PatchMatch-Based Neighborhood Consensus for Semantic Correspondence

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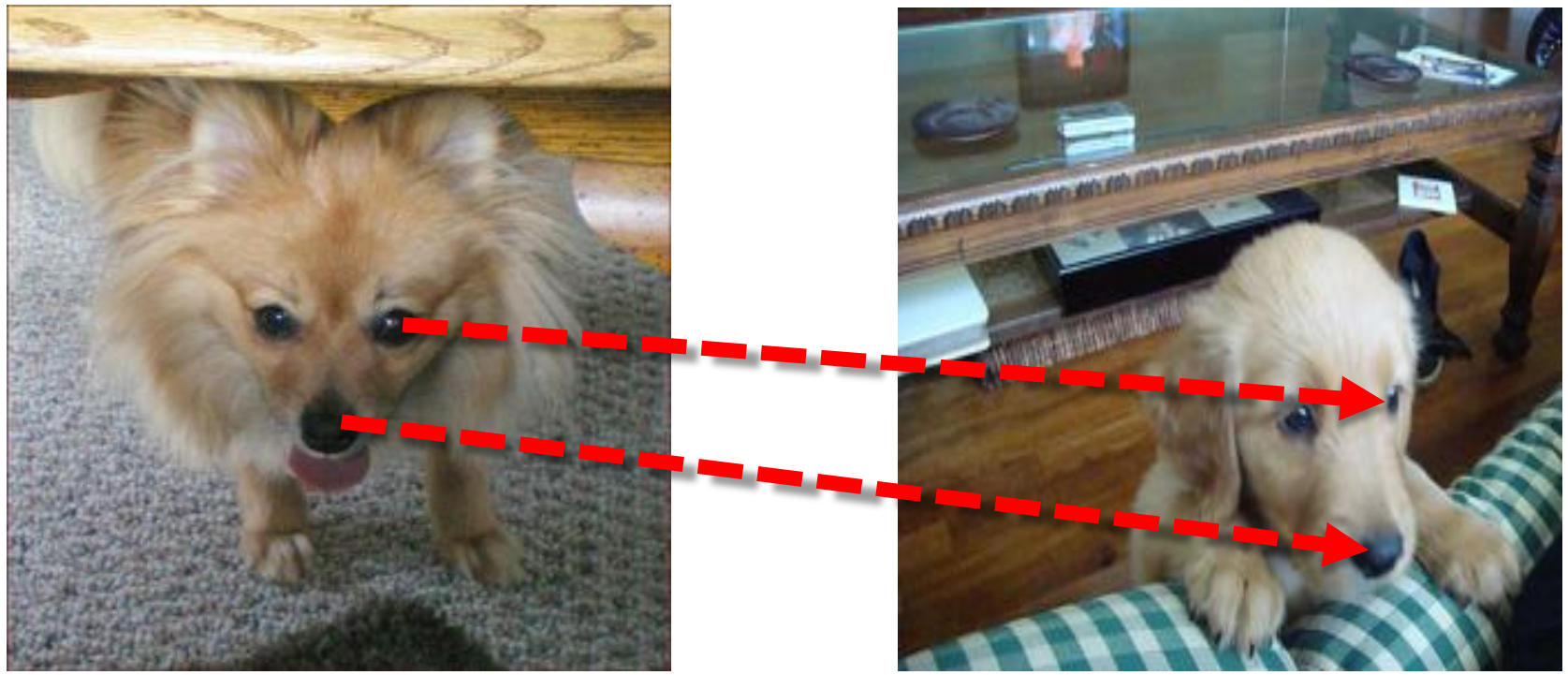
1. ILLINOIS

