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DOMAINDESC: LEARNING LOCAL DESCRIPTORS WITH DOMAIN ADAPTATION

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Abstract

Robust and efficient local descriptor is crucial in a wide range of applications. In this paper, we propose a novel descriptor DomainDesc which is invariant as much as possible by learning local Descriptor with Domain adaptation. We design the feature-level domain adaptation loss to improve robustness of our DomainDesc by punishing inconsistent high-level feature distributions of different images, while we present the pixel-level cross-domain consistency loss to compensate for the inconsistency between the descriptors corresponding to the keypoints at the pixel level. Besides, we adopt a new architecture to make the descriptor contain as much information as possible, and combine triplet loss and cross-domain consistency loss for descriptor supervision to ensure the distinguished ability of our descriptor. Finally, we give a cross-domain dataset generation strategy to quickly construct our training dataset for diverse domains to adapt to complex application scenarios. Experiments validate that our DomainDesc achieves state-of-the-art performances on HPatches image matching benchmark and Aachen-Day-Night localization benchmark.

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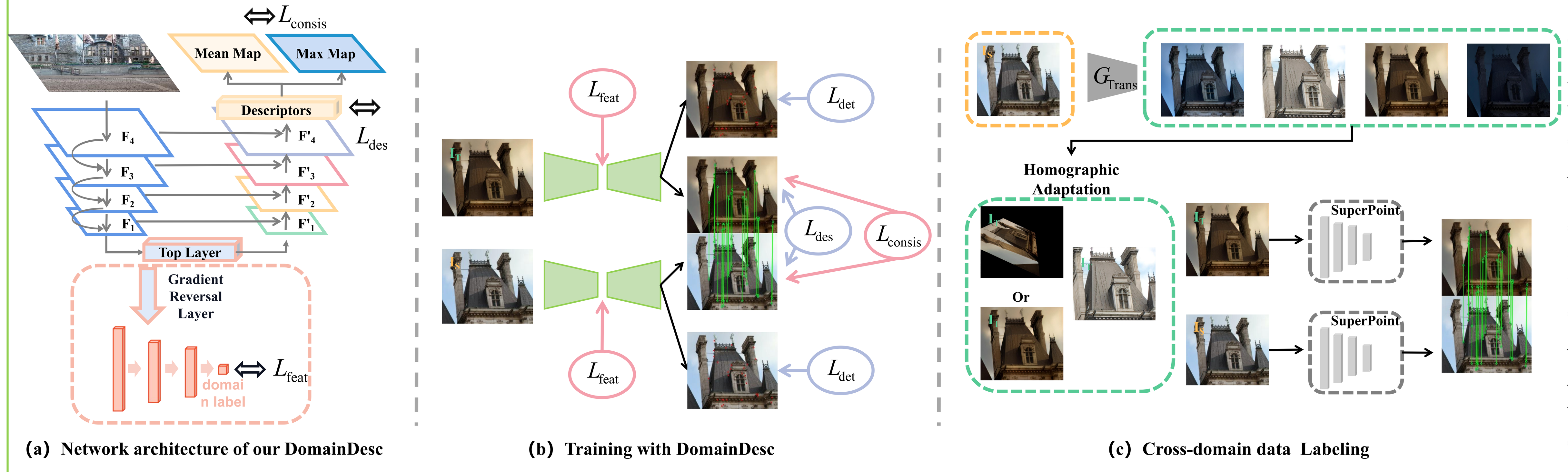
Methods



The overview of our DomainDesc.(a) The architecture of our DomainDesc. (b) We conduct training by applying feature-level domain adaptation loss and pixel-level cross-domain consistency loss on our DomainDesc. (c) We use the translation network and homographic adaptation to obtain a cross-domain dataset with labels

Feature-level Domain Adaptation Supervision

we define our feature-level domain loss as:

$$L_{feat}(F(I_S),F(I_T)) = \left[\frac{1}{N}\sum_{i=1}^{N}(-l_i log(t_i) - (1-l_i)log(1-t_i)) + tanh(H(t_i)\right]^2.$$

