

# Deep Semantic Matching with Foreground Detection and Cycle-Consistency

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Code available!



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VIRGINIA TECH

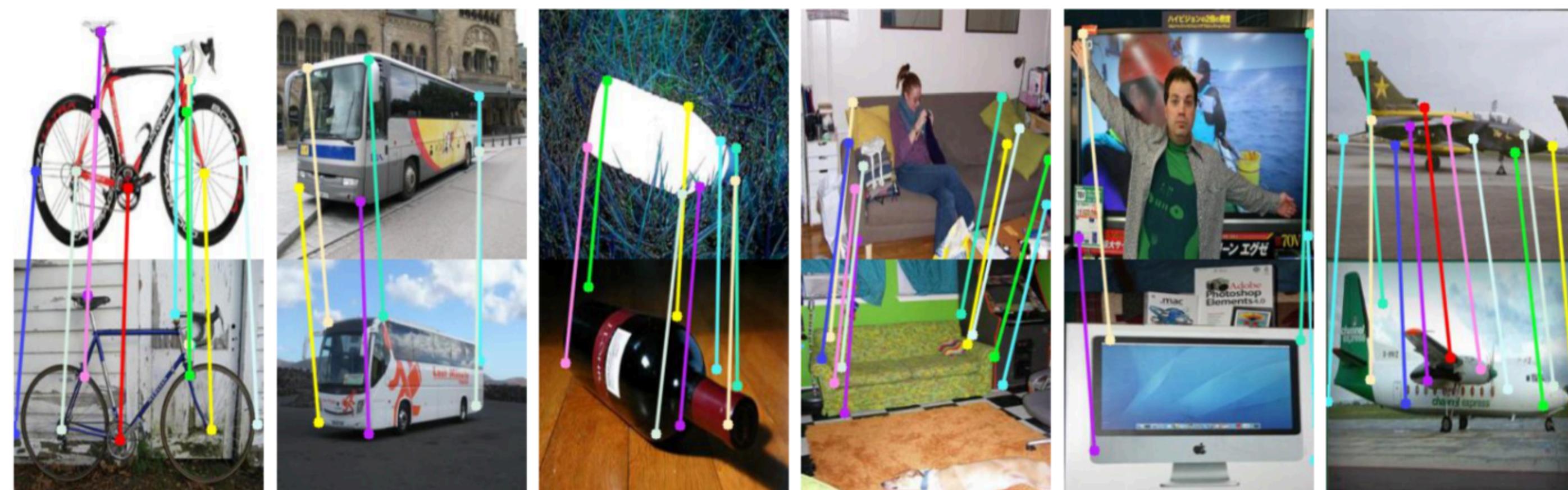
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UCMERCED

Google Cloud



## Semantic matching

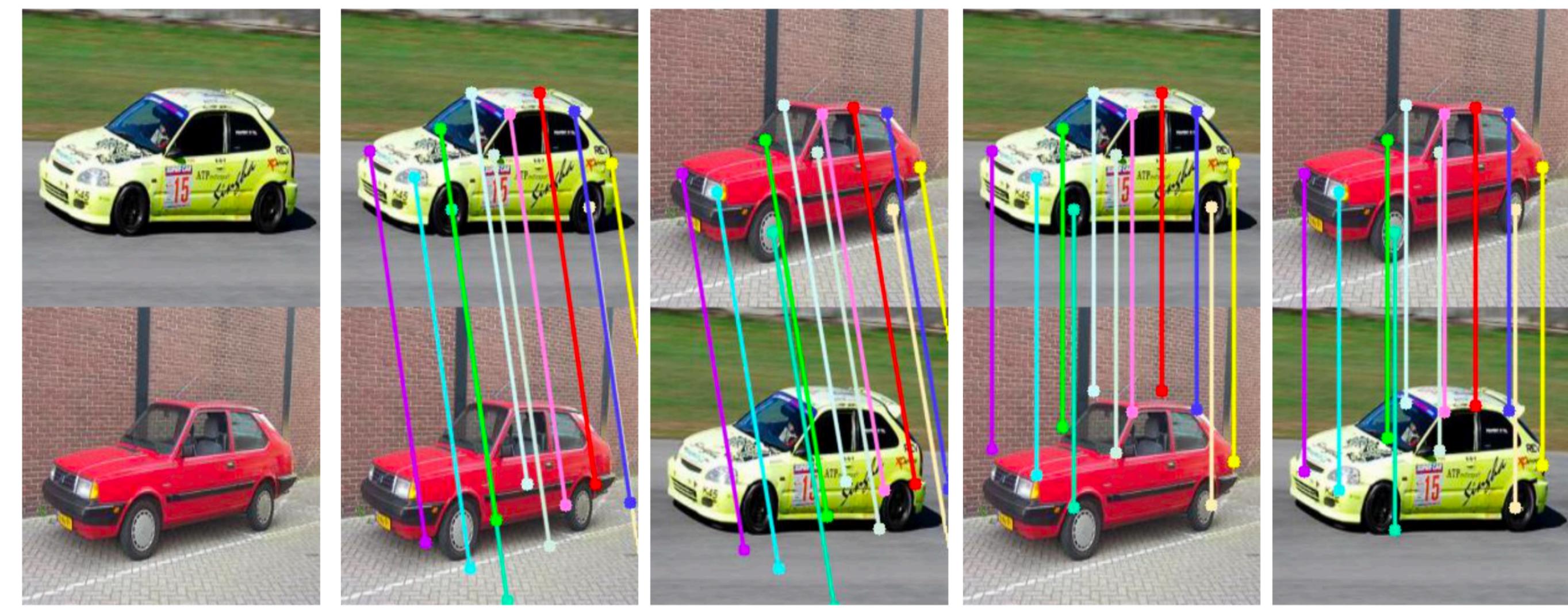
- Input: A set of images containing instances of an object category
- Goal: Estimate correspondences between image pairs



