Exploiting Distilled Learning for Deep Siamese Tracking

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Motivation

- **Existing deep Siamese trackers :**
  - huge power consumption
  - high memory usage
- **Our aim: Learning tracking model with**
  - efficiency
  - high accuracy

Formulation

- **Point-wise Distillation**

$$\mathcal{L}_{point} = \|\mathbf{F}_T - E(\mathbf{F}_S)\|_2$$

where $\mathbf{F}_T$ and $\mathbf{F}_S$ are teacher and student features

- **Pair-wise Distillation**

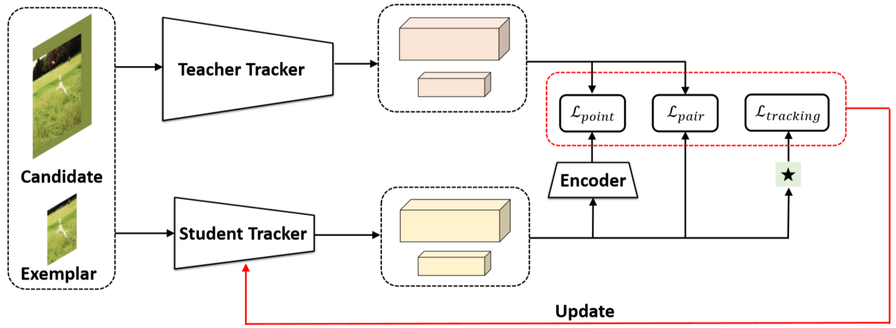
$$S^{ij}_{\mathbf{F}} = \frac{1}{h \times w} \cdot \frac{\mathbf{F}_i}{\|\mathbf{F}_i\|_2} \cdot \frac{\mathbf{F}_j}{\|\mathbf{F}_j\|_2} \qquad \mathcal{L}_{pair} = \sum_i \sum_j \left\| S^{ij}_{\mathbf{F}_S} - S^{ij}_{\mathbf{F}_T} \right\|^2$$

where $S \in \mathbb{R}^{hw \times hw}$ is the pair-wise similarity matrix

- **Optimization**

$$\mathcal{L} = \mathcal{L}_{tracking} + \lambda_0 \mathcal{L}_{point} + \lambda_1 \mathcal{L}_{pair}$$

Method



An overview of our proposed Distilled Learning Framework (DLF).
During training, student tracker is optimized under the guidance of teacher tracker.

Ablation Study

Teacher: SiamDW *Student*: SiamDW-L & SiamDW-S

Network Parameters

Model	SiamDW	SiamDW-L	SiamDW-S
Parameters	1.445M	0.354M	0.136M
Compress Rate	-	4.08	10.62

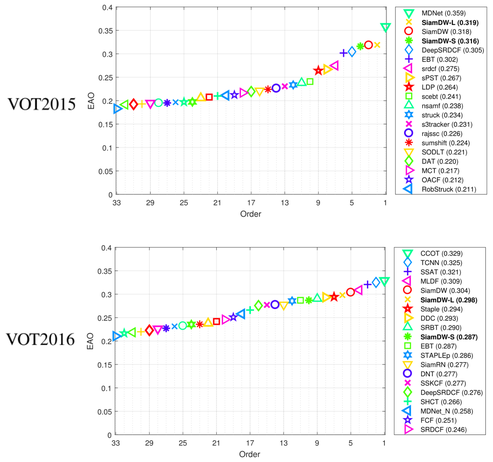
Speed comparison

Model	SiamDW	SiamDW-L	SiamDW-S
FPS	53	73	80

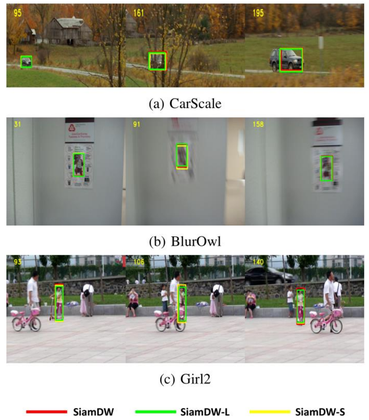
Ablation Study of distillation

Model	PoD	PaD	Logistic	AUC
SiamDW-L			✓	0.560
	✓		✓	0.612
		✓	✓	0.622
	✓	✓	✓	0.636
SiamDW-S			✓	0.538
	✓		✓	0.587
		✓	✓	0.599
	✓	✓	✓	0.618

Experiments & Results



Visualization on OTB2015 benchmark



(a) CarScale
(b) BlurOwl
(c) Girl2