Distilling Object Detectors with Feature Richness

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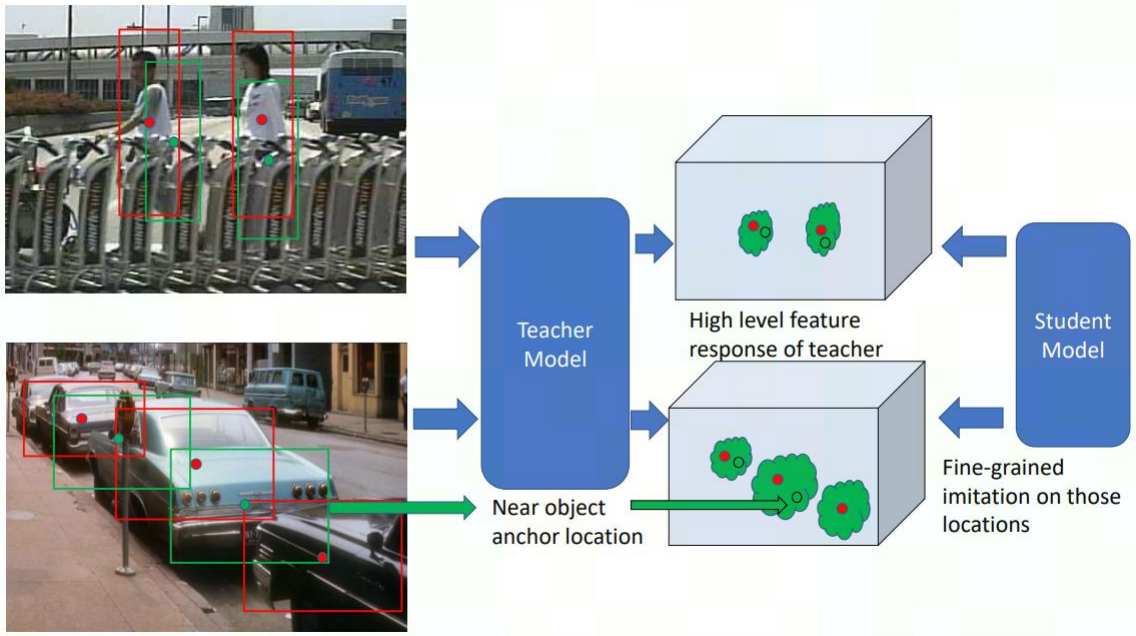
