Beyond Appearance:
a Semantic Controllable Self-supervised Learning Framework for Human-Centric Visual Tasks

Weihua Chen, Xianzhe Xu, Jian Jia, Hao Luo, Yaohua Wang, Fan Wang, Rong Jin, Xiuyu Sun

Paper ID: 8746

Session Tag: WED-PM-257

JUNE 18-22, 2023
CVPR
VANCOUVER, CANADA

Alibaba Group 阿里巴巴集团

SOLIDER

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1. MOTIVATION

Background

1. Human-centric tasks are **curial in application**;
2. **Massive unlabeled** human images available;
3. **Semantic information** is important.
4. Different downstream tasks require **different needs** of semantic.

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1. Learn **a general human representation** from **massive unlabeled** data.
2. The pre-trained model can benefit to downstream tasks and meet their **different semantic requirements**. (**One pretrained model adapt to All**.)

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Main Contributions

1. Build a **semantic supervision from human prior** to train SOLIDER.
2. Design a **semantic controller** to adjust the semantic rate in the pre-trained model.

2. METHOD

Contribution 1. Semantic Supervision from Human Prior

The framework of SOLIDER

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Contribution 1. Semantic Supervision from Human Prior

The framework of SOLIDER

Contribution 2. Semantic Controller

3. EXPERIMENTS

3.1. Can SOLIDER learn semantic ?

DINO space:
Different parts from same person are closer.

SOLIDER space:
Same semantic parts from different people are closer.

3. EXPERIMENTS

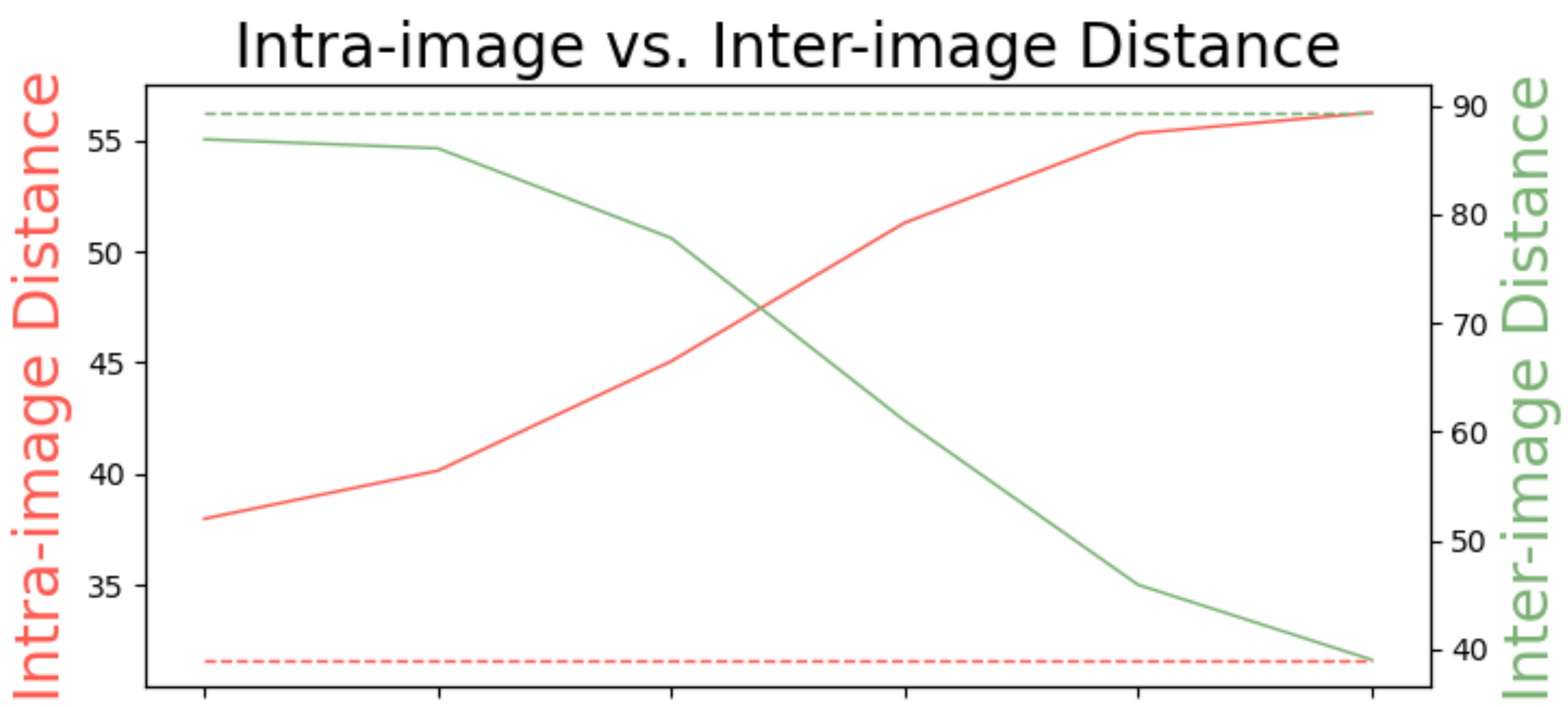
3.2. Can λ control semantic rate ?