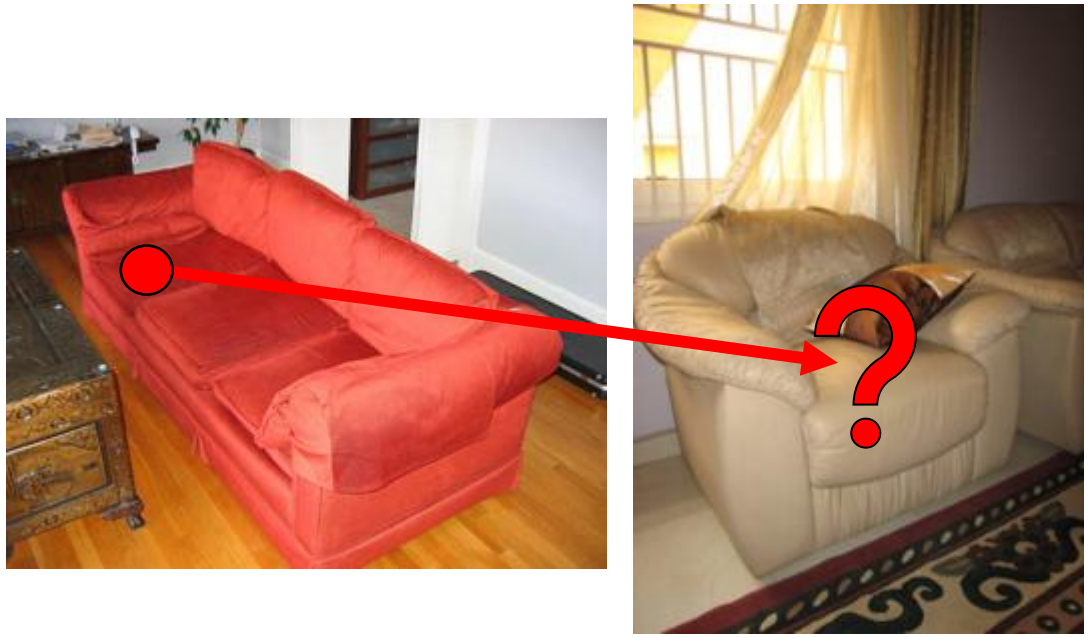
2. Microsoft

Semantic Correspondence



Challenges

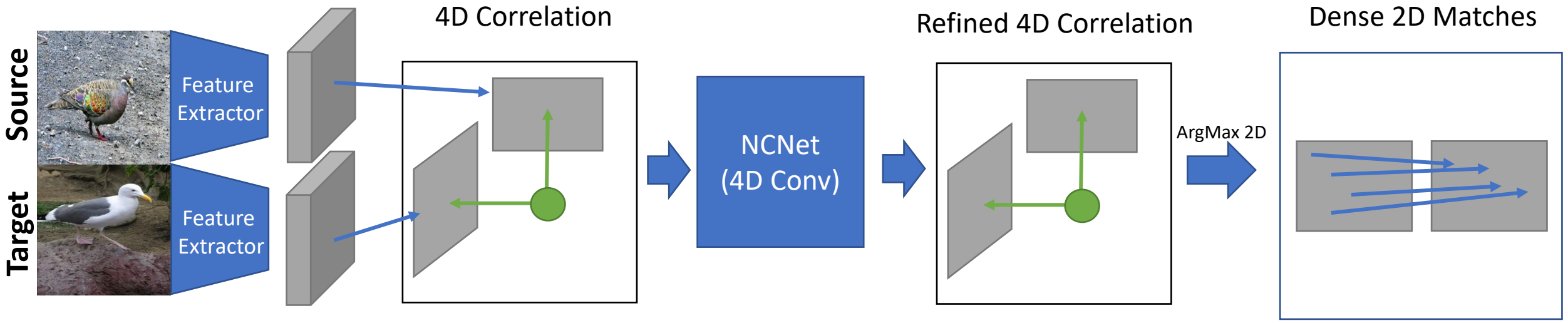
Large Intra-Class Variation



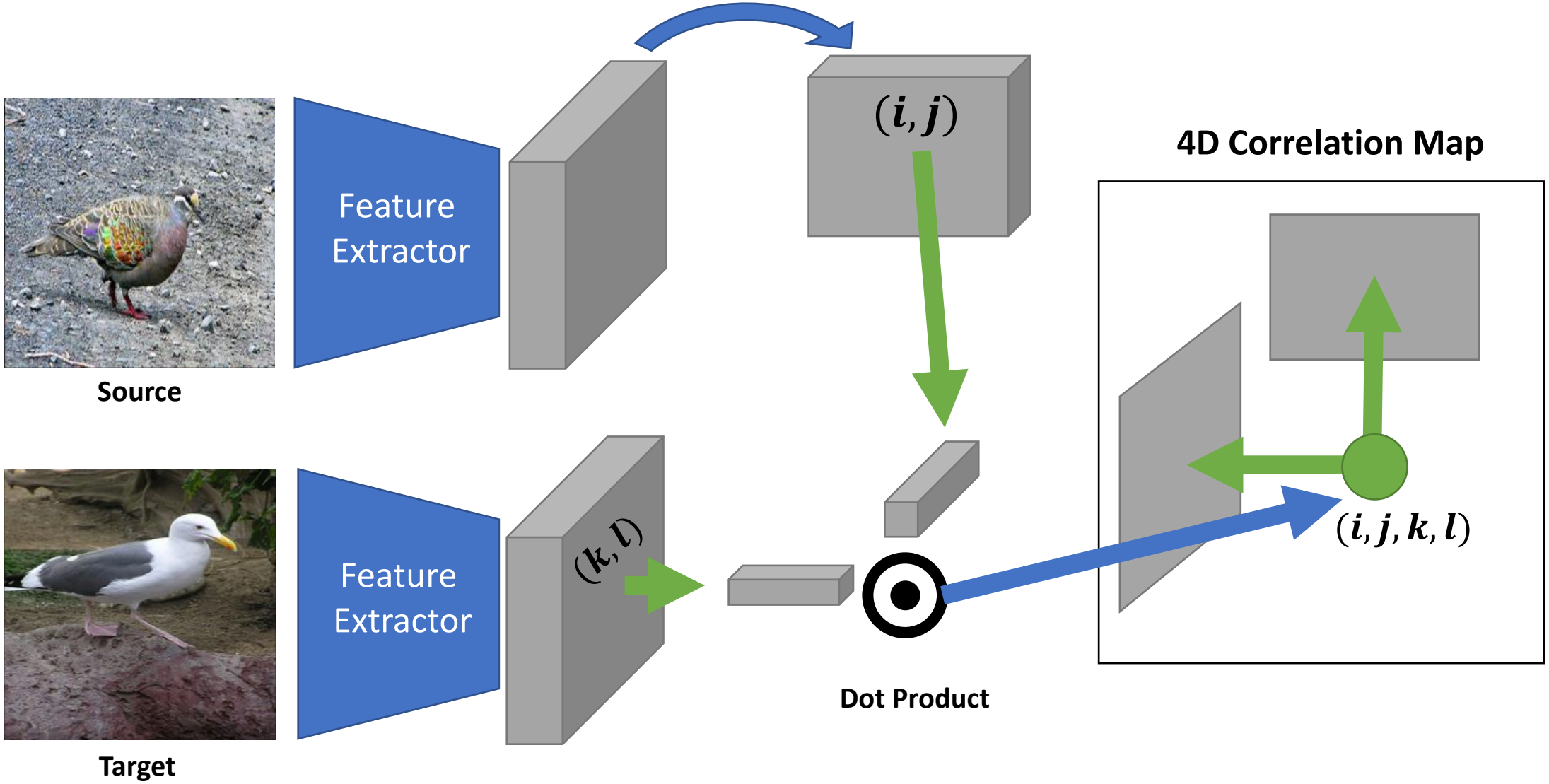
Ambiguous Dense Annotation

Related work: Neighborhood Consensus Network

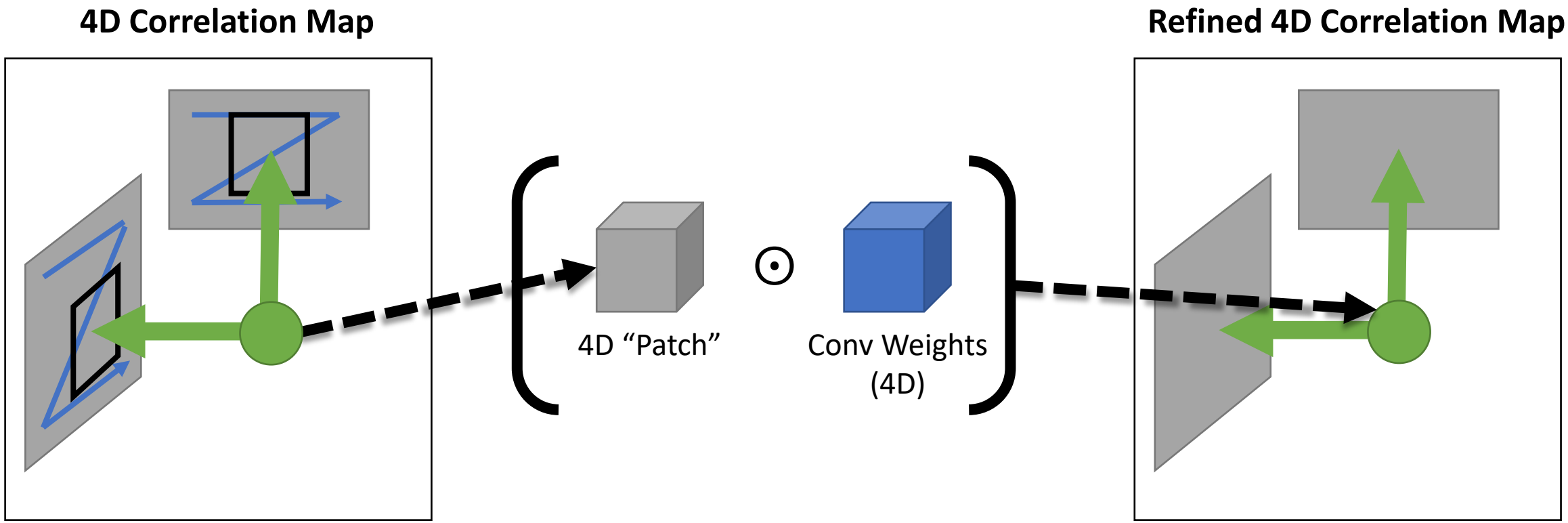
