





### Motivation

- Exhaustive search in coarse & fine localization is inefficient and inaccurate
- Some landmarks are robust for both coarse & fine localization

### Contribution

- Hierarchical localization by recognizing global instances
- Progressive reference search to handle recognition errors
- Efficient two-step pose estimation



①Global instance ②Recognition-based ③Instance-wise reference search detection & matching estimation recognition

### System overview.

### • References

- NetVLAD, Relja Arandjelovic, et al., CVPR 2016
- Suerpoint, Daniel DeTone, et al., CVPRW 2018
- Superglue, Paul-Edouard Sarlin, et al., CVPR 2020
- Hloc, Paul-Edouard Sarlin, et al., CVPR 2019
- Global unique instance segmentation, Ignas Budvytis, et al., BMVC2 019
- R2D2, Jerome Revaud, et al., NeurIPS 2019

# **Efficient Large-scale Localization by Global Instance Recognition**

### Global instance definition

Discriminative landmarks, e.g., buildings

Localization by recognition

Global instance recognition

Geometric verification

Progressive search

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### • Architecture

- Global feature
- Local feature

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Instance recognition

4 Pose

• Pose	e refinement			
	Predicted label	Confidence map	Candidate i	
		<i>P</i>	Instance selection	
	Refinement		Co-visible f	
( <i>R</i> , <i>t</i> )	EPnP RANSAC			
	ge	geometric consistency check $(R_{ir})$		

## Automatic labeling

### Fei Xue, Ignas Budvytis, Daniel Olmeda Reino, Roberto Cipolla



### • Results on Aachen Day-Night dataset



Method	Avg. day	Search Frame night
IR	6697	6697
Ours	202	650

Progressive search #reference images

Group	Method	Day	Night
Н	SIFT [27] SPP [10] D2Net [11] R2D2 [35] ASLFeat [29] CAPS + SIFT [27,61] LISRD + SPP [10,33] LLF + R2D2 [10,50]	72.2 / 78.4 / 81.7 87.9 / 93.6 / 96.8 84.1 / 91.0 / 95.5 88.8 / 95.3 / 97.8 88.0 / 95.4 / 98.2 82.4 / 91.3 / 95.9	19.4 / 23.0 / 2 70.2 / 84.8 / 9 63.4 / 83.8 / 9 72.3 / 88.5 / 9 70.7 / 84.3 / 9 61.3 / 83.8 / 9 73.3 / 86.9 / 9 71.2 / 81.2 / 9
М	SPP + Superglue [10,38] Patch2Pix [67] LoFTER [49]	<b>89.8 / 96.1 / 99.4</b> 86.4 / 93.0 / 97.5 88.7 / 95.6 / 99.0	77.0/90.6/19 72.3/88.5/9 78.5/90.6/9
	Ours	89.1 / 96.1 / 99.3	77.0/90.1/9

Localization accuracy (**best**, **second-best**)

## • Qualitative results



Localization pipeline





### Project website





Recognized instances and matches



Tracking length of extracted keypoints