Instant-Teaching: An End-to-End Semi-Supervised Object Detection Framework

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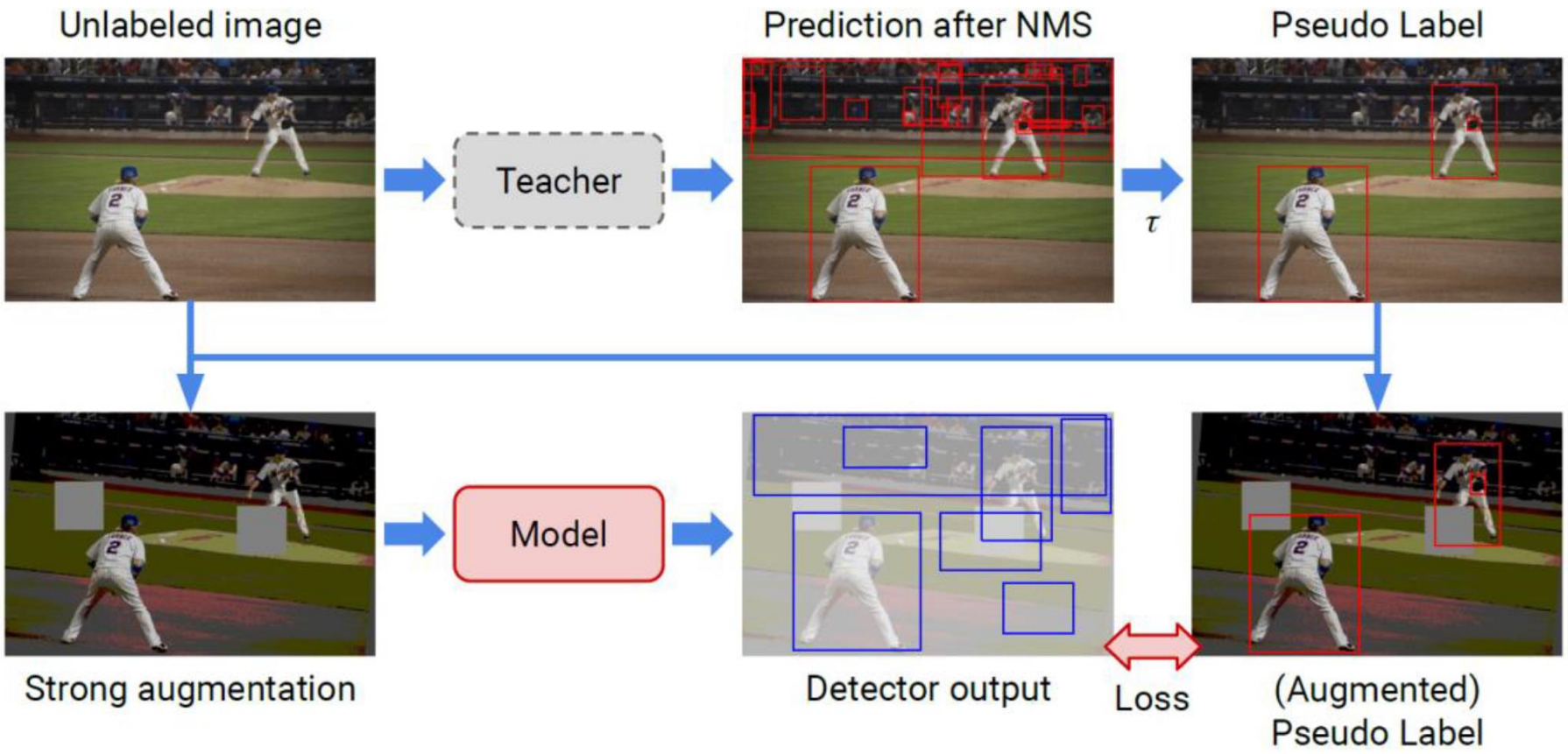
Motivation