Rocco et al. (NeurIPS 2018)



Computing 4D Correlation Map



Computing 4D Convolution



Related work: Neighborhood Consensus Network

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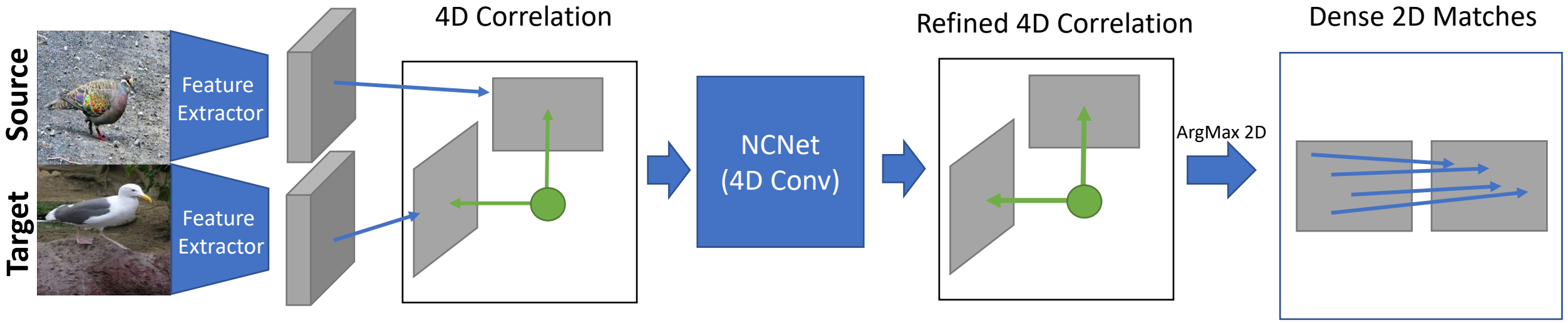
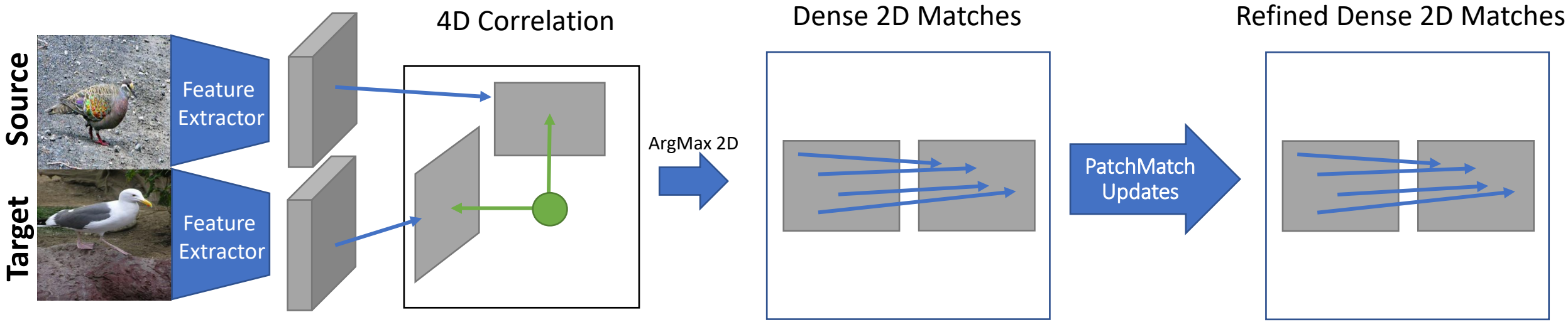
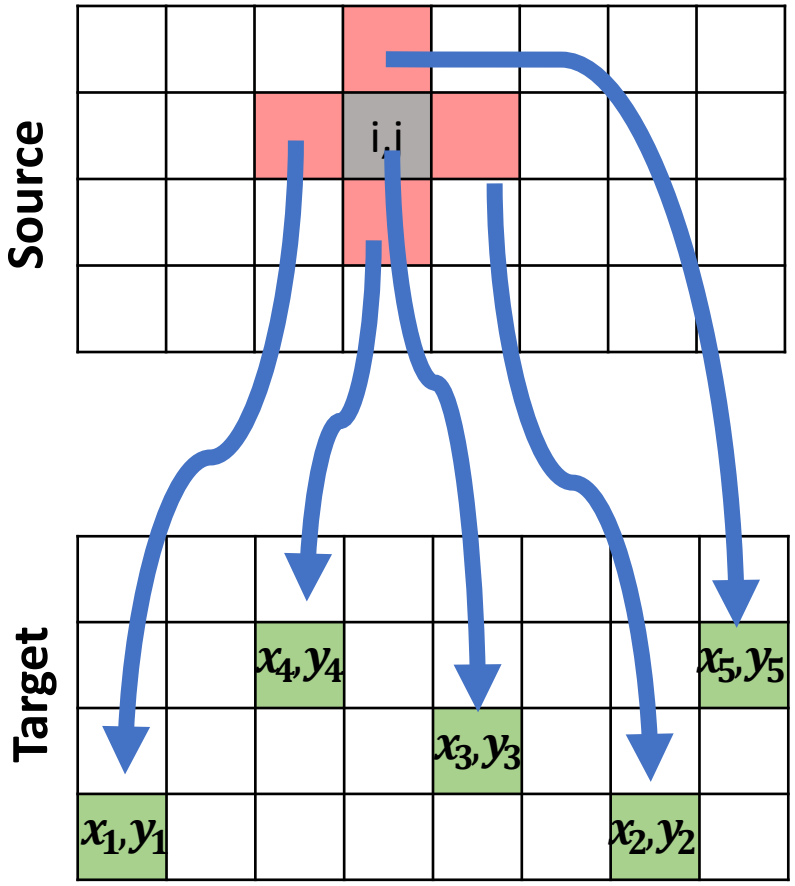