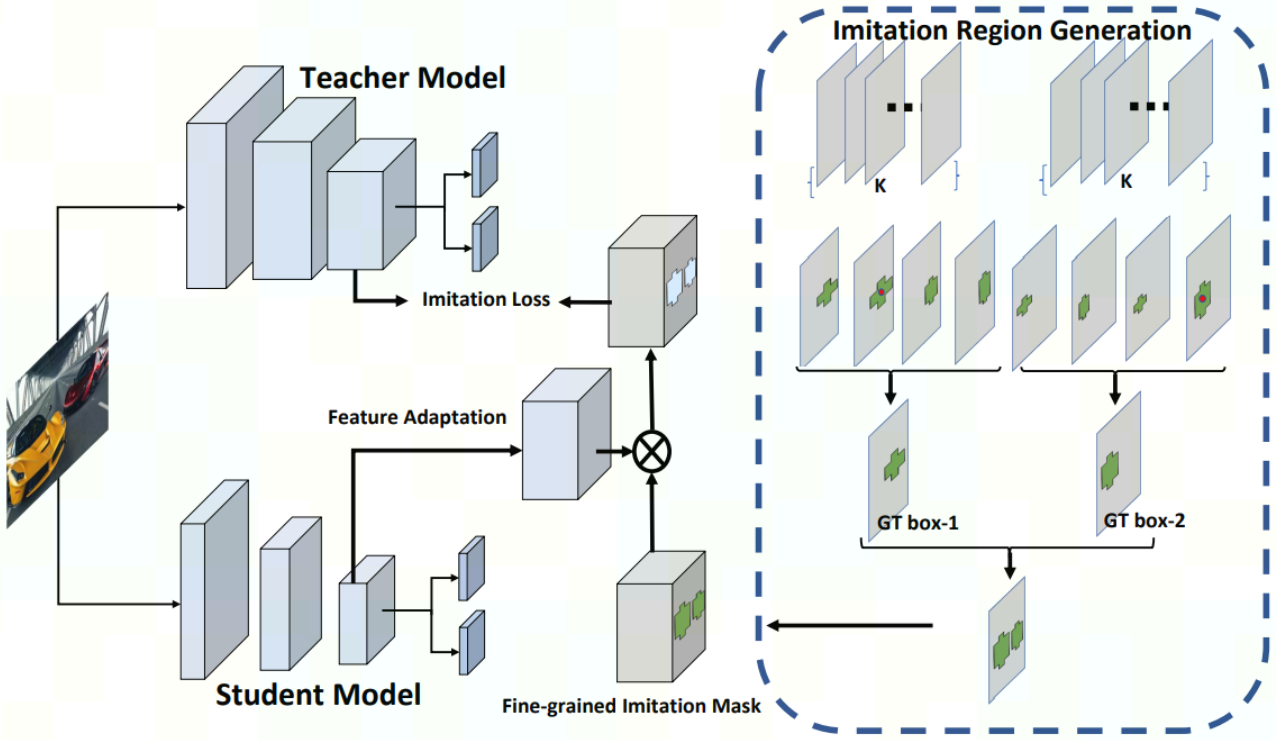
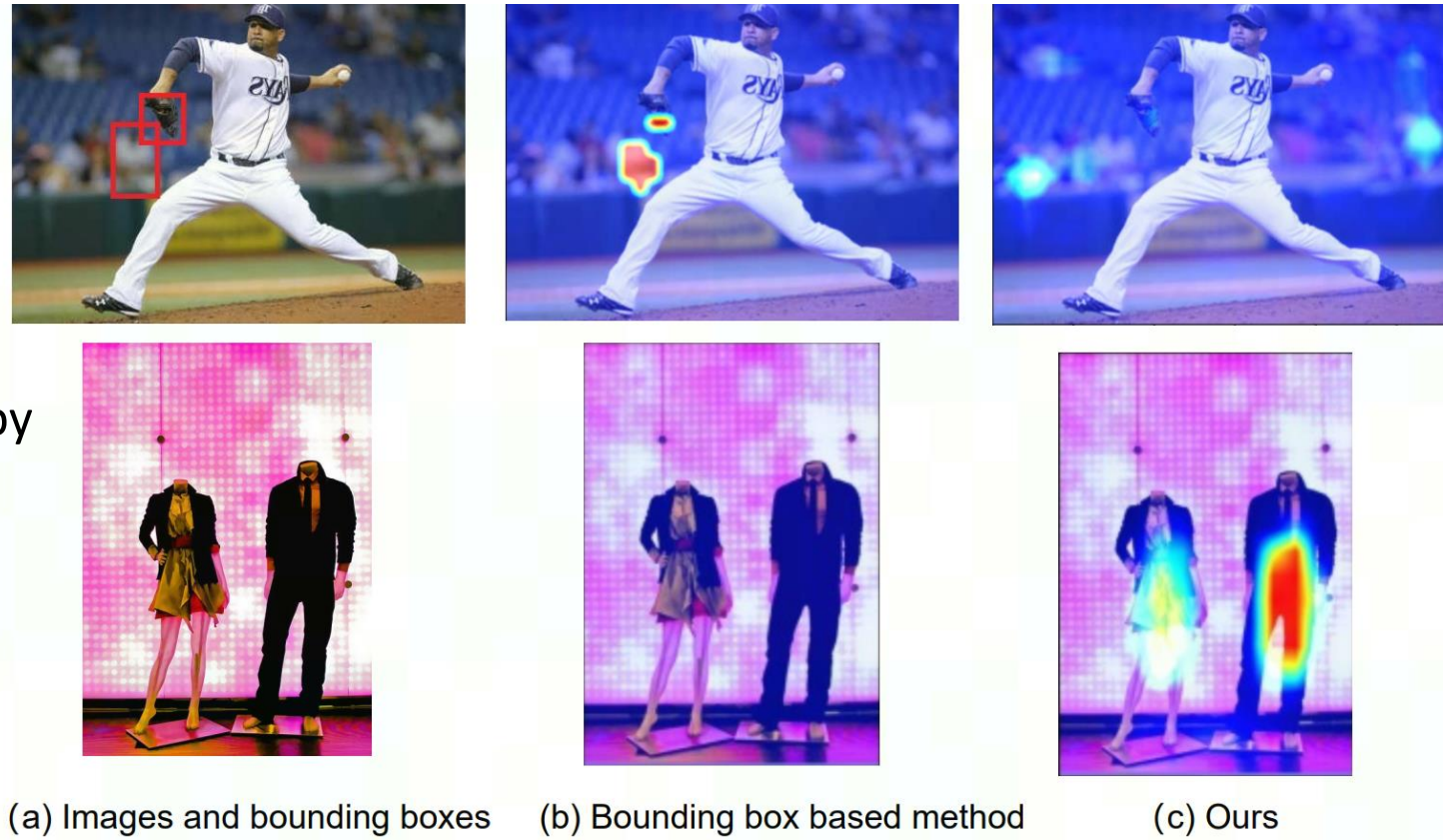
Knowledge Distillation In the field of object detection





