Discrete Cycle-Consistency Based Unsupervised Deep Graph Matching

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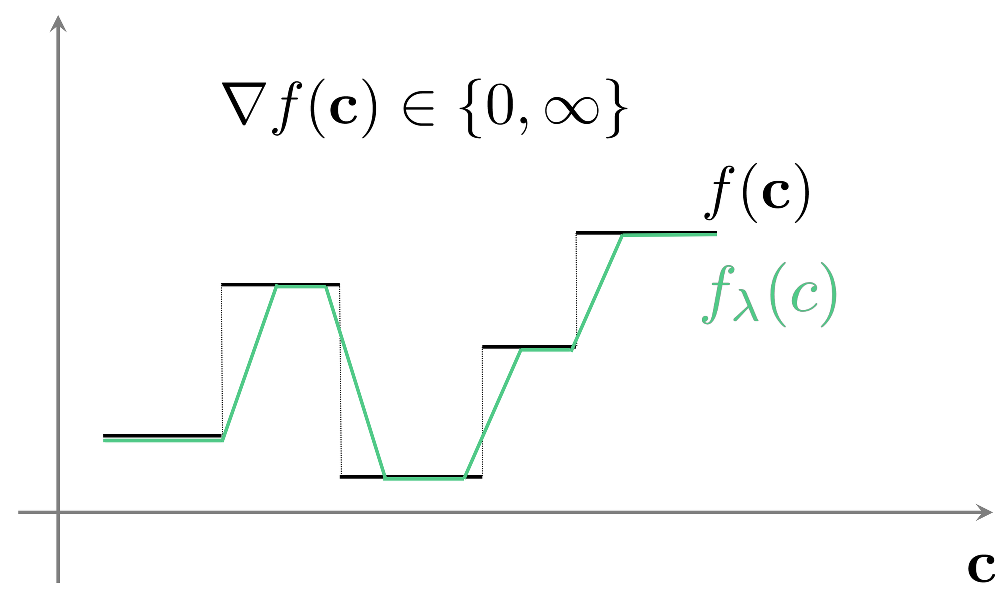
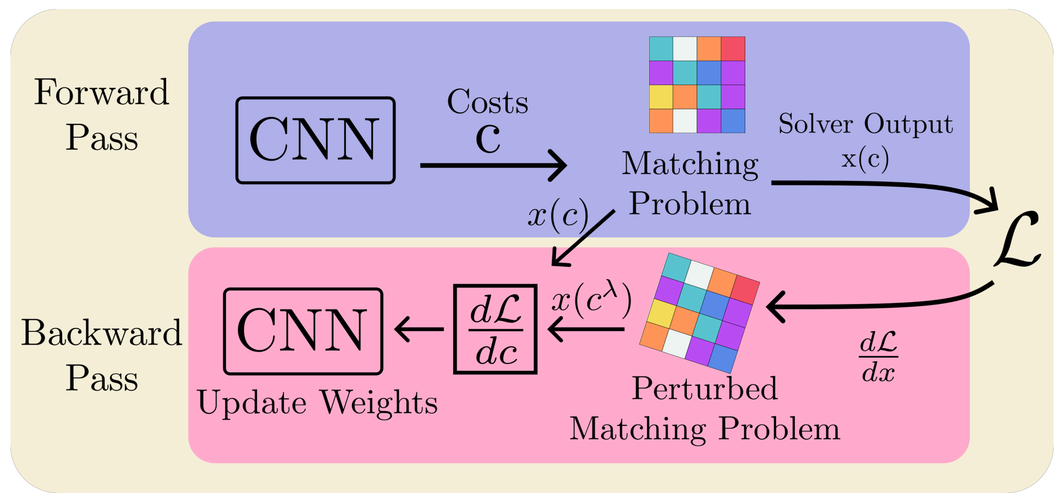
Combinatorial solver:

$$\mathbf{x}(\mathbf{c}) = \arg\min_{\mathbf{x}\in\mathcal{X}} \langle \mathbf{c}, \mathbf{x} \rangle \ .$$



Differentiation of blackbox combinatorial solvers [1]:

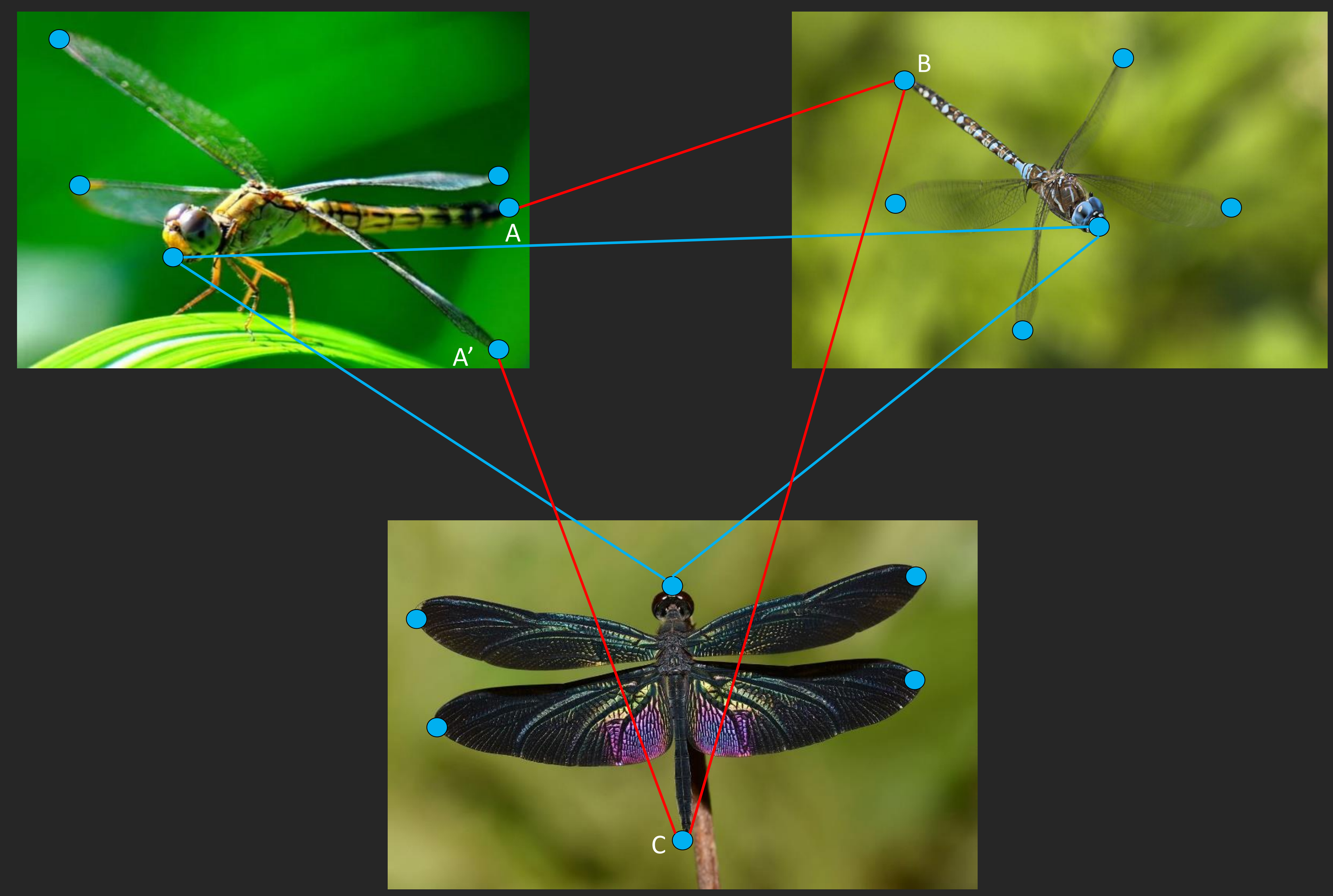


Perturbed costs: $c^\lambda = c + \lambda \dfrac{d\mathcal{L}}{dx}(x(c))$

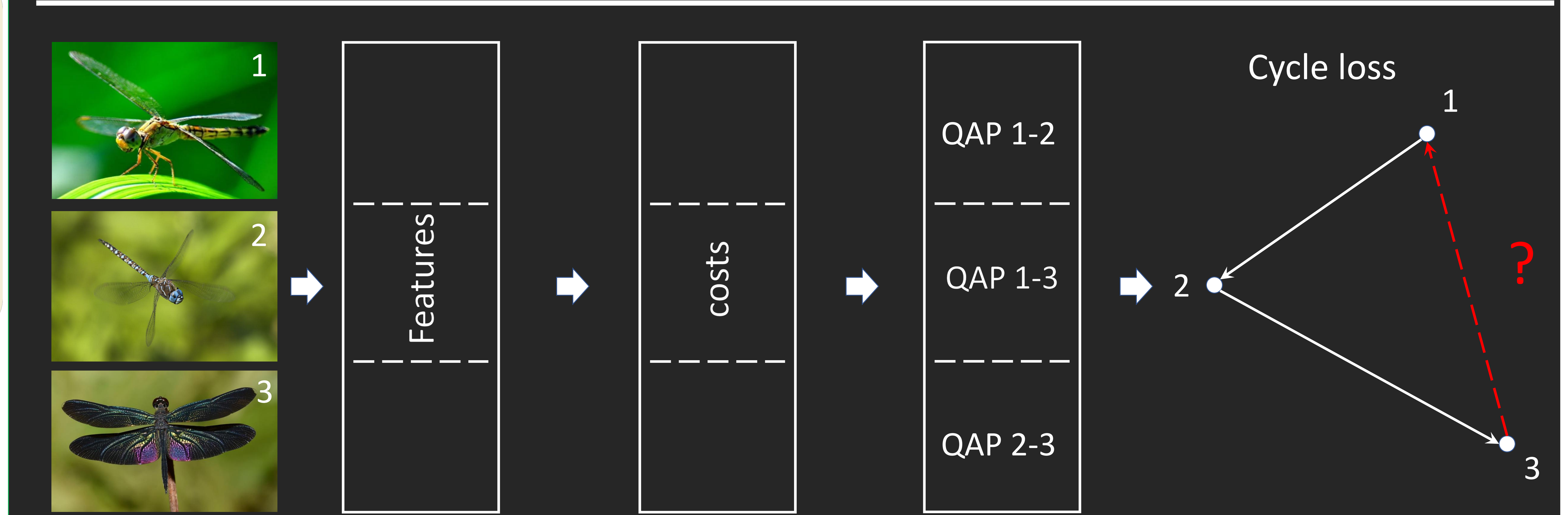
Approx. loss gradient:

$$\frac{d\mathcal{L}(x(c))}{dc} := \frac{x(c^\lambda) - x(c)}{\lambda}$$

Can we train COMBINATORIAL ALGORITHMS

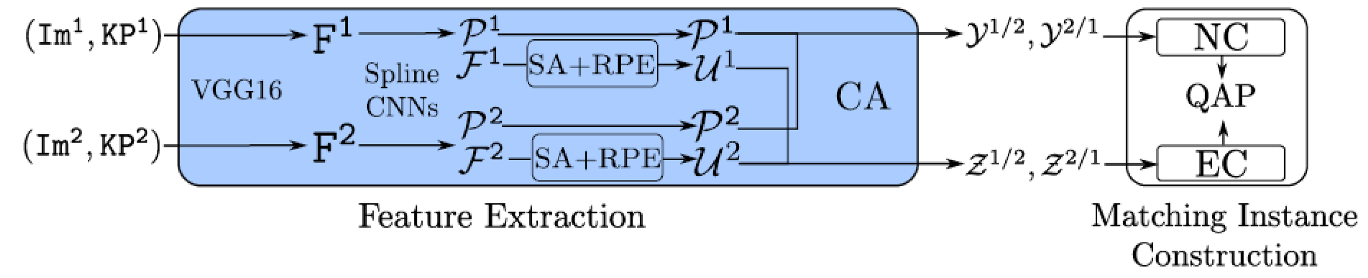


in an UNSUPERVISED way?