Proposed Method

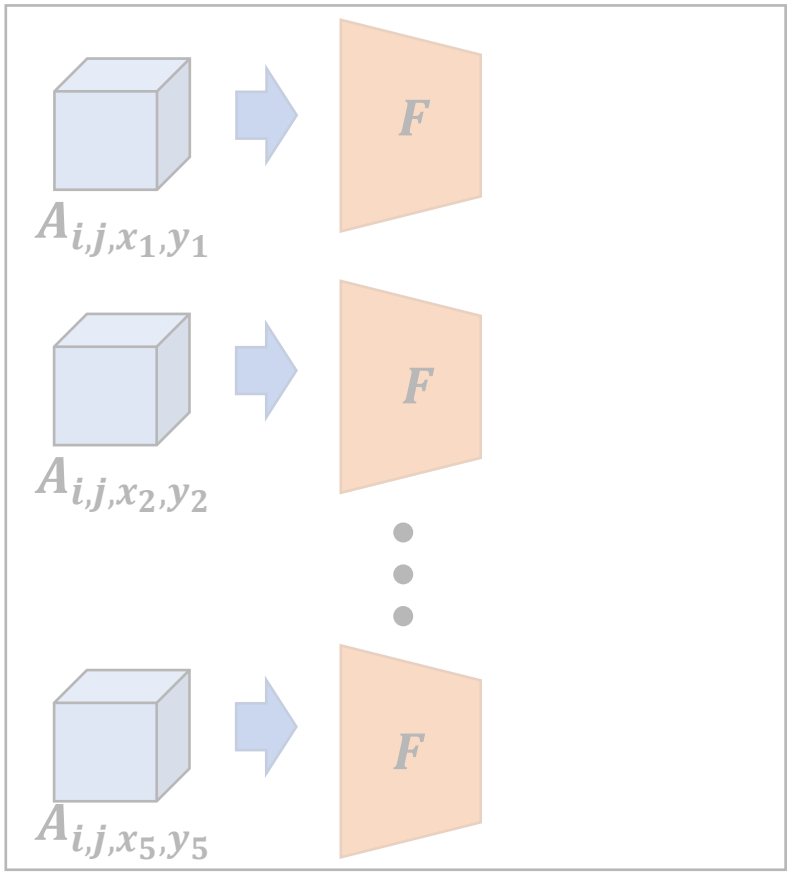


PatchMatch Updates

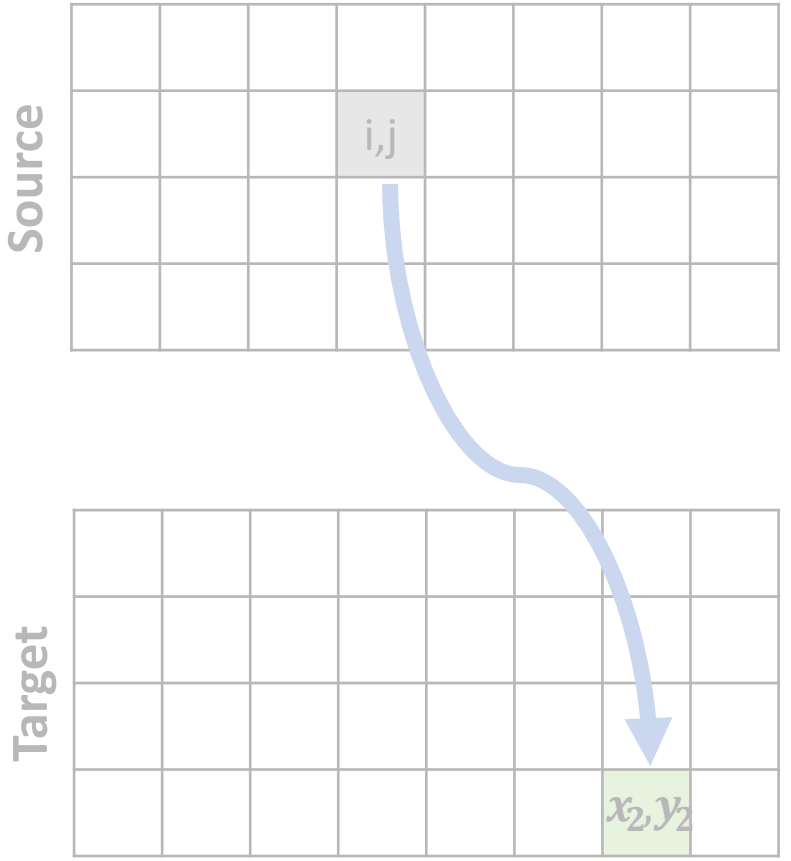
Propagation Candidates



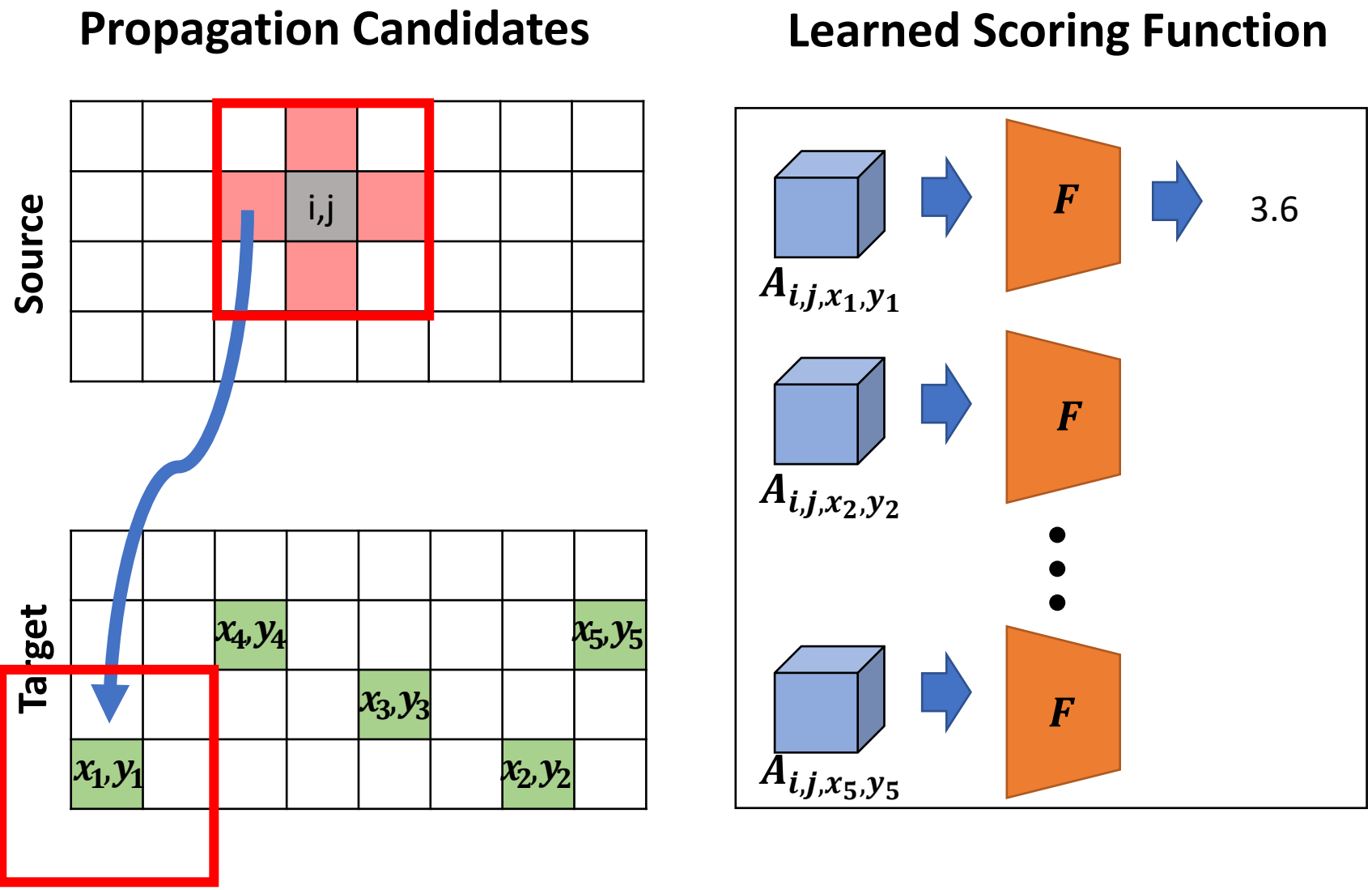
Learned Scoring Function



Updated Correspondence



PatchMatch Updates



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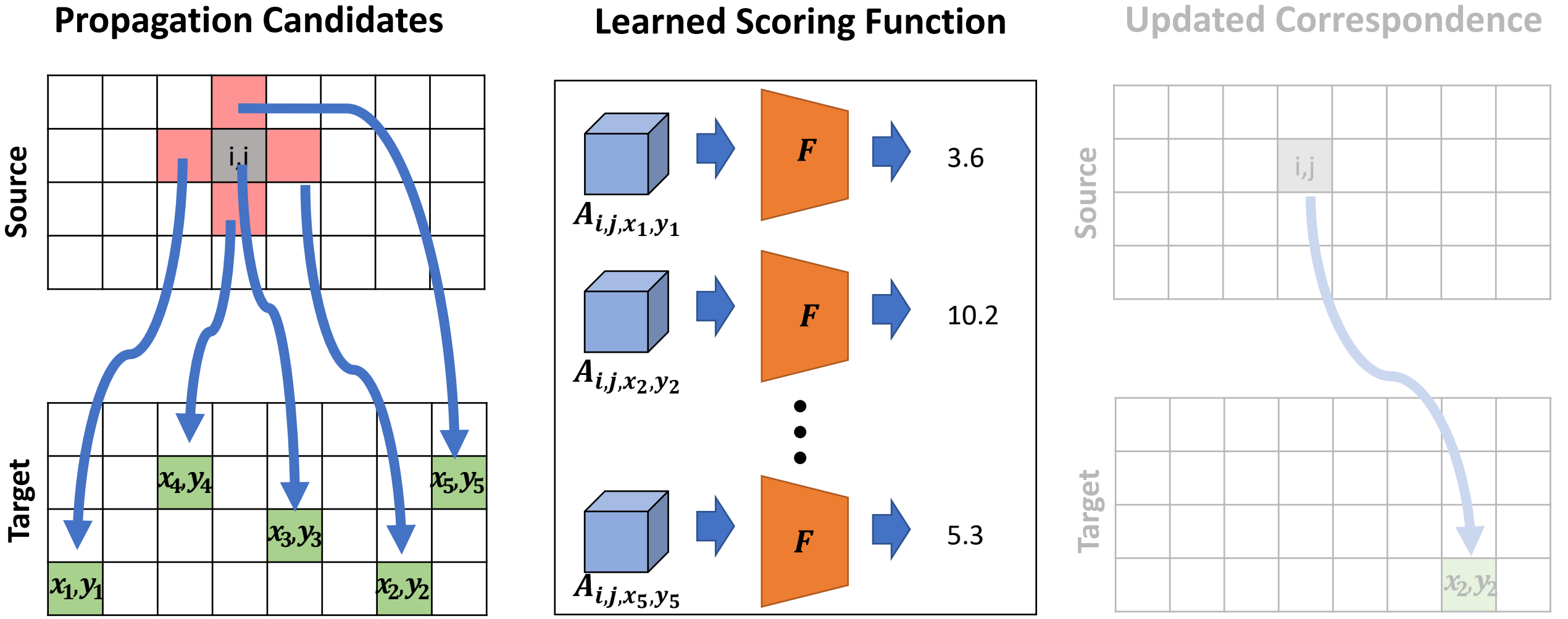
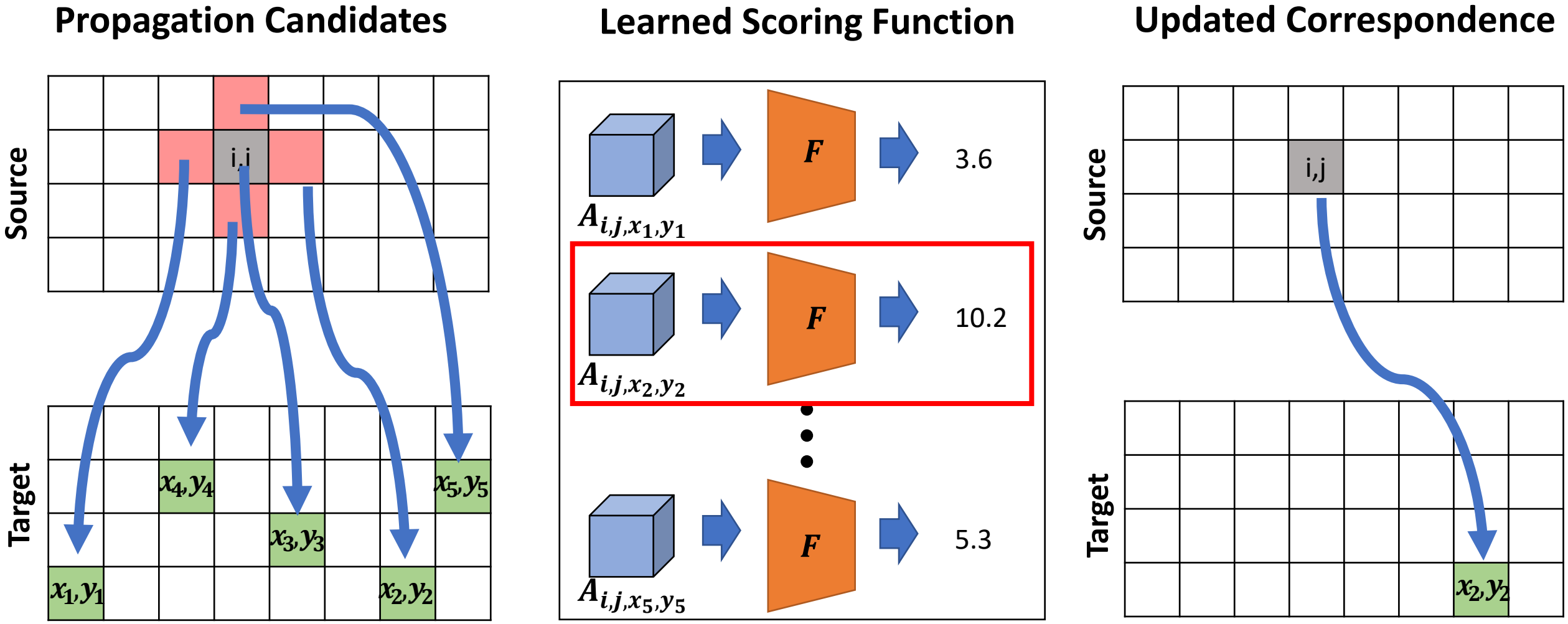