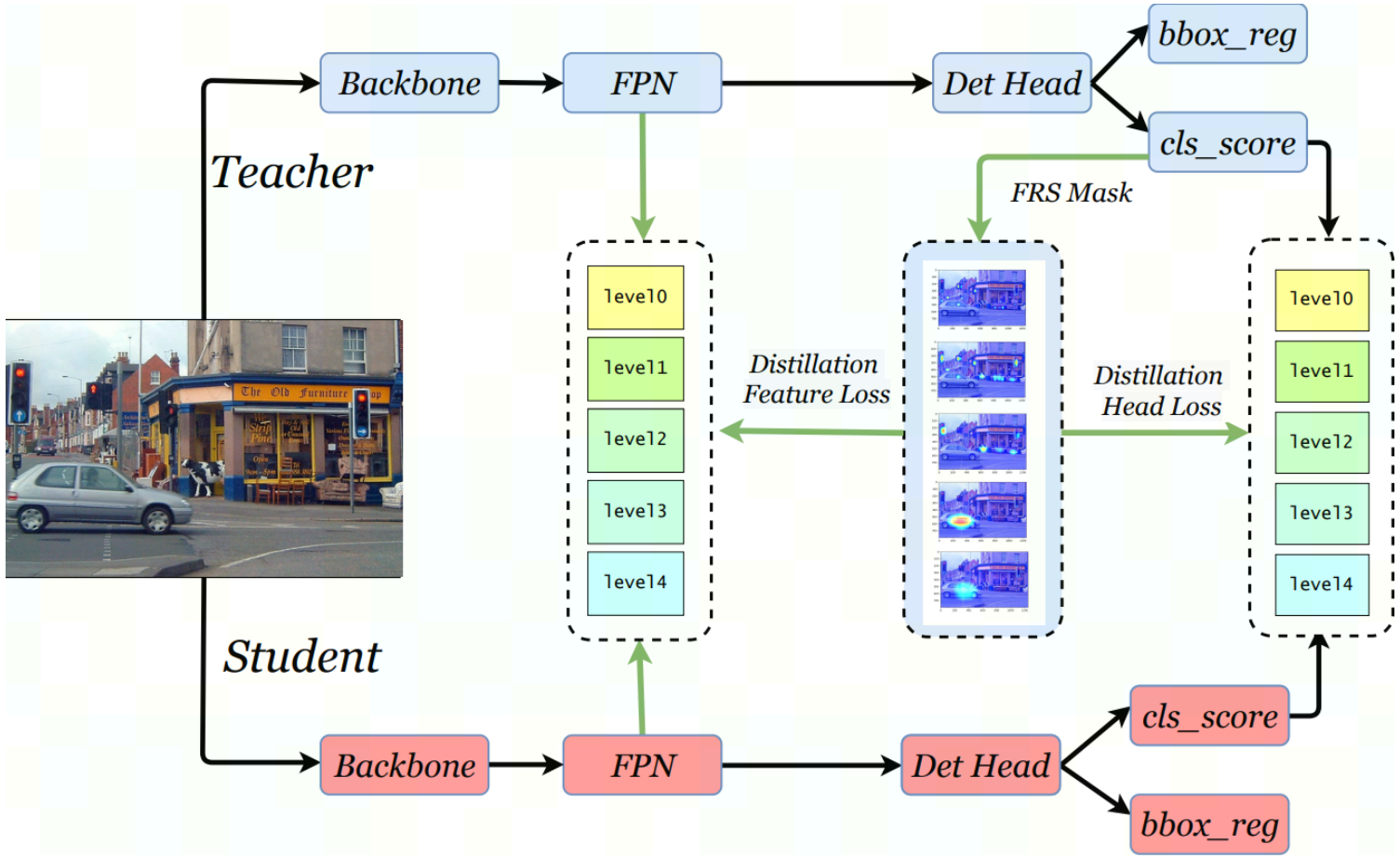
Two limitations of traditional methods

- They Ignore the beneficial features outside the bounding boxes
- These methods imitate some features which are mistakenly regarded as the background by the teacher detector