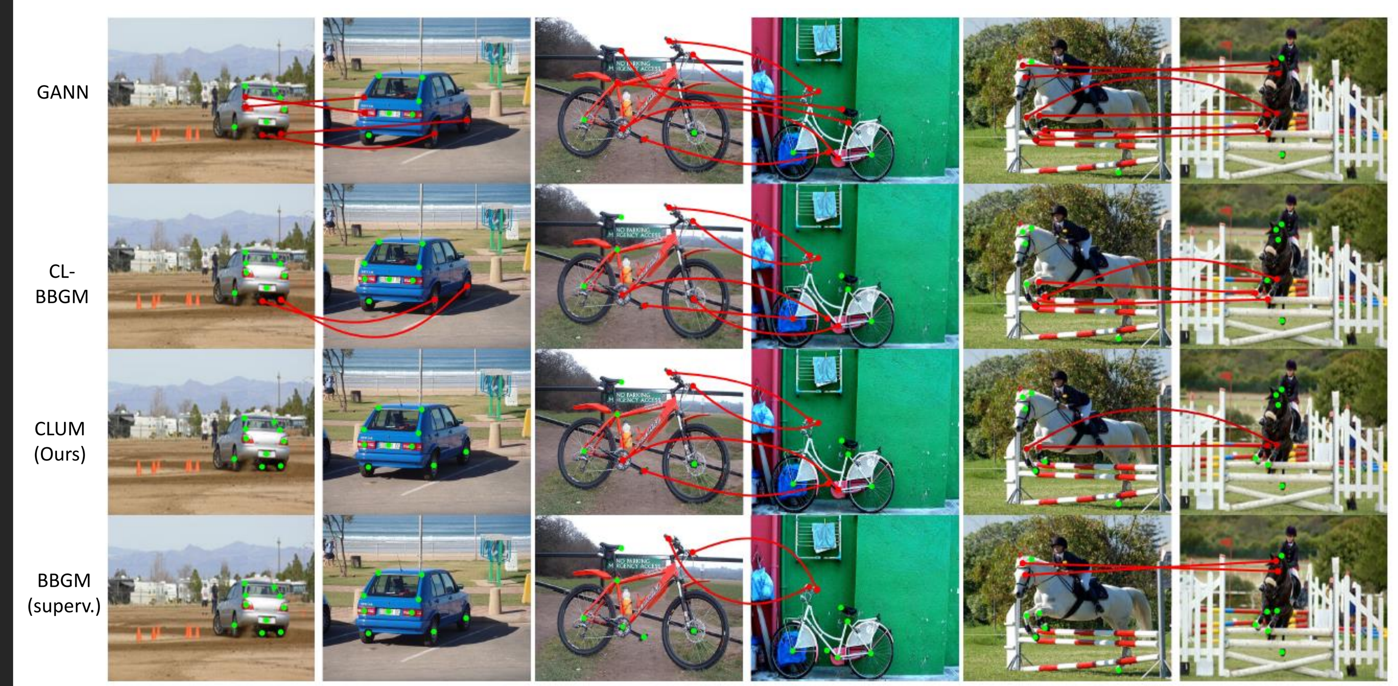
supervised	**unsupervised**	
BBGM [2]	SCGM w/BBGM	Ours/CL-BBGM
55.4	33.9	**43.5/41.7**

Our Proposed Architecture



Im^1, Im^2-images, KP^1, KP^2-keypoints,
SA+RPE - self-attention+relative position, CA - cross-attention,
NC - node costs, EC - edge costs,
QAP - quadratic assignment solver

Results



Dataset	Supervised BBGM	Supervised NGMv2	Unsupervised GANN	SCGM w/NGMv2	SCGM w/BBGM	CL-BBGM	CL-BBGM (SCGM)	**CLUM-L**	**CLUM (Ours)**
PasVOC(Filt)	*79*	*80.1*	*31.5*	*54.3*	*57.1*	58.4	58.8	59.7	**62.4**
PasVOC(Unf)	*55.4*	*54.0*	*24.3*	32.1*	33.9*	38	41.7	40.3	**43.5**
Willow	*97.2*	*97.5*	*92.0*	*91.0*	*91.3*	91.6	93.2	93.4	**95.6**
SPair-71K	*82.1*	*80.2*	31.7	36.9	38.7	40.6	41.2	41.6	**43.1**

F1 score for Pascal VOC (Unfiltered) and average accuracy for other datasets.

References

[1] Differentiation of Blackbox Combinatorial Solvers, Vlastelica et al., ICLR 2019
[2] Deep Graph Matching Based of Blackbox Differentiation, Rolinek et al., ECCV 2020
[3] Graduated assignment for joint multi-graph matching and clustering with application to unsupervised graph matching, Wang et al., Neurips 2020
[4]. Self-supervised learning of visual graph matching", Liu, Chang, et al , *ECCV 2022*

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