PatchMatch Updates



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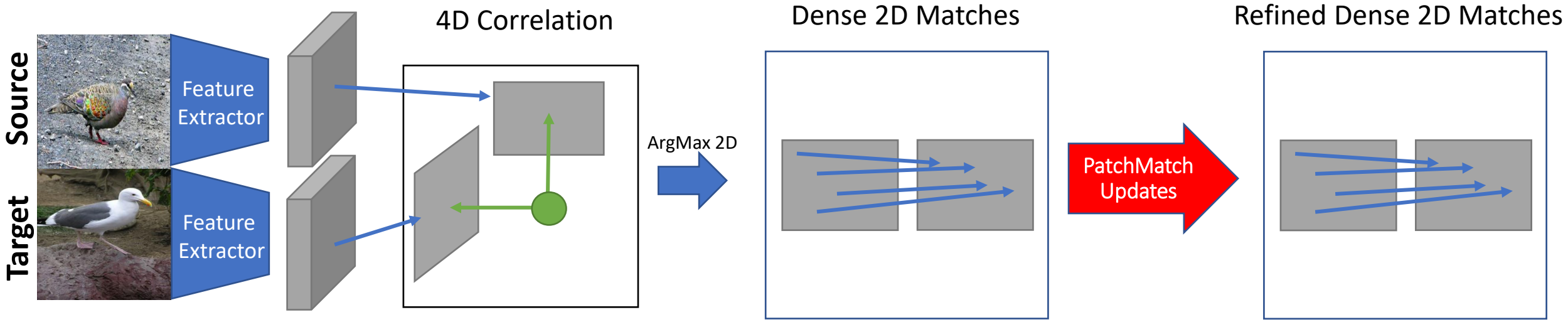
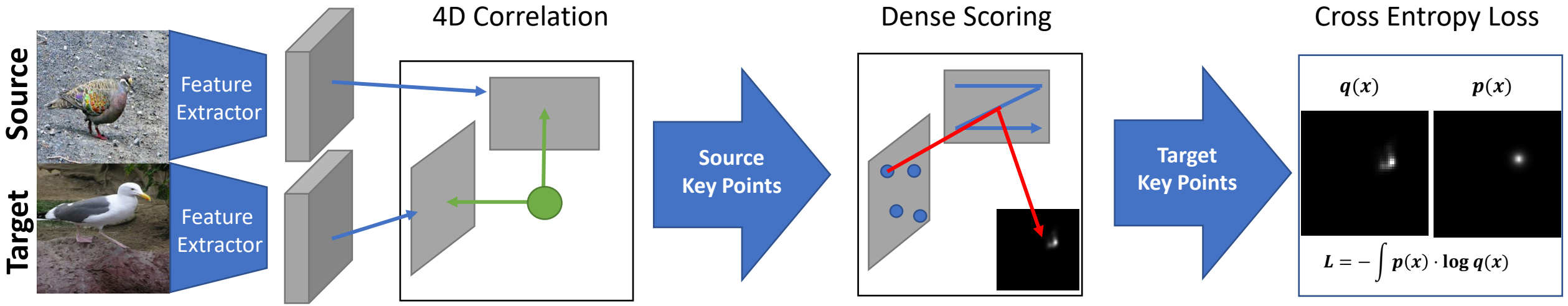
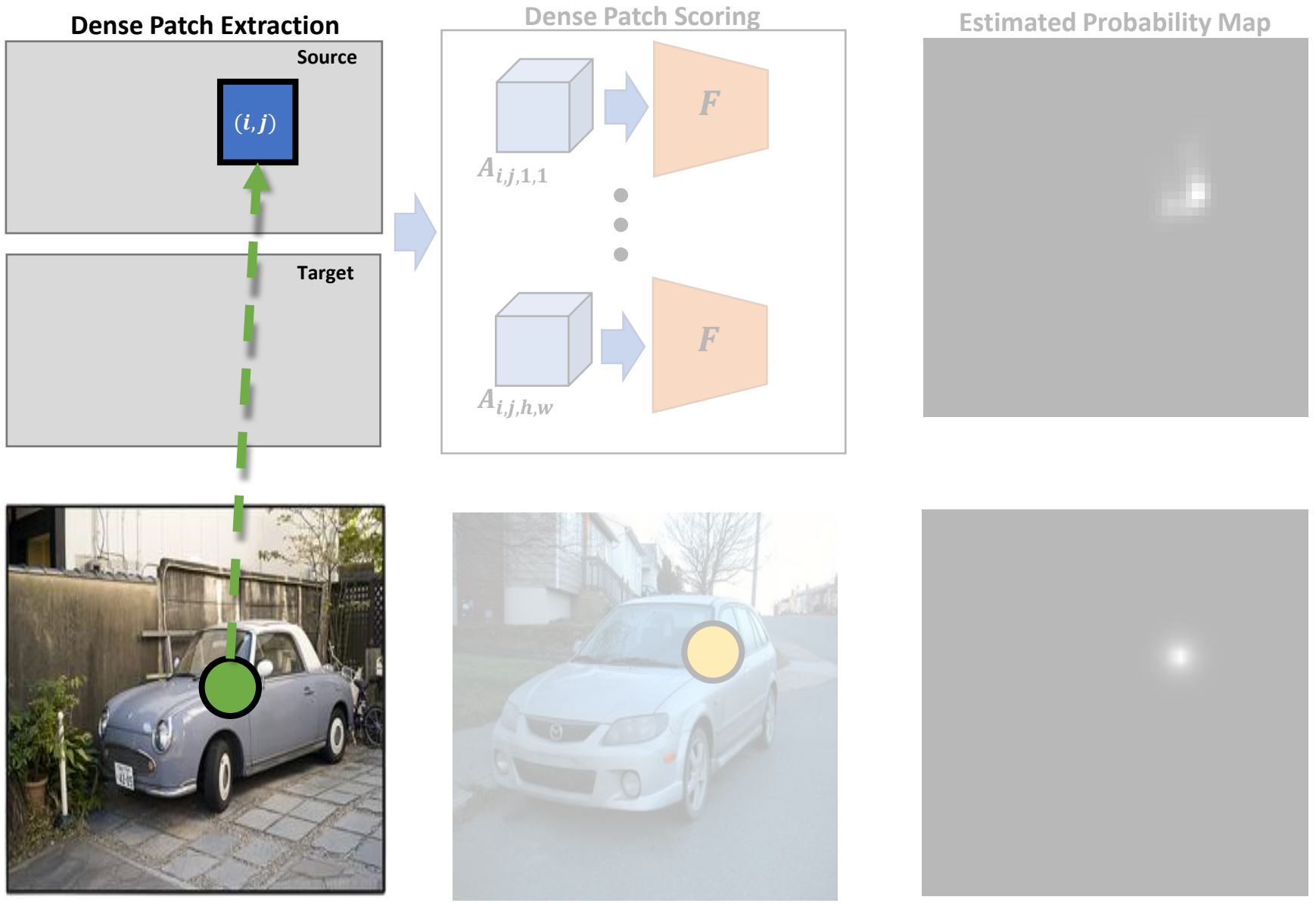


Proxy model for training scoring function



Dense Scoring and Cross Entropy Loss



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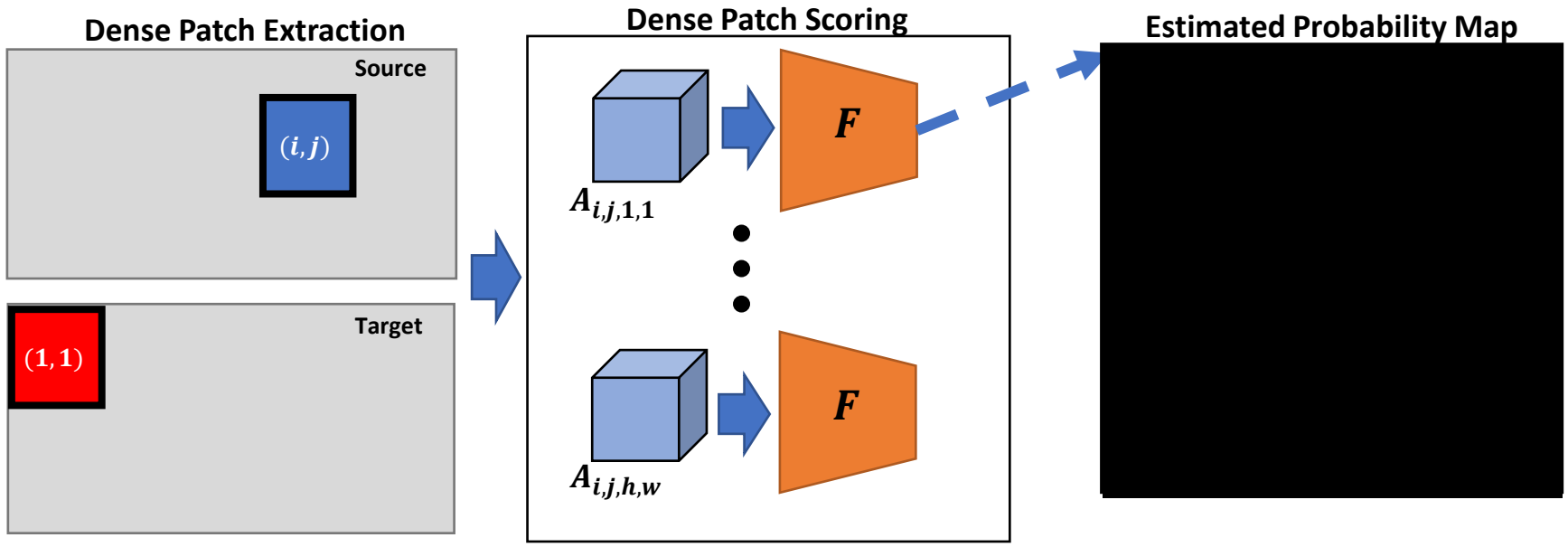
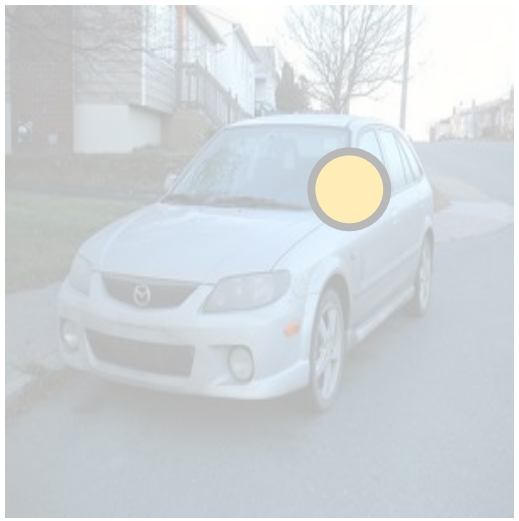