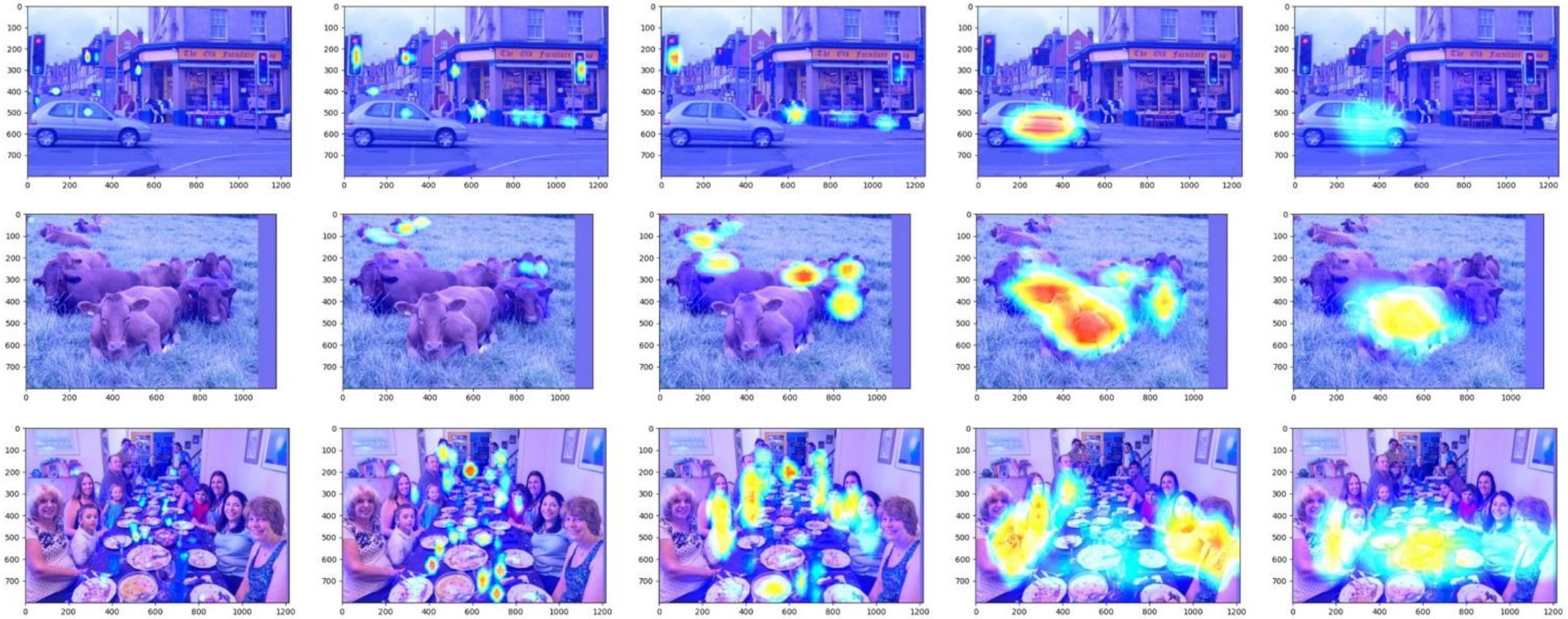


(a) Images and bounding boxes (b) Bounding box based method (c) Ours

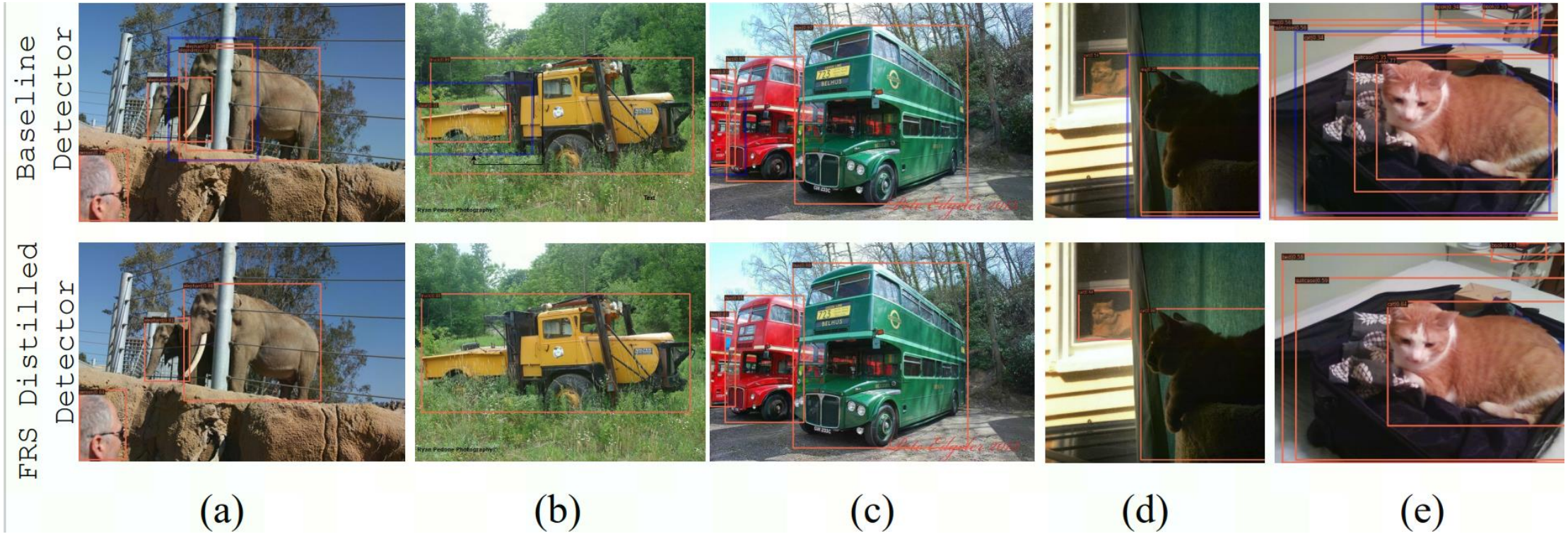
Our Methods


Backbone
FPN
Det Head
bbox_reg
cls_score
Teacher
FRS Mask
level0
level1
level2
level3
level4
Distillation
Feature Loss
Distillation
Head Loss
Student
Backbone
FPN
Det Head
cls_score
bbox_reg

Mask in Different layers of FPN



Experimental effect



Experiments of different detector

	mode	mAP	AP50	AP75	AP_S	AP_M	AP_L
Retina-Res101(teacher)	2x	38.9	58.0	41.5	21.0	42.8	52.4
Retina-Res50(student)	2x	37.4	56.7	39.6	20.0	40.7	49.7
ours	2x	39.7	58.6	42.4	21.8	43.5	52.4
gain		+2.3	+1.9	+2.8	+1.8	+2.8	+2.7
GFL-Resnet101(teacher)	2x	44.9	63.1	49.0	28.0	49.1	57.2
GFL-Resnet50(student)	1x	40.2	58.4	43.3	23.3	44.0	52.2
ours	1x	43.6	61.9	47.5	25.9	47.7	56.4
gain		+3.4	+3.5	+4.2	+2.6	+3.7	+4.2
GFL-Resnet101(teacher)	2x	44.9	63.1	49.0	28.0	49.1	57.2
