrees.
- Back-rotate images before running reconstruction.
- Significant boost in accuracy on cyprus and dioscuri.
- Some wrong predictions on zoomed-in images.



Maji et al.: Deep Image Orientation Angle Detection. Arxiv, 2020.

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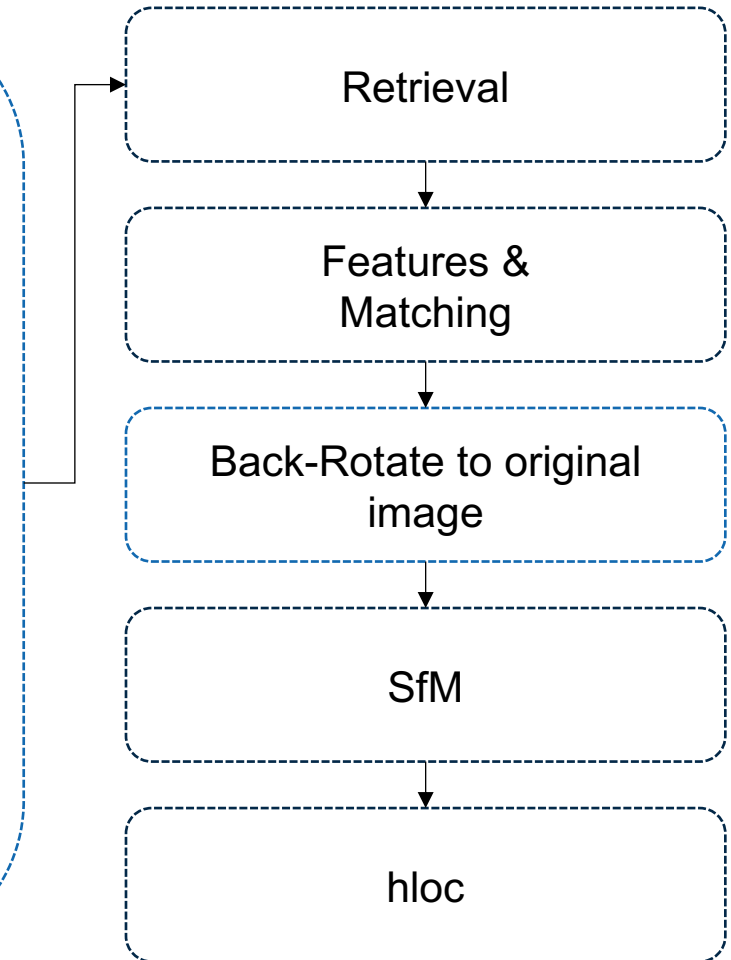
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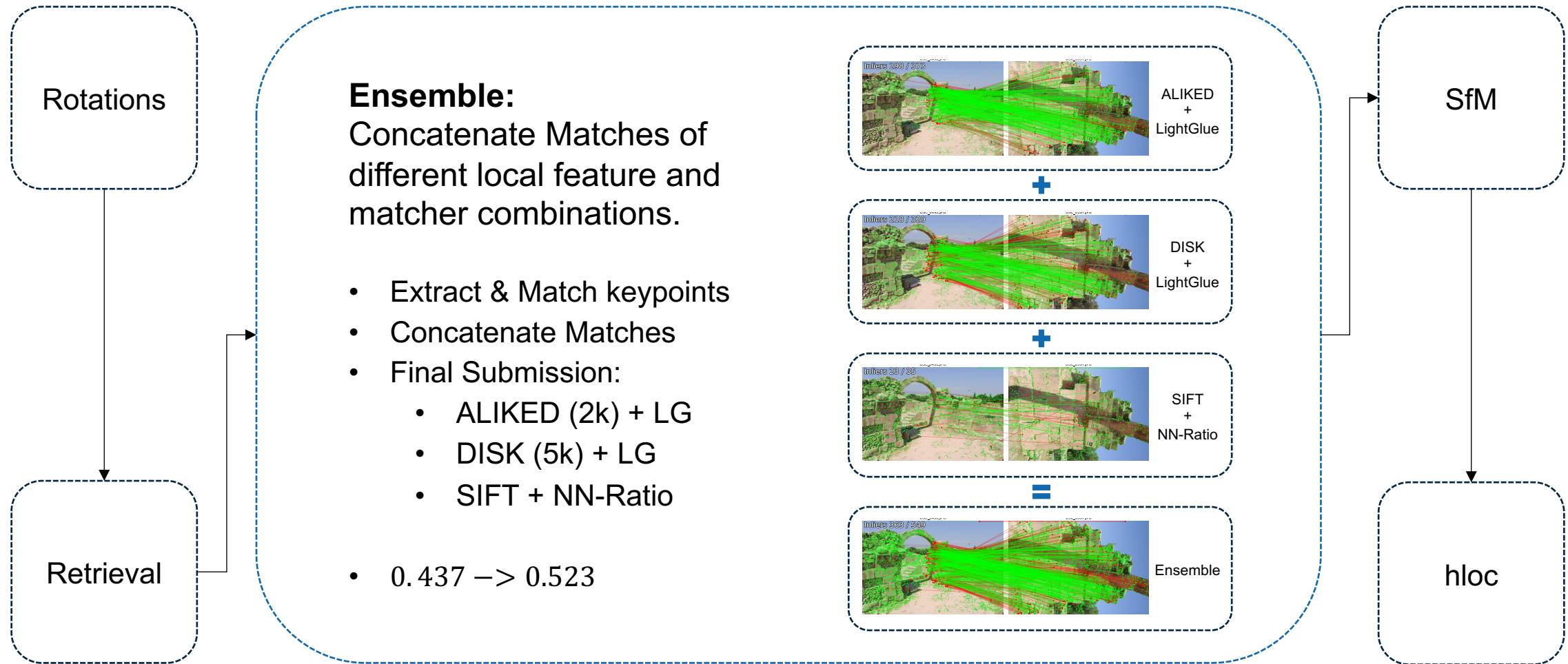
–0.042 upon submission  
(0.475 vs 0.432)  
—> not used for submissions