- 有标注数据的获取成本比较高
- 无标注数据获取非常容易

- 使用半监督方法，利用无标注数据对网络进行训练

Motivation

- STAC的框架



Motivation

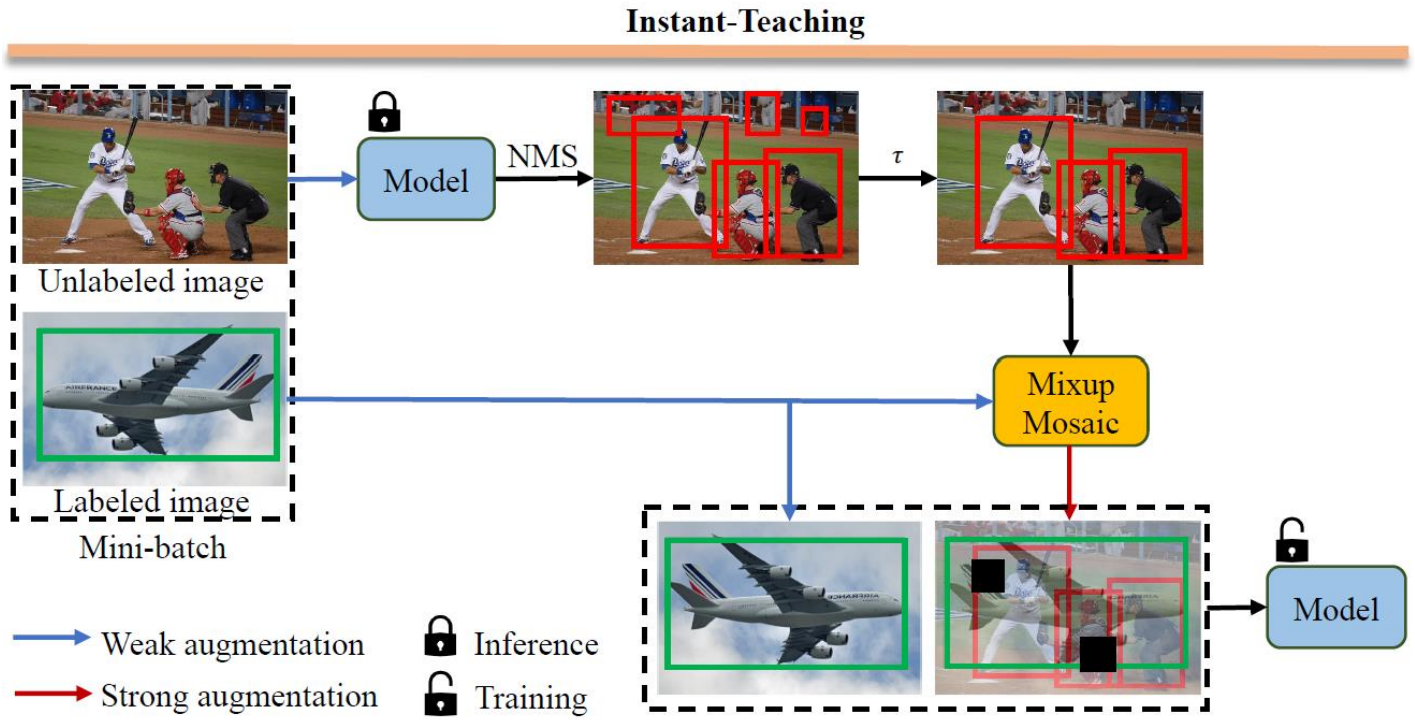
- STAC存在的问题：
  - 训练阶段复杂，在训练模型之前，需要先训练一个teacher model，然后使用这个teacher mode预先产生无标签数据的伪标签
  - 在模型训练阶段，预先产生的伪标签数据不会被更新，维持不变的伪标签会限制模型的性能

Motivation

- 解决confirmation bias的问题
  - 当模型产生高置信度的不正确预测时，这些不正确的预测将通过不正确的伪标签进一步加强
  - 模型本身很难纠正这些错误的预测
- 提升伪标签的质量
- 提出了co-rectify策略

