



DETRs with Hybrid Matching

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Paper

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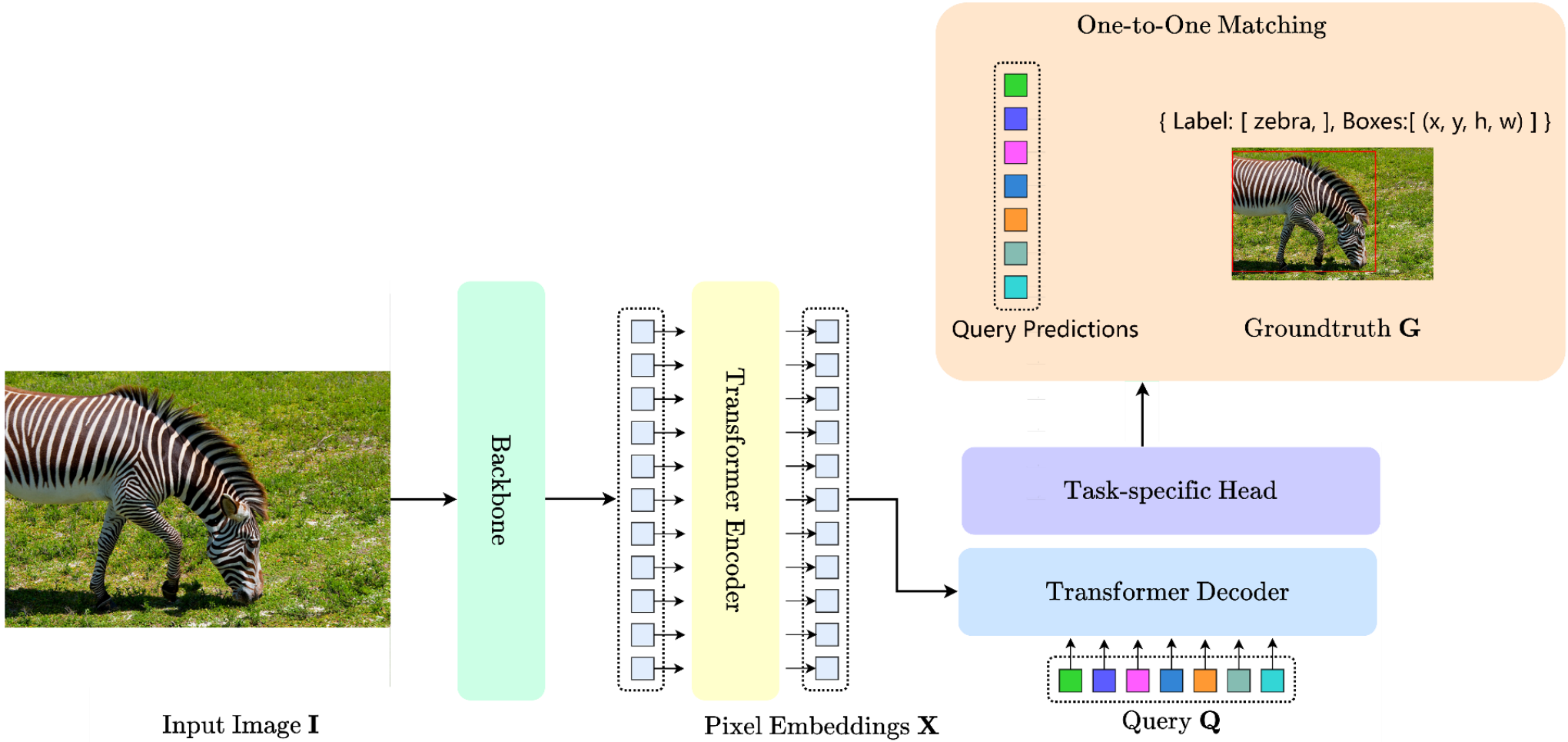
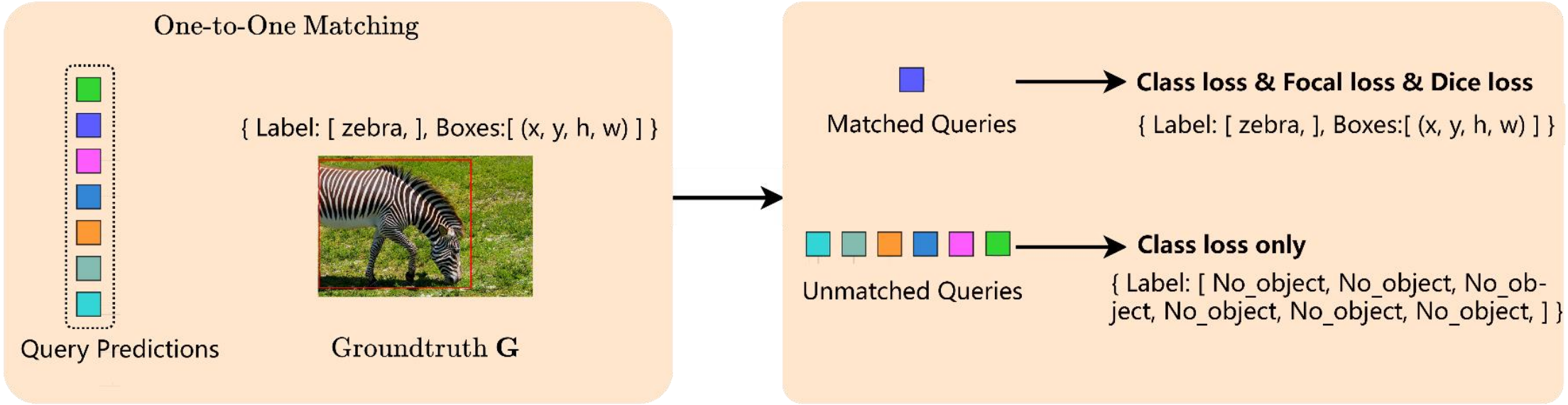
The conventional DETR framework