Maji et al.: Deep Image Orientation Angle Detection. Arxiv, 2020.



Achieved the most promising results by utilizing an ensemble of DISK, ALIKED, and SIFT, while avoiding non-permissive licenses.

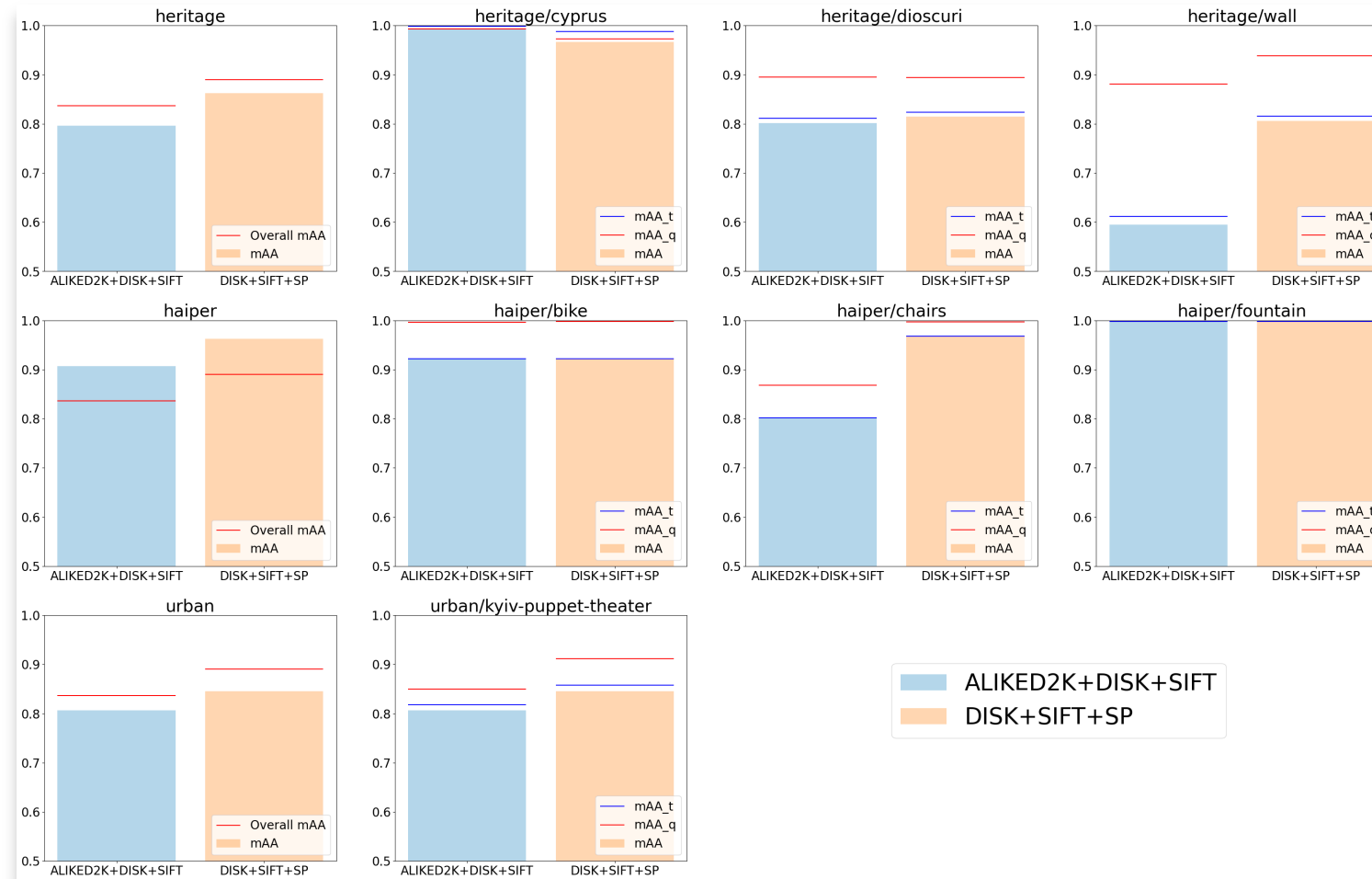


Zhao, et al.: ALIKED: A Lighter Keypoint and Descriptor