Pixel-level Cross-domain Consistency Supervision

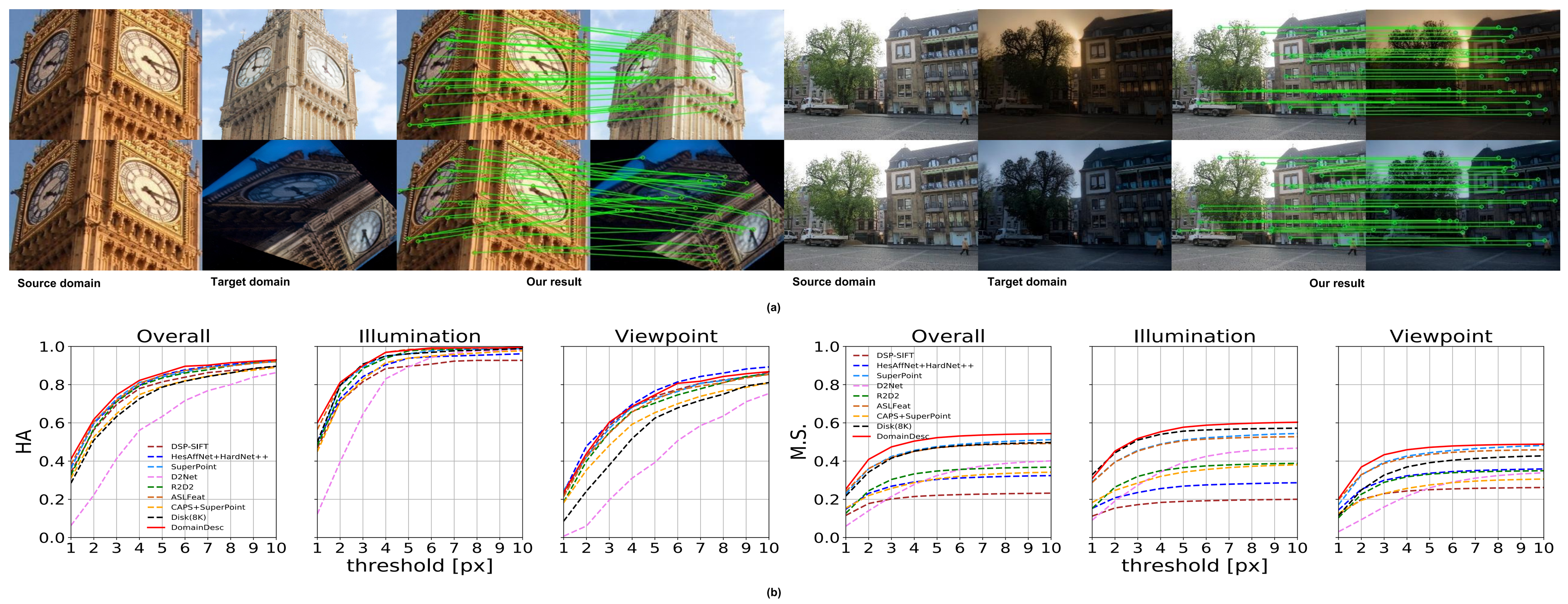
we define our pixel-level cross-domain consistency loss as:

$$L_{consis}(D,D') = \frac{1}{n^2}\sum_{i=1}^{n^2}[|\bar{d}_i - \bar{d}'_i| + |d_i^{max} - d_i'^{max}|]^2.$$

Results

Aachen Day-Night v1.1 dataset					
Method	Kpts	Dim	Correctly localized queries		
			0.25m,2°	0.5m,5°	5m,10°
ROOT-SIFT [18]	11K	128	53.4	62.3	72.3
DSP-SIFT [19]	11K	128	40.3	47.6	51.3
SuperPoint [7]	7K	256	68.1	85.9	94.8
D2Net [8]	14K	512	67.0	86.4	97.4
R2D2 [9]	10K	128	70.7	85.3	96.9
ASLFeat [10]	10K	128	71.2	85.9	96.9
CAPS + SuperPoint [11]	7K	256	71.2	86.4	**97.9**
DISK [12]	10K	128	72.8	86.4	97.4
Baseline	7K	128	70.2	84.3	95.3
+ Cross-domain data	7K	128	70.7	86.4	96.9
+ Feature loss	7K	128	72.8	86.4	96.3
+ Consis loss (DomainDesc)	7K	128	**73.3**	**86.9**	96.9

Evaluation on Aachen Day-Night v1.1: + Cross-domain data: using the cross-domain dataset; + Feature loss: augmenting our feature-level domain adaptation loss; + Consis loss: augmenting our pixel-level cross-domain consistency loss.



Matching results of our method. (a) Two matching results of applying our DomainDesc to image pairs composed of different source domain images and target domain images. (b) The evaluation results applying our DomainDesc on the Hpatches dataset. Compared with other state-of-the-art methods, the HA and M.S. metrics of our DomainDesc are significantly leading.