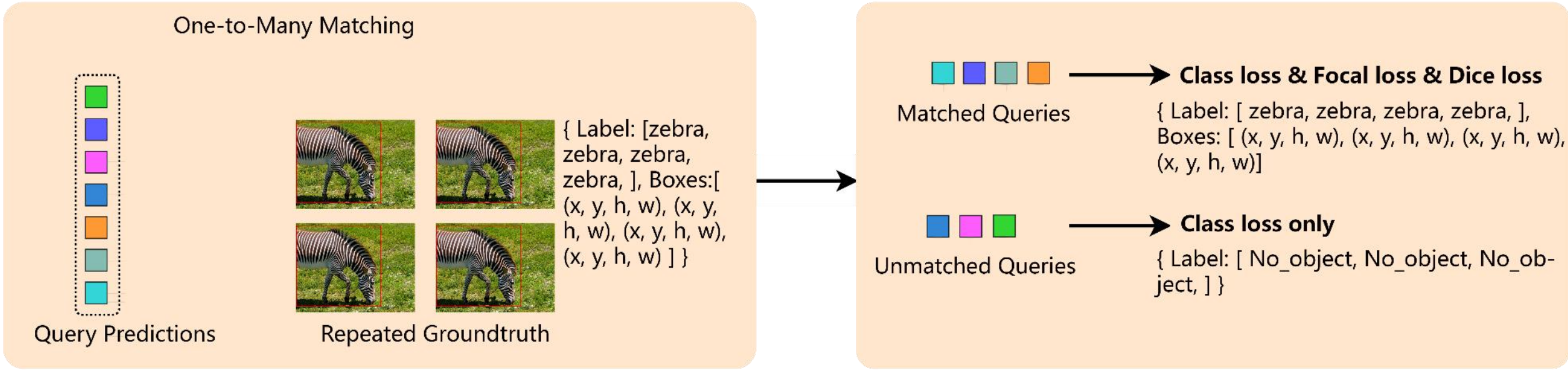


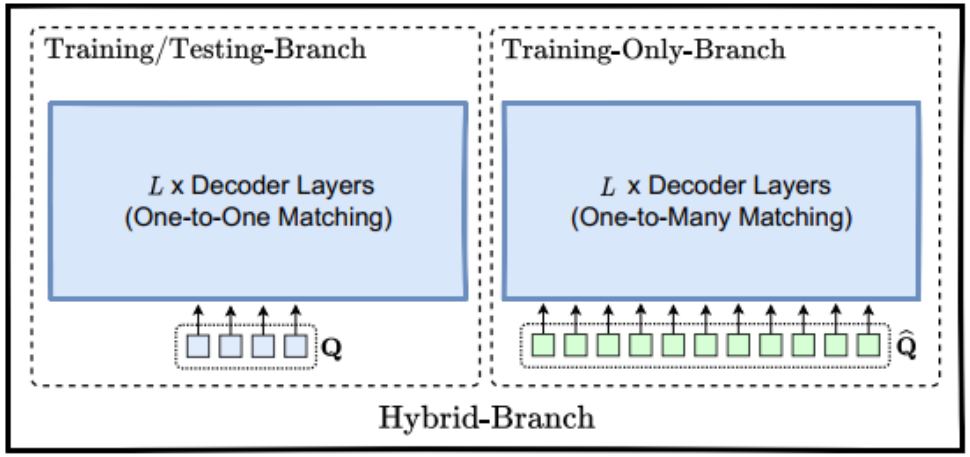
Hybrid Matching Framework

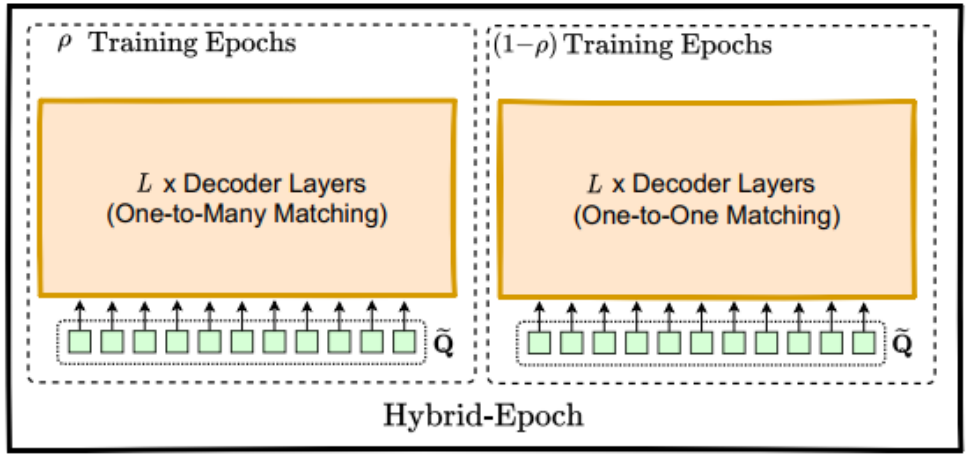