Extraction Network via Deformable Transformation. Trans. Instrum. Meas., 2023.

Tyszkiewicz et al.: DISK: Learning local features with policy gradient. NIPS, 2020.

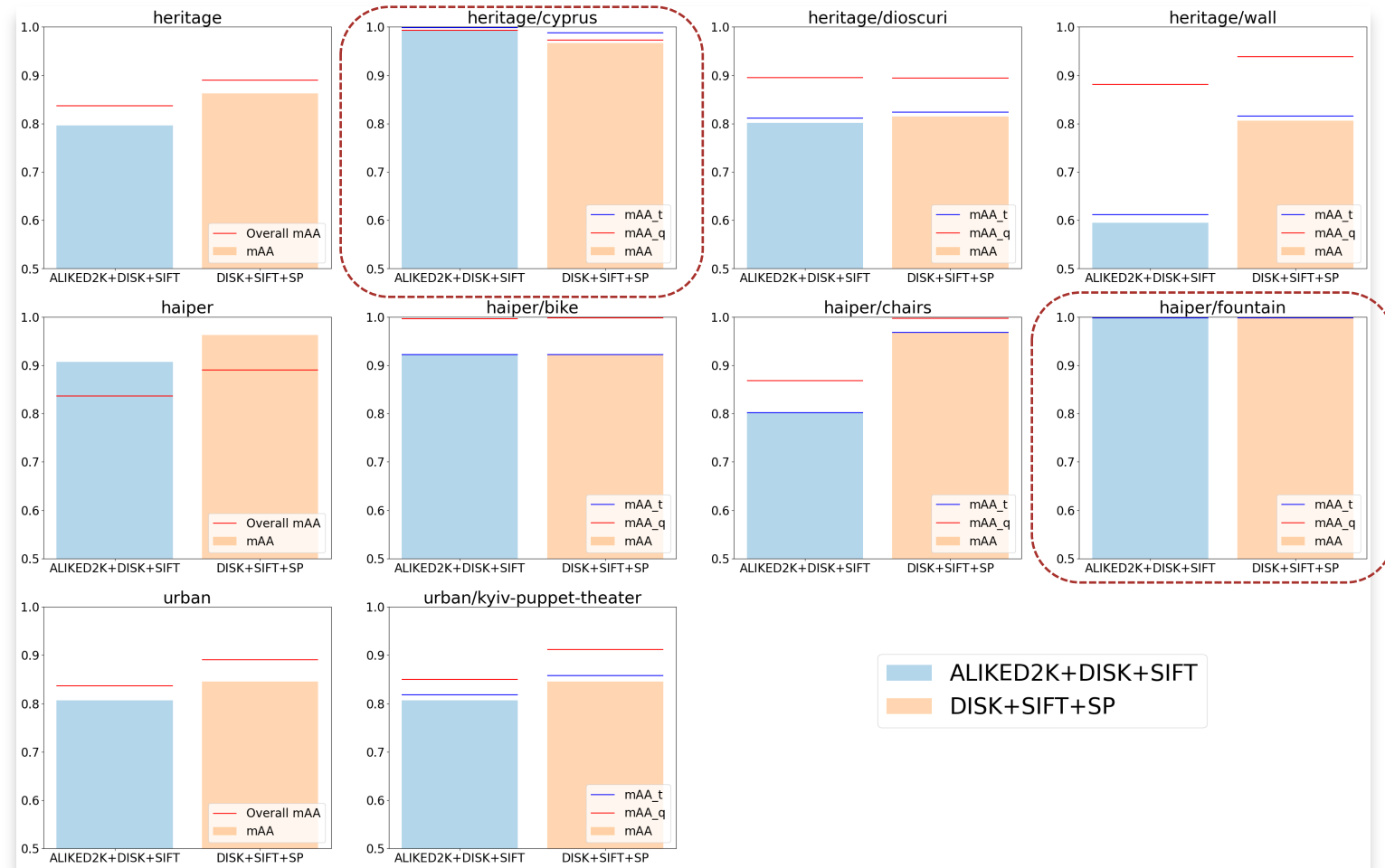
Lowe et al.: Distinctive Image Features from Scale-Invariant Keypoints. IJCV, 2004.