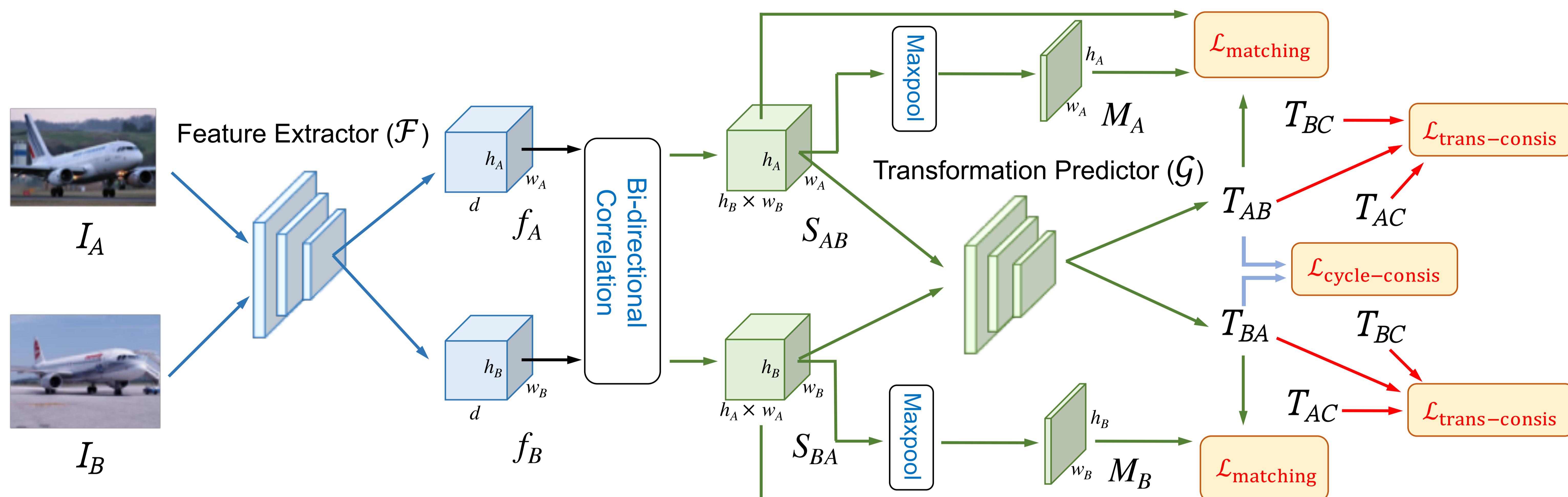
Our matching results.

## Challenges

- Background clutters
- Inconsistent bidirectional matching
- Require keypoint annotation for supervision