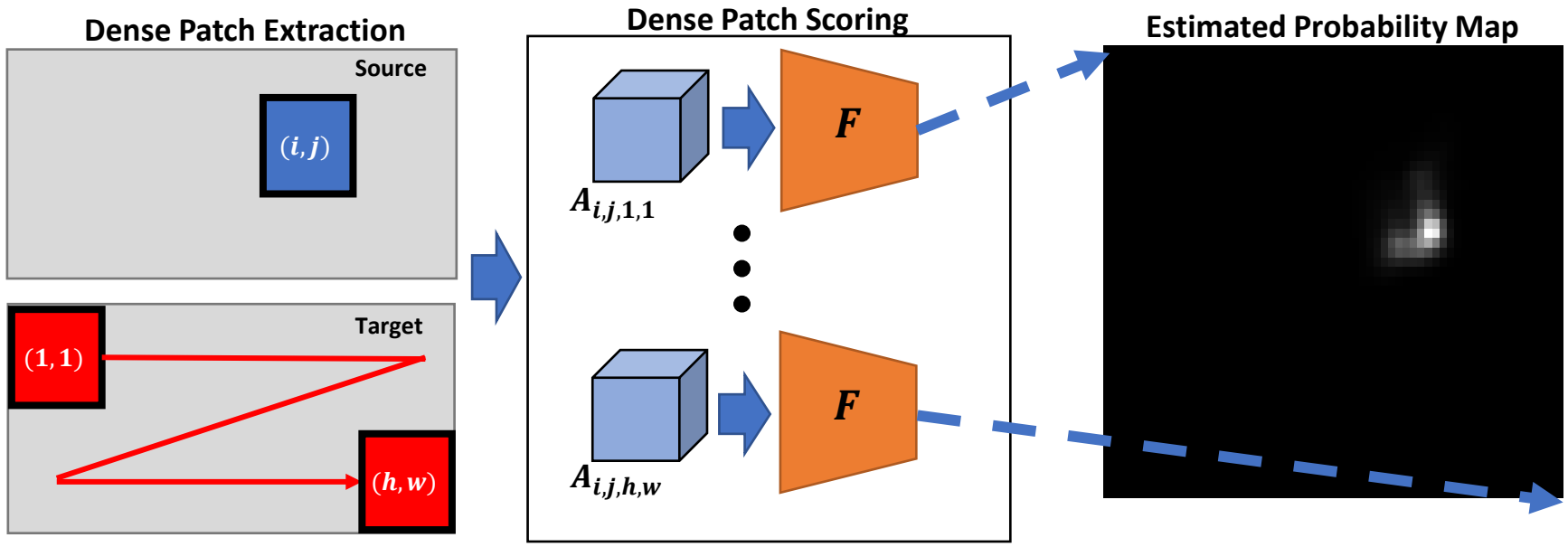
Source



Target

Ground Truth Probability Map

Dense Scoring and Cross Entropy Loss



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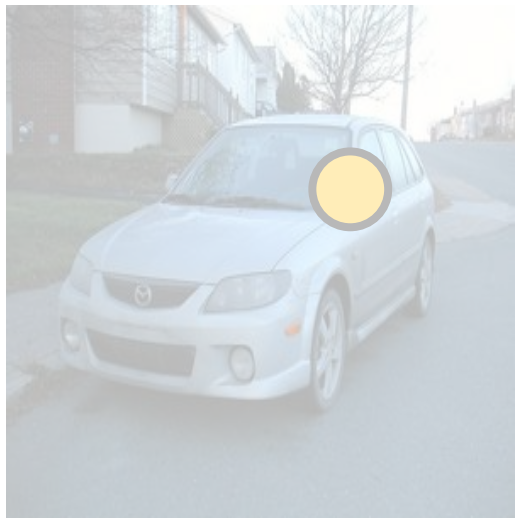

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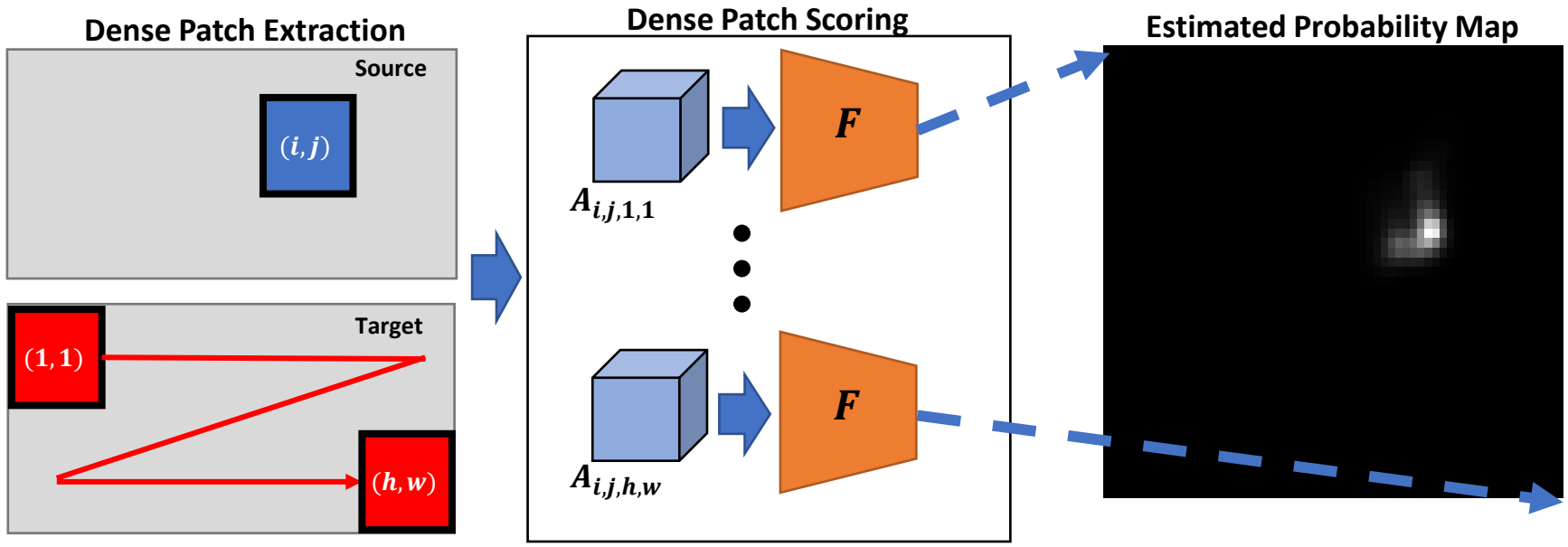
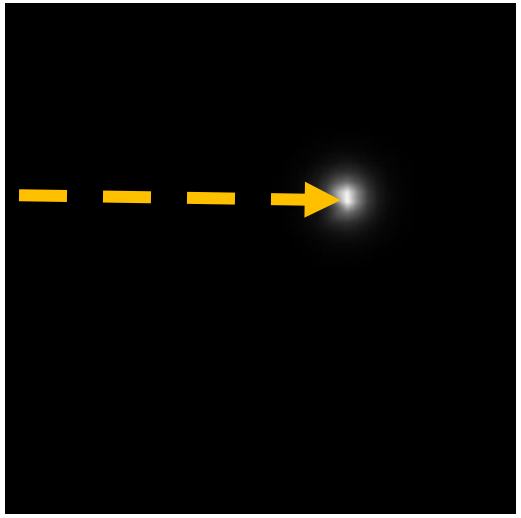