[Exp 1] *With λ increased:*

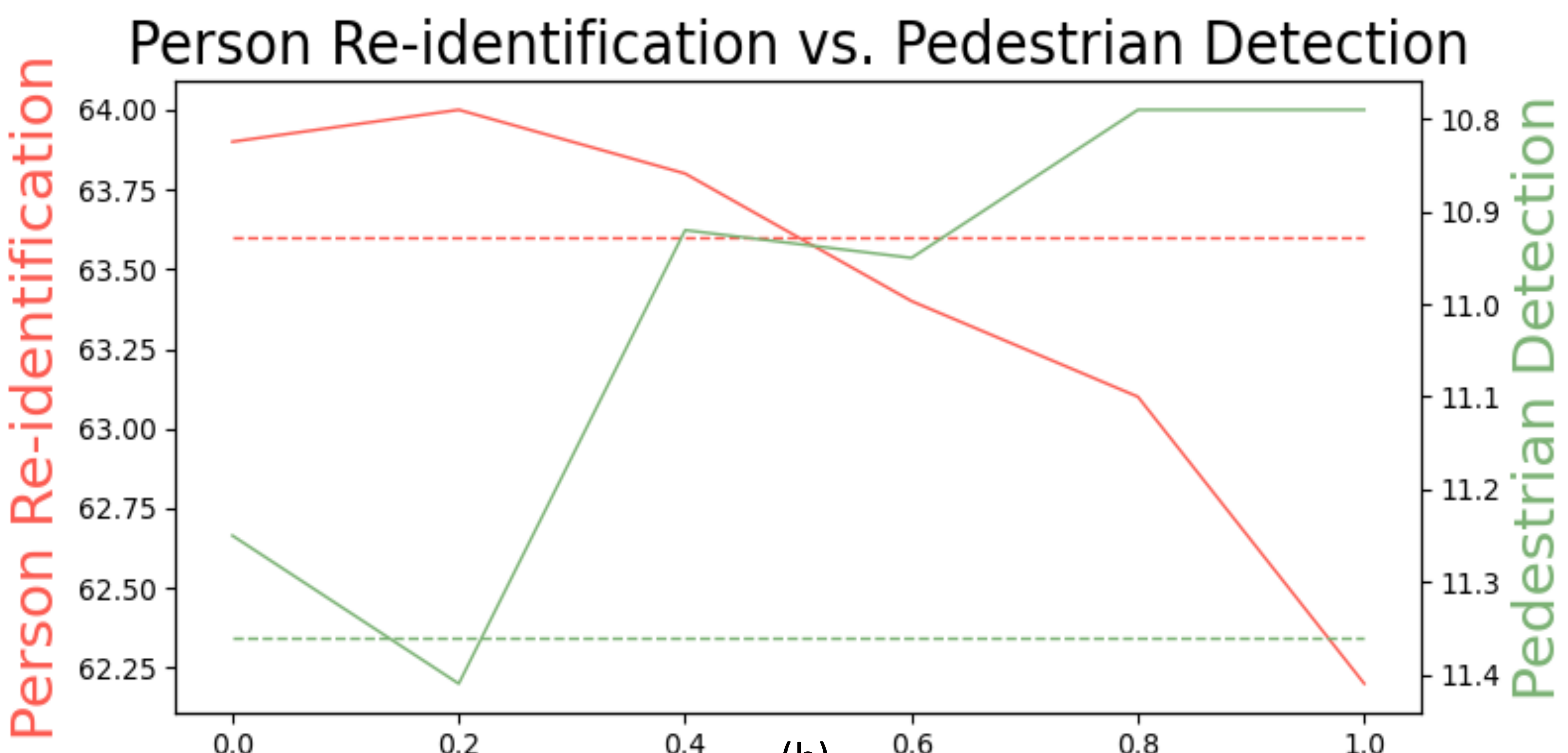
Observation 1. Different parts from same person (intra-distance) gets further.
Observation 2. Same semantic parts from different people (inter-distance) gets closer.

[Exp 2] *With λ increased:*

Observation 1. The person re-identification performance is lower.
Observation 2. The pedestrian detection performance is higher.