Our final ensemble performs on par with SuperPoint in the majority of scenes and achieves a perfect score on both Cyprus and Fountain.

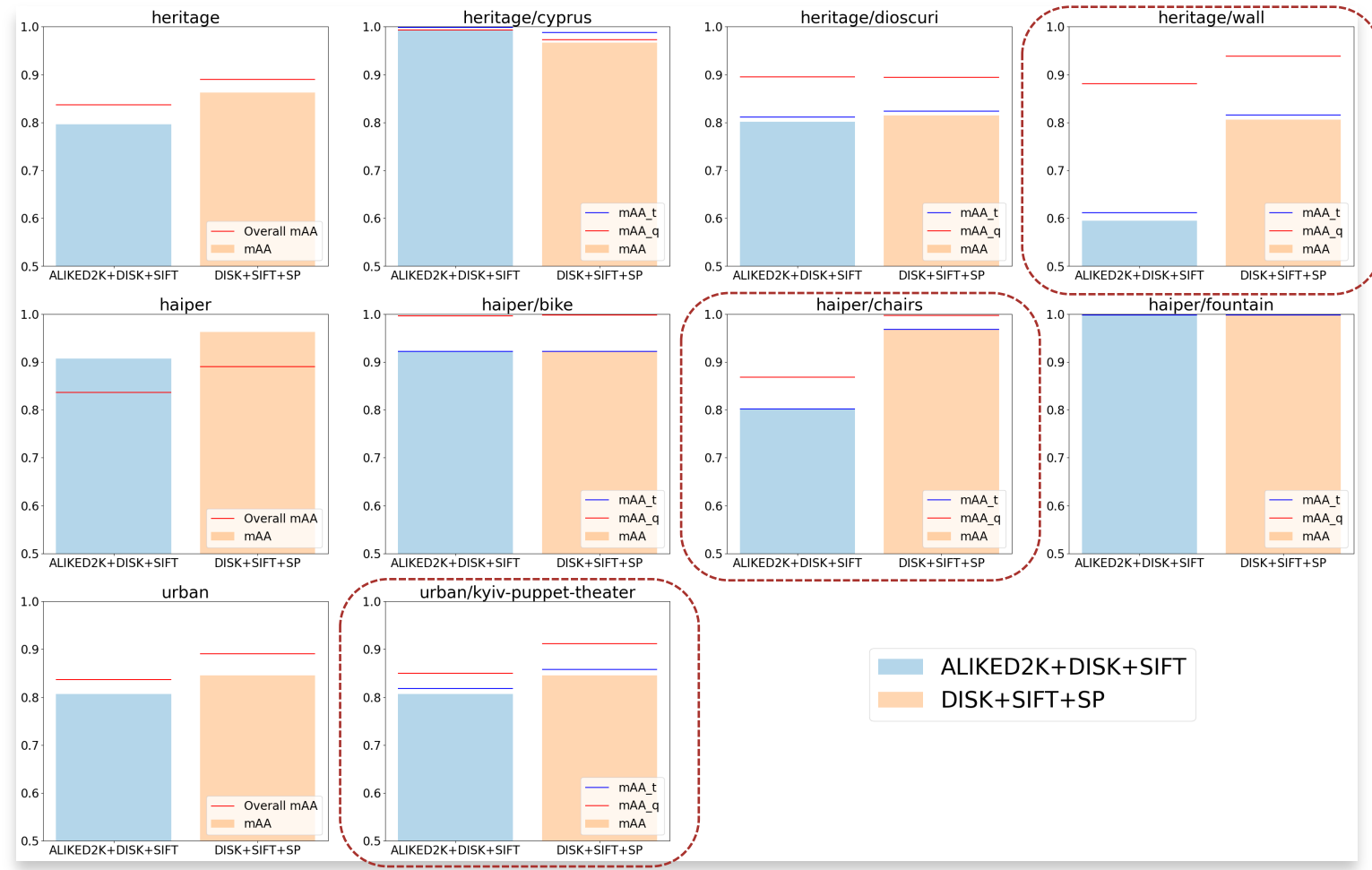