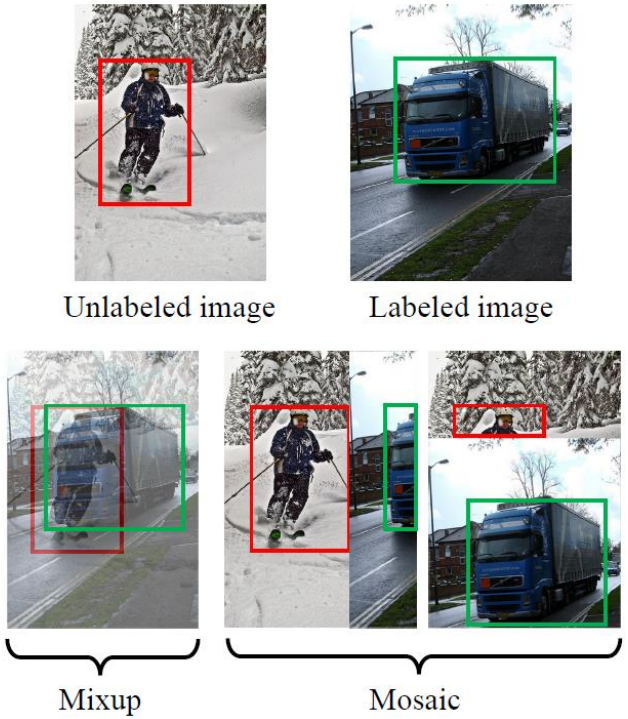
Method

- Instant-Teaching
- 在每一个训练的回合中，利用weak-strong数据增强即时产生伪标签



Method

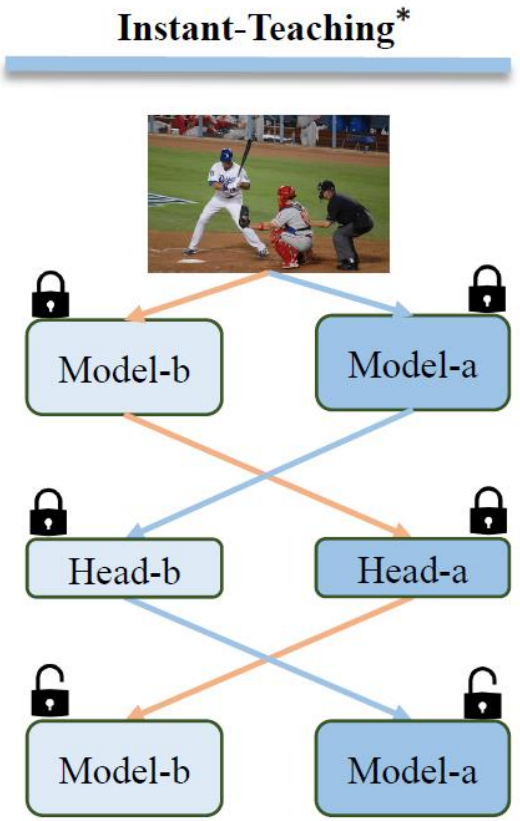
- 在weak augmentation不变的情况下，strong augmentation越复杂，模型从pseudo label中学到的东西越多
- 两种strong augmentation方法



Method

- Instant-Teaching*
  - 解决confirmation bias的问题
- 同时训练两个模型
  - 两个模型结构相同，权重不同
- 损失函数

$$\ell = \ell_s + \lambda_u \ell_u,$$



Experiment

- Datasets: COCO, PASCAL VOC
- Metric: mAP

- 在COCO数据集上不同方法的性能

Methods	Backbone	1% COCO	2% COCO	5% COCO	10% COCO	100% COCO
Supervised	R50-FPN	9.05±0.16	12.70±0.15	18.47±0.22	23.86±0.81	37.63
CSD† [22]	R50-FPN	10.20±0.15 (+1.15)	13.60±0.10 (+0.90)	18.90±0.10 (+0.43)	24.50±0.15 (+0.64)	38.87 (+1.24)
STAC[45]	R50-FPN	13.97±0.35 (+4.92)	18.25±0.25 (+5.55)	24.38±0.12 (+5.91)	28.64±0.21 (+4.78)	39.21 (+1.58)
Instant-Teaching (ours)	R50-FPN	**16.00±0.20** (+6.95)	**20.70±0.30** (+8.00)	**25.50±0.05** (+7.03)	**29.45±0.15** (+5.59)	**39.60** (+1.97)
Instant-Teaching* (ours)	R50-FPN	**18.05±0.15** (+9.00)	**22.45±0.15** (+9.75)	**26.75±0.05** (+8.28)	**30.40±0.05** (+6.54)	**40.20** (+2.57)

Experiment

- 在PASCAL VOC数据集上各个方法的性能
- VOC07为有标签数据，VOC12为无标签数据

Methods	Backbone	Unlabeled	$AP^{0.5:0.95}$	$AP^{0.5}$	$AP^{0.75}$
Supervised (Ours)	R50-FPN		43.60	76.70	44.50
CSD [22]	R101-R-FCN	VOC12	-	74.70	-
STAC [45]	R50-FPN		44.64 (+1.04)	77.45	-
Instant-Teaching	R50-FPN		**48.70** (+5.10)	**78.30**	**52.00** (+7.50)
Instant-Teaching*	R50-FPN		**50.00** (+6.40)	**79.20**	**54.00** (+9.50)
CSD [22]	R101-R-FCN	VOC12 & COCO	-	75.10	-
STAC [45]	R50-FPN		46.01 (+2.41)	79.08	-
Instant-Teaching	R50-FPN		**49.70** (+6.10)	79.00	**54.10** (+9.60)
Instant-Teaching*	R50-FPN		**50.80** (+7.20)	**79.90**	**55.70** (+11.20)