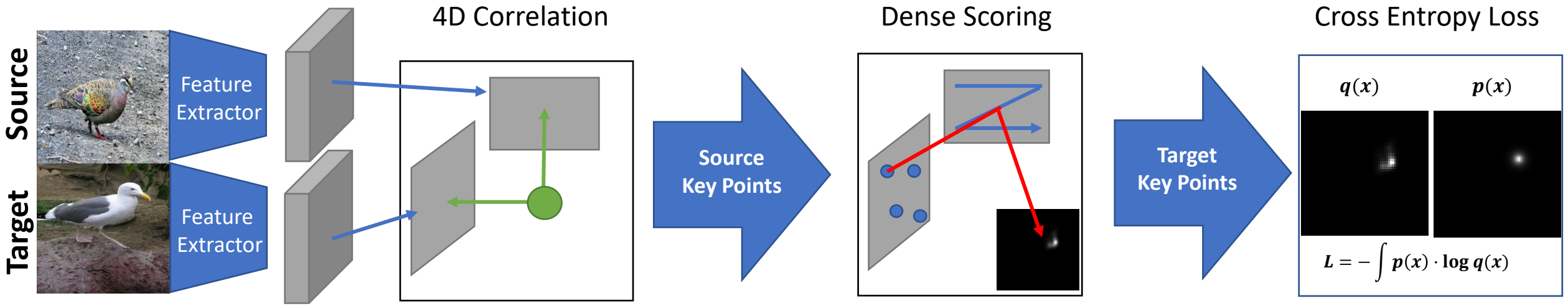
Source

Target

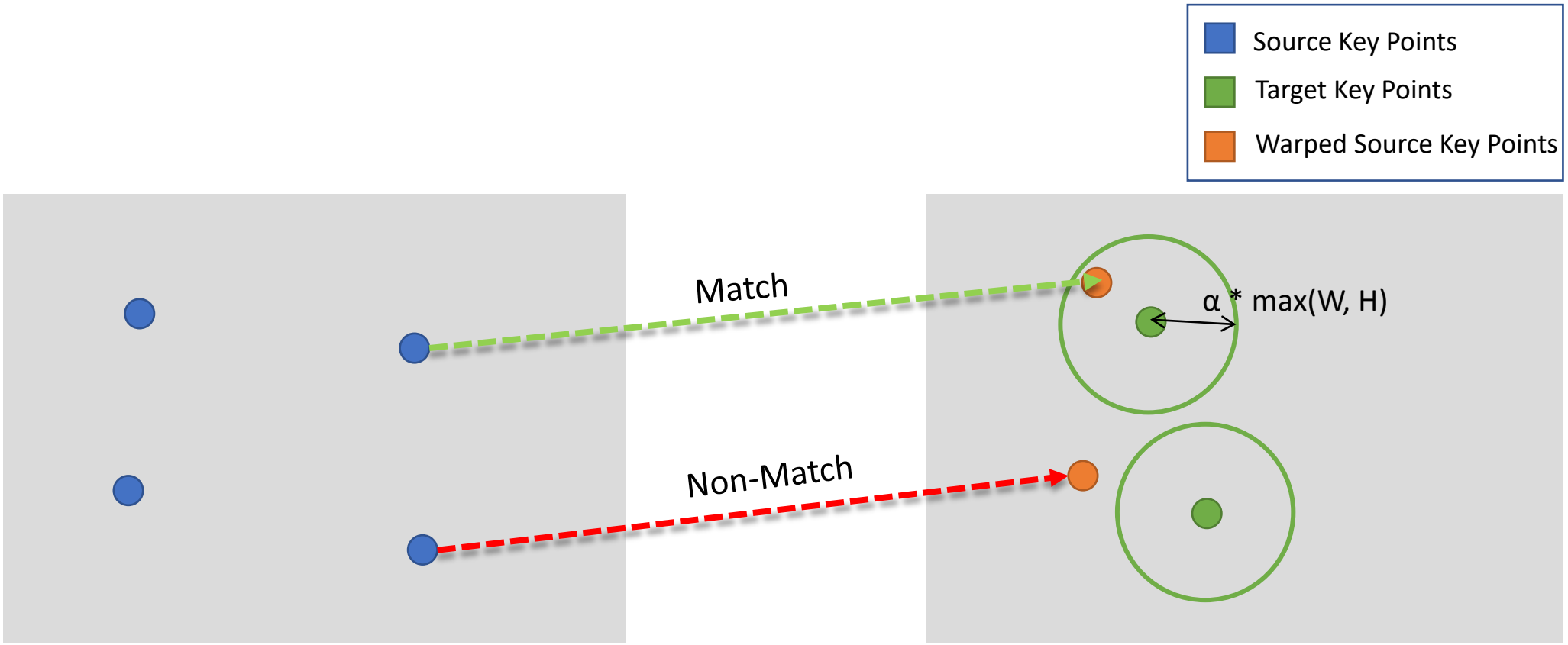


Ground Truth Probability Map

Proxy model for training scoring function



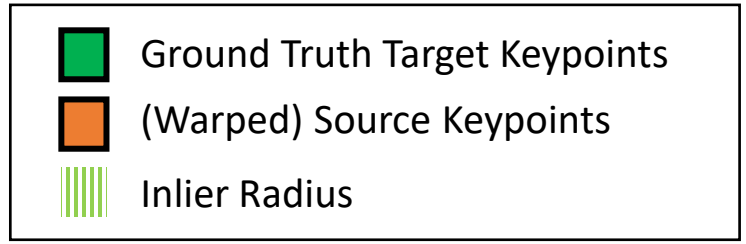
Evaluation Metric: Percent Correct Keypoints (PCK)



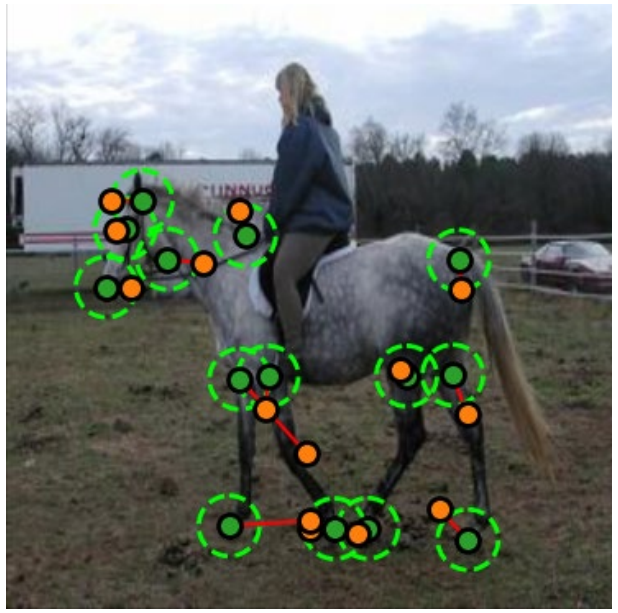
$$\text{PCK} = \frac{N_{match}}{N_{total}}$$

More Accurate Correspondence Estimation

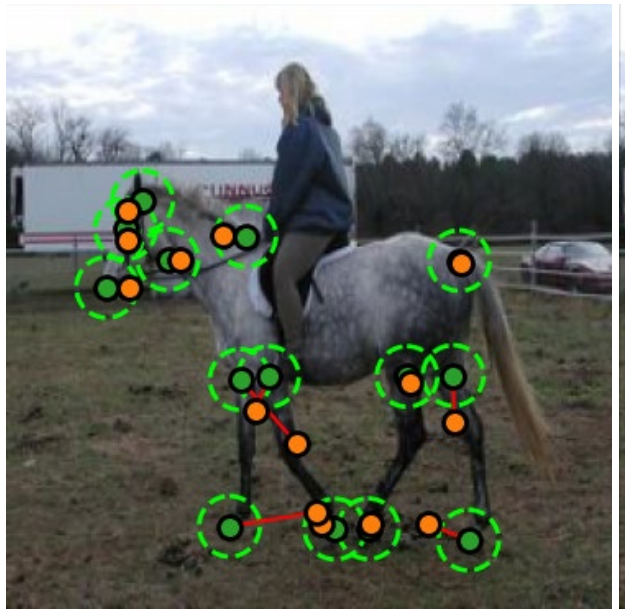
Evaluation on PF-Pascal Dataset



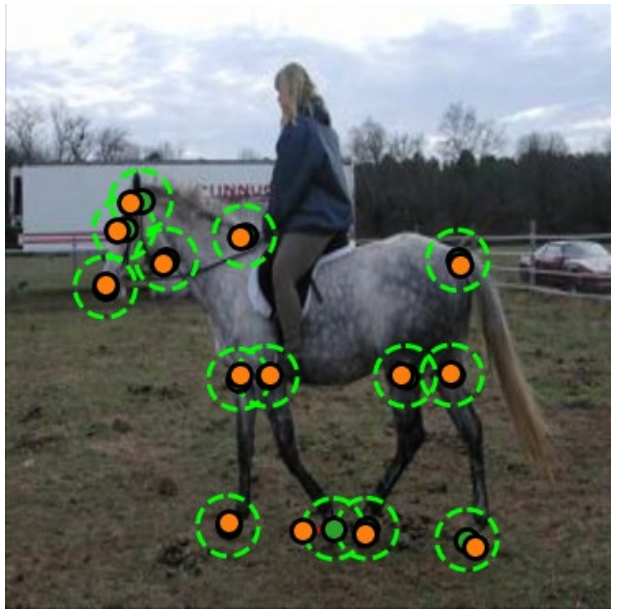
Source Image



NC-Net



ANC-Net



PMNC (Ours)