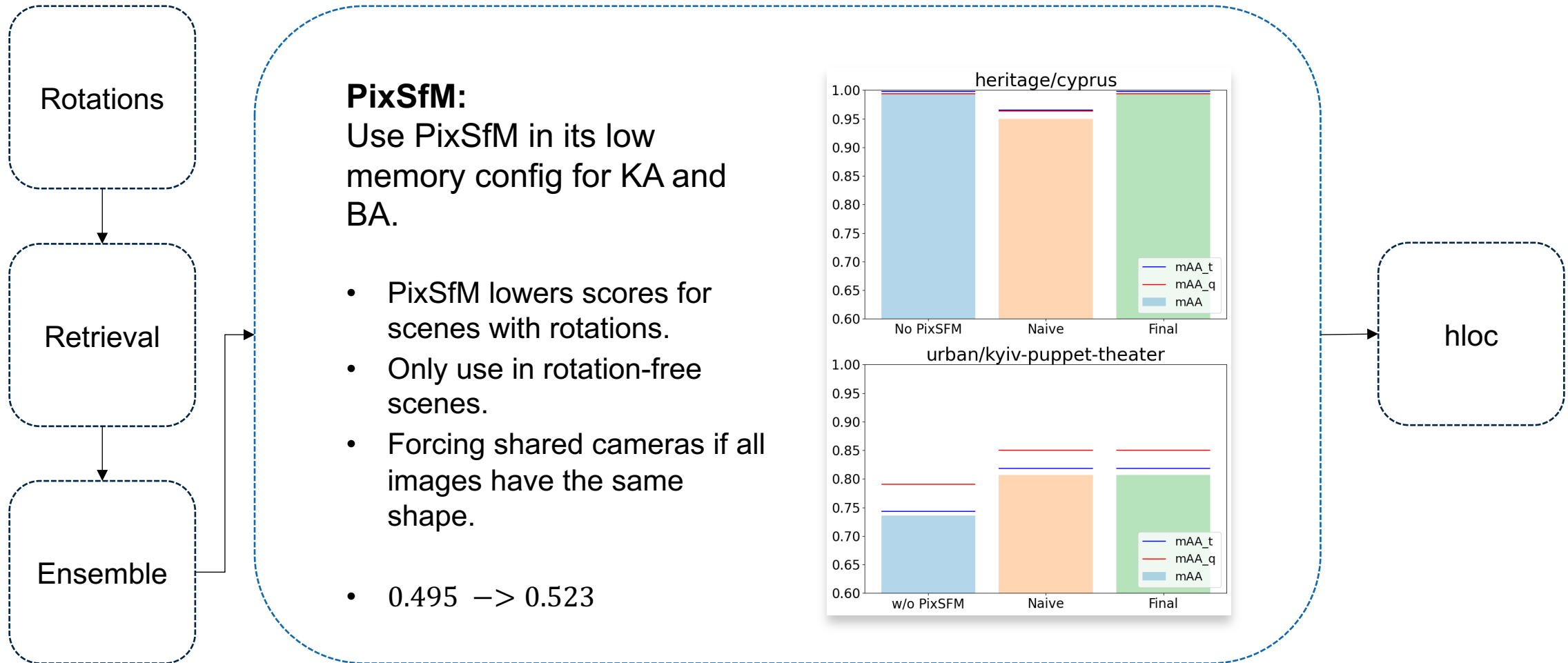
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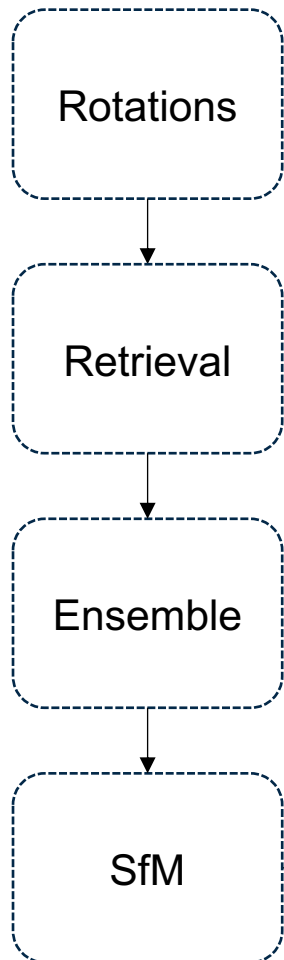