GFL-Resnet50(student)	2x	42.9	61.2	46.5	27.3	46.9	53.3
ours	2x	44.7	63.0	48.4	28.7	49.0	56.7
gains		+1.8	+1.8	+1.9	+1.4	+2.1	+3.4
Faster-Res101(teacher)	1x	39.4	60.1	43.1	22.4	43.7	51.1
Faster-Res50(student)	1x	37.4	58.1	40.4	21.2	41.0	48.1
ours	1x	39.5	60.1	43.3	22.3	43.6	51.7
gains		+2.1	+2.0	+2.9	+1.1	+2.6	+3.6
FCOS-Resnet101(teacher)	2x	40.8	60.0	44.0	24.2	44.3	52.4
FCOS-Resnet50(student)	2x	38.5	57.7	41.0	21.9	42.8	48.6
ours	2x	40.9	60.3	43.6	25.7	45.2	51.2
gains		+2.4	+2.6	+2.6	+3.8	+2.4	+2.6

Table 1: Results of the proposed method with different detection frameworks. we use 2x learning schedule to train 24 epochs or the 1x learning schedule to train 12 epochs on COCO dataset.

Different Modules

Retina-Res50	✓		✓	✓	✓
Retina-Res101		✓			
FPN layers			✓		✓
Classification Head				✓	✓
mAP	37.4	38.9	39.4	38.4	39.7

Table 3: Ablation Study for various distillation modules on COCO dataset