(a)



(b)

3. EXPERIMENTS

3.3. How is Ablation Study and SOTA Comparison?

Ablation Study

Pretrain Methods		Sup	DINO [6]	+ Clustering	+ Clustering&Controller
Pretrain Data		ImageNet	LUP1M	LUP1M	LUP1M
Person Re-identification mAP/Rank1 ↑ TransReID [36]	Market1501	78.1/90.2	89.6/95.9	89.5/95.5	**89.9/96.1**
	MSMT17	49.7/73.6	63.3/83.2	61.6/82.2	**63.9/83.8**
Attribute Recognition mA ↑ RethinkPAR [38]	$PETA_{zs}$	72.86	73.64	73.90	**74.20**
	RAP_{zs}	72.10	73.04	73.16	**73.21**
	PA100k	80.67	82.98	82.98	**84.15**
Person Search mAP/Rank1 ↑ SeqNet [45]	CUHK-SYSU	93.0/94.1	93.6/94.3	93.6/94.1	**94.0/94.7**
	PRW	50.0/84.4	52.9/84.7	53.0/84.0	**54.1/85.0**
Pedestrian Detection MR^{-2}(R/HO) ↓ CSP [73]	CityPerson	11.6/43.8	11.4/43.1	11.1/41.7	**10.8/40.7**
Human Parsing mIOU ↑ SCHP [43]	LIP	51.10	54.45	55.25	**55.45**
Pose Estimation AP/AR ↑ HRFormer [83]	COCO	72.4/78.2	73.1/78.5	73.4/78.7	**74.4/79.7**

SOTA Comparison

							SOLIDER		
Person Re-identification mAP/Rank1 ↑		SCSN [16]	ABDNet [9]	TransReID [36]	UP-ReID [81]	PASS [97]	Swin-T	Swin-S	Swin-B
	Market1501	88.5/95.7	88.3/95.6	89.5/95.2	91.1/97.1	93.3/**96.9**	91.6/96.1	93.3/96.6	**93.9/96.9**
	MSMT17	58.5/83.8	60.8/82.3	69.4/86.2	63.3/84.3	74.3/89.7	67.4/85.9	76.9/90.8	**77.1/90.7**
Attribute Recognition mA ↑		MsVAA [61]	VAC [30]	ALM [66]	JLAC [65]	RethinkPAR [38]	SOLIDER Swin-T	SOLIDER Swin-S	SOLIDER Swin-B
	$PETA_{zs}$	71.53	71.91	73.01	73.60	71.62	74.37	76.21	**76.43**
	RAP_{zs}	72.04	73.70	74.28	76.38	72.32	74.23	76.84	**77.06**
	PA100k	80.41	79.16	80.68	82.31	81.61	84.14	86.25	**86.37**
Person Search mAP/Rank1 ↑		NAE+ [7]	AlignPS+ [79]	TCTS [68]	SeqNet [45]	GLCNet [93]	SOLIDER Swin-T	SOLIDER Swin-S	SOLIDER Swin-B
	CUHK-SYSU	92.1/92.9	94.0/94.5	93.9/95.1	94.8/95.7	**95.8/96.2**	94.9/95.7	95.5/95.8	94.9/95.5
	PRW	44.0/81.1	46.1/82.1	46.8/87.5	47.6/87.6	47.8/**87.8**	56.8/86.8	**59.8**/86.7	59.7/86.8
Pedestrian Detection MR^{-2}(R/HO) ↓		RepLoss [71]	CSP [73]	NMS-Loss [56]	ACSP [70]	PedesFormer [33]	SOLIDER Swin-T	SOLIDER Swin-S	SOLIDER Swin-B
	CityPerson	13.2/56.9	11.0/49.3	10.8/-	9.3/46.3	**9.2/36.9**	10.3/40.8	10.0/39.2	9.7/39.4
Human Parsing mIOU ↑		JPPNet [46]	BraidNet [50]	CE2P [60]	PCNet [87]	SCHP [43]	SOLIDER Swin-T	SOLIDER Swin-S	SOLIDER Swin-B
	LIP	51.37	54.40	53.10	57.03	59.36	57.52	60.21	**60.50**
Pose Estimation AP/AR ↑		CPN [17]	SimpleBase [75]	TokenPose [44]	HRNet [63]	HRFormer [83]	SOLIDER Swin-T	SOLIDER Swin-S	SOLIDER Swin-B
	COCO	68.6/-	74.3/79.7	75.8/80.9	76.3/81.2	**77.2/82.0**	74.4/79.6	76.3/81.3	76.6/81.5

4. OPEN CODE

Project Website: *https://github.com/tinyvision/SOLIDER*

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SOLIDER

a Semantic cOntrollable seLf-supervIseD lEaRning framework

from Alibaba Group

State of the Art | Pedestrian Attribute Recognition on PA-100K

State of the Art | Person Re-Identification on MSMT17 (using additional training data)

Ranked #3 | Person Re-Identification on Market-1501 (using additional training data)

Ranked #4 | Person Search on CUHK-SYSU

State of the Art | Person Search on PRW

Ranked #6 | Pedestrian Detection on CityPersons (using additional training data)

State of the Art | Semantic Segmentation on LIP val

Ranked #2 | Pose Estimation on COCO

Updates

- **[2023/04/24: Codes of attribute recognition task is released!]** NEW
  - Training details of our pretrained model on downstream person attribute recognition task is released.
- **[2023/03/28: Codes of 3 downstream tasks are released!]**
  - Training details of our pretrained model on 3 downstream human visual tasks, including person re-identification, person search and pedestrian detection, are released.
- **[2023/03/13: SOLIDER is accepted by CVPR2023!]**
  - The paper of SOLIDER is accepted by CVPR2023, and its offical pytorch implementation is released in this repo.