# Exclusively employing Pixel-Perfect-SfM in rotation-free scenes and employing shared cameras in selected scenes.



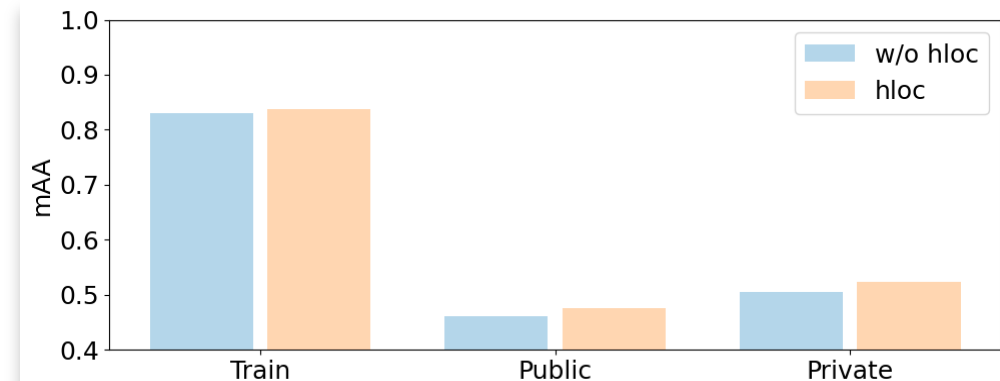
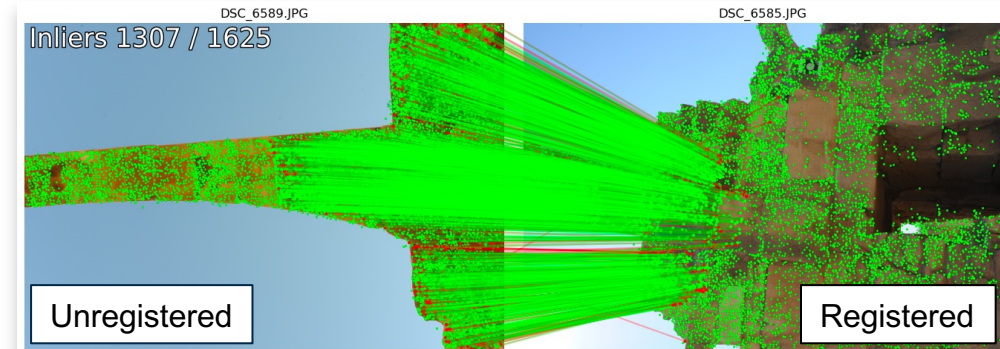
Lindenberg, et al.: Pixel-Perfect Structure-from-Motion with Featuremetric Refinement. ICCV, 2021.