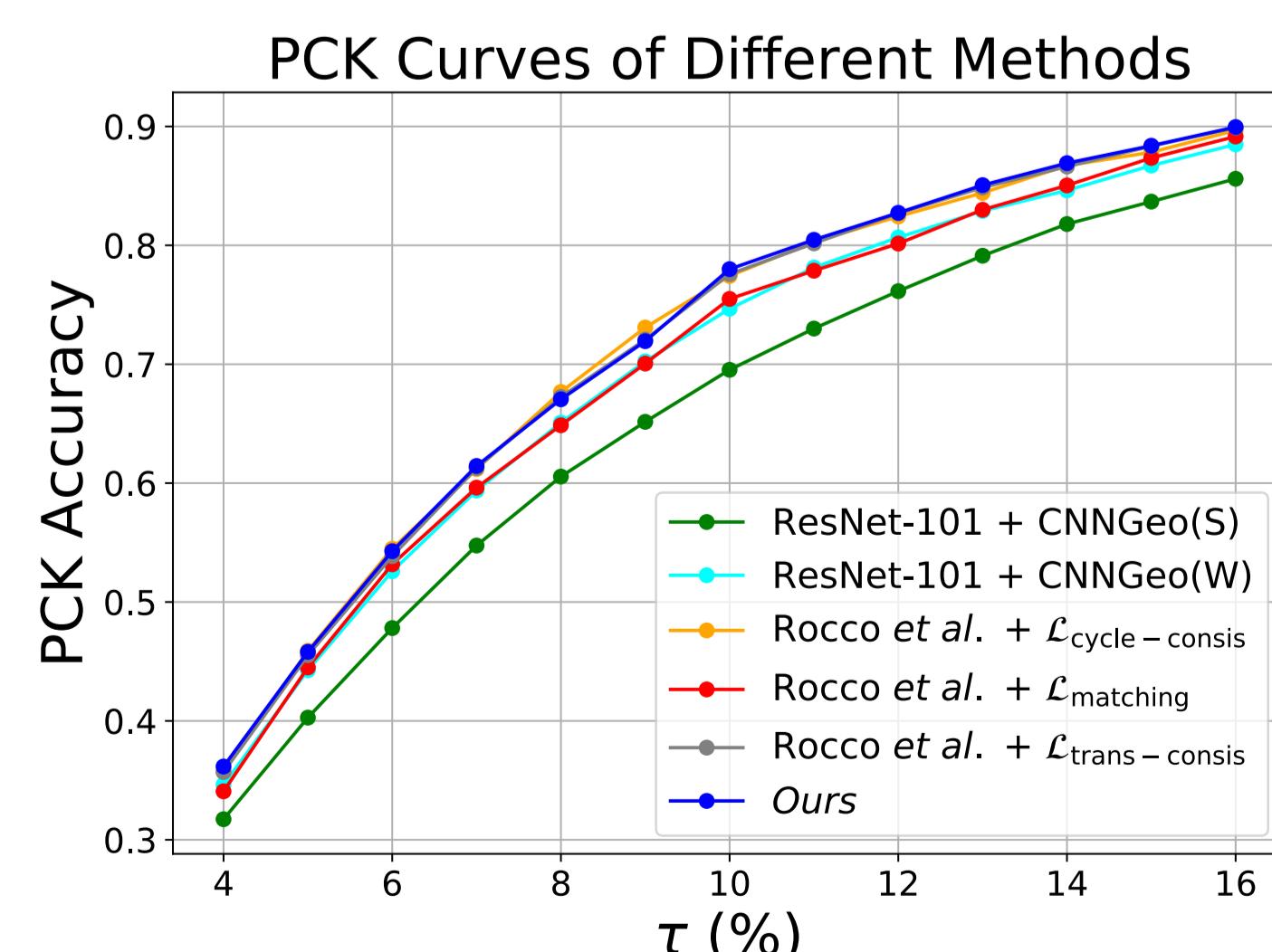
## Weakly-supervised semantic matching network



## Experimental results

### (a) Results on PF-PASCAL.

Method	mean PCK
HOG+PF-LOM	62.5
UCN	55.6
VGG-16+SCNet-A	66.3
VGG-16+SCNet-AG	69.7
VGG-16+SCNet-AG+	72.2
VGG-16+CNNGeo	62.6
ResNet-101+CNNGeo(S)	69.5
ResNet-101+CNNGeo(W)	74.8
Ours	<b>78.0</b>



Ground Truth Label	
Foreground	Background
82.3 %	29.1 %
17.7 %	70.9 %

Rocco et al.