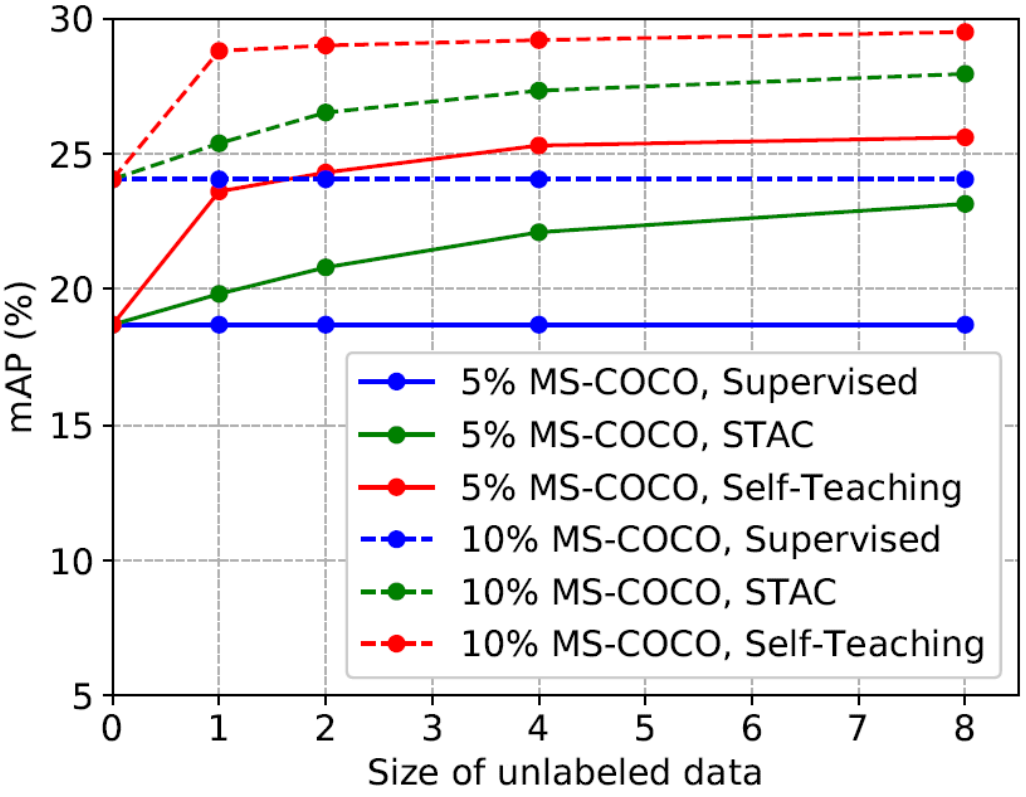
Experiment

- 不同数据增强方法的性能
- 5% MS-COCO作为有标签数据

Methods	Strong data augmentations				mAP
	Color+Cutout	Geometric	Mixup	Mosaic	
STAC[45]	√	√			23.14
Instant-Teaching	√*				21.60 (-1.54)
	√				24.70 (+1.56)
	√		√		25.40 (+2.26)
	√			√	25.00 (+1.86)
	√		√	√	**25.60** (+2.46)

Experiment

- 不同无标签数据比例，各个方法的性能



Experiment

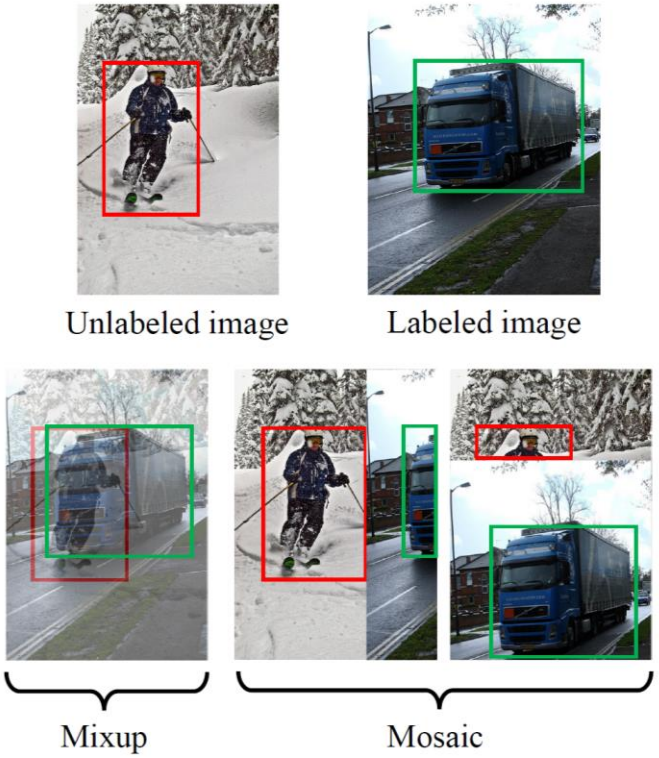
- 可视化

Instant-Teaching

Instant-Teaching*

Comment

- 优点
  - 伪标签是即时产生的，作为一个端到端的模型，训练的阶段也并不复杂
- 缺点
  - 数据增强的方法破坏了原有的信息量



谢 谢!