# Leveraging Hierarchical-Localization (hloc), we are able to get poses for unregistered images.



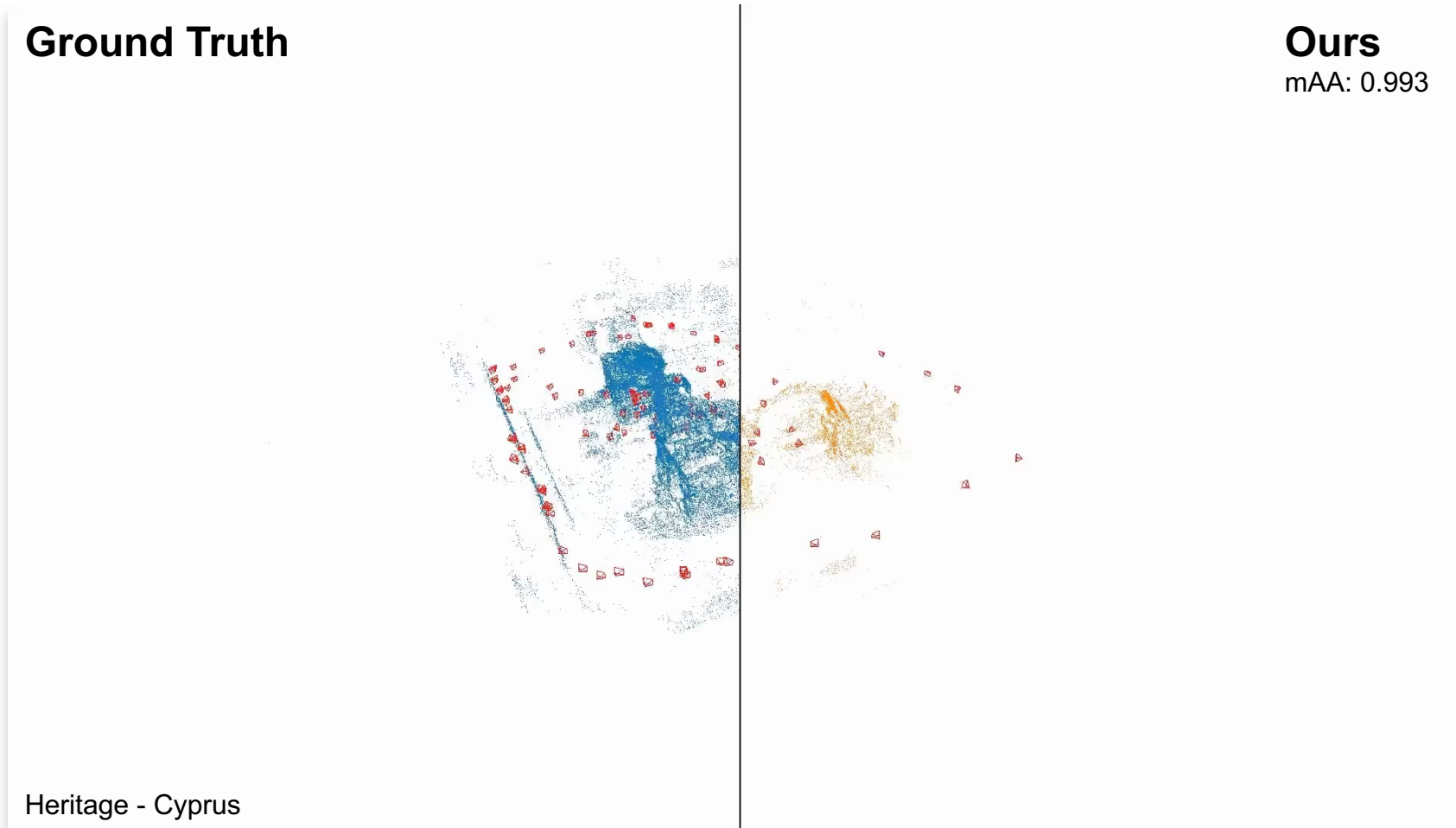
**Hierarchical-Localization:**  
Using hloc, we were able to get some poses for unregistered images.

- Some unregistered images had numerous matches with registered ones.
- Leveraging hloc for estimating their relative pose enhanced performance.
- 0.505  $\rightarrow$  0.523



Sarlin, et al.: From Coarse to Fine: Robust Hierarchical Localization at Large Scale. CVPR, 2019.

The final reconstruction achieved outstanding accuracy, featuring remarkably precise camera poses.



# Thank You!



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LightGlue Paper