Ground Truth Label	
Foreground	Background
84.7 %	27.8 %
15.3 %	72.2 %

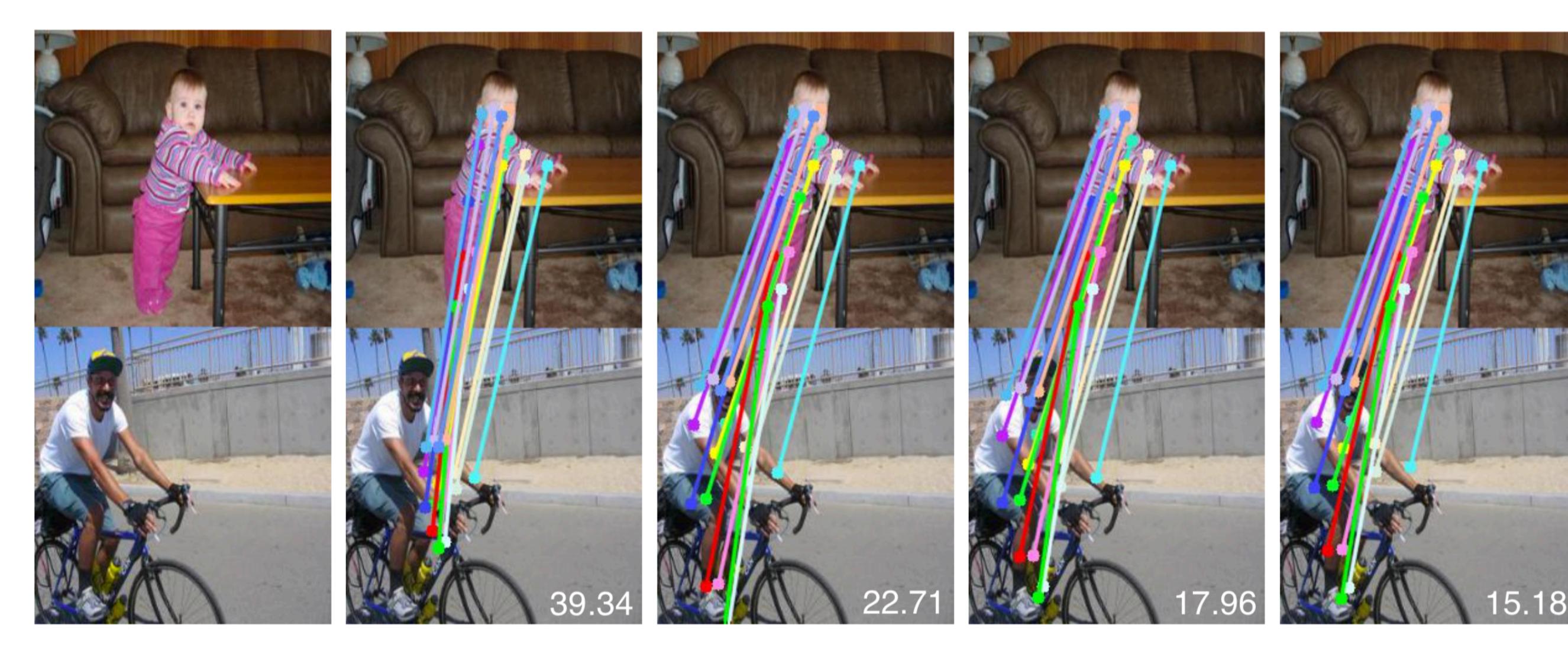
Ours

### (b) Results on PF-WILLOW.

Method	$ \tau = 0.05 $	$ \tau = 0.1 $	$ \tau = 0.15 $
SIFT Flow	0.247	0.380	0.504
VGG w/SF	0.324	0.456	0.555
FCSS w/SF	0.354	0.532	0.681
UCN	0.291	0.417	0.513
SCNet-A	0.390	0.725	0.873
SCNet-AG	0.394	0.721	0.871
SCNet-AG+	0.386	0.704	0.853
ResNet-101+CNNGeo(S)	0.448	0.777	0.899
ResNet-101+CNNGeo(W)	0.477	0.812	0.917
Ours	<b>0.491</b>	<b>0.819</b>	<b>0.922</b>

### (d) Ablation study on PF-PASCAL.

Method	mean
Rocco et al.	74.8
Rocco et al. + $\mathcal{L}_{\text{matching}}$	75.5
Rocco et al. + $\mathcal{L}_{\text{cycle-consis}}$	77.4
Rocco et al. + $\mathcal{L}_{\text{trans-consis}}$	77.6
Ours	<b>78.0</b>



An image pair      Rocco et al.      Rocco et al. + foreground detection      Rocco et al. + cycle consistency      Ours

### References:

- Choy et al. Universal Correspondence Network. In NIPS, 2016.
- Han et al. SCNet: Learning Semantic Correspondence. In ICCV, 2017.
- Ham et al. Proposal Flow: Semantic Correspondences from Object Proposals. TPAMI, 2017.
- Rocco et al. Convolutional Neural Network Architecture for Geometric Matching. In CVPR, 2017.
- Rocco et al. End-to-End Weakly-Supervised Semantic Alignment. In CVPR, 2018.

### (e) Effect of using the foreground-guided matching loss $\mathcal{L}_{\text{matching}}$ .