Our method is more precise, faster, and uses less memory

Evaluation on PF-Pascal Dataset

* All methods using same spatial resolution (25 x 25)

Architecture	$\alpha = 0.1$	$\alpha = 0.05$	$\alpha = 0.03$	$\alpha = 0.01$	Time per Pair	Memory
NCNet ResNet 101 Layer 4 (25x25)	79.0%	54.3%	30.9%	4.9%	0.29s	406MB
ANCNet ResNet 101 Layer 4 (25x25)	85.9%	58.1%	31.9%	5.1%	0.33s	1310MB
Ours ResNet101 Layer 4 (25x25)	**86.8%**	**74.5%**	**58.0%**	**14.7%**	**0.09s**	**273MB**

Precision improves with larger window size

Evaluation on PF-Pascal Dataset

* Resnet101 Layer 3 uses spatial resolution of 50x50

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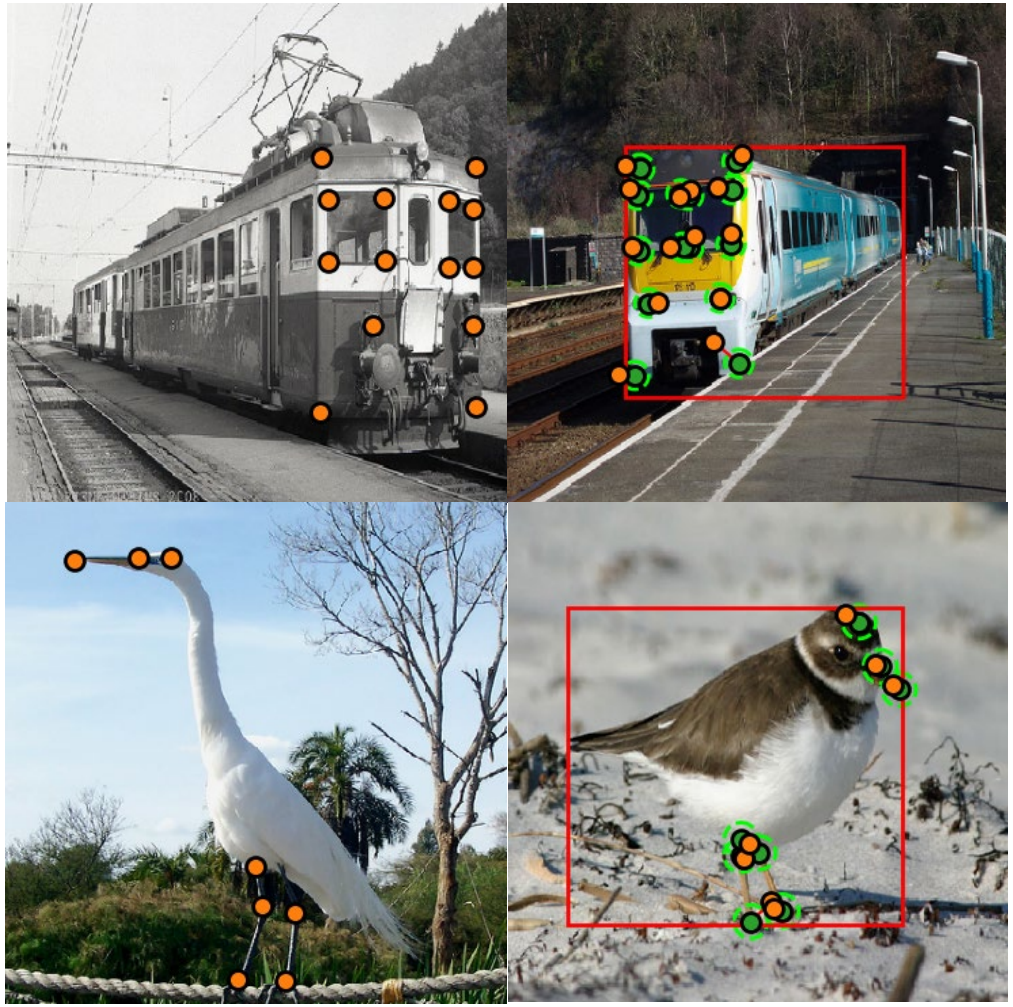
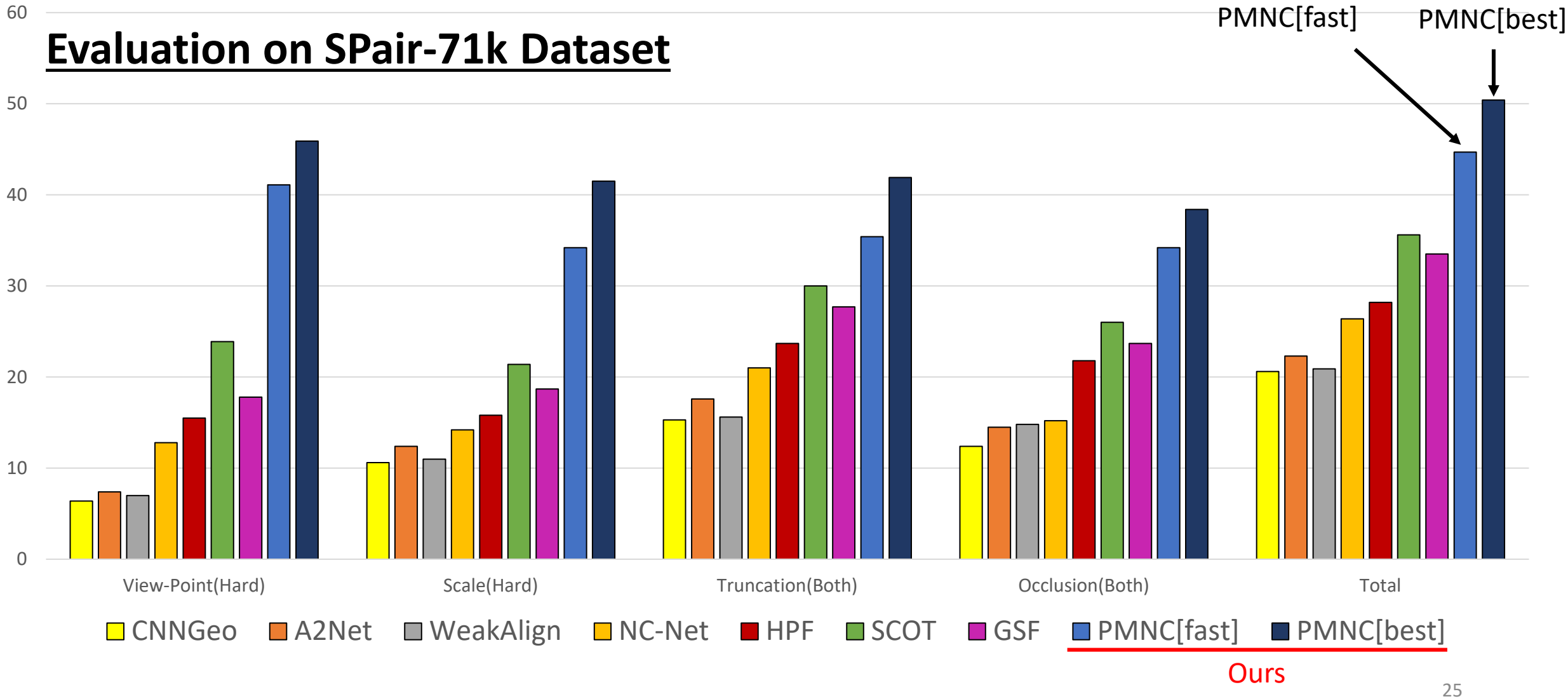
Ours ResNet101 Layer 4 (25x25)	86.8%	74.5%	58.0%	14.7%	**0.09s**	**273MB**
Ours ResNet101 Layer 3 (50x50)	**90.6%**	**82.4%**	**71.6%**	**29.1%**	0.96s	2610MB

Our method works on challenging cases

Evaluation on SPair-71k Dataset



Our method is robust under different nuisances



Thank you

Jae Yong Lee

Joseph DeGol

Victor Fragoso

Sudipta Sinha

Our code is available at https://github.com/leejaeyong7/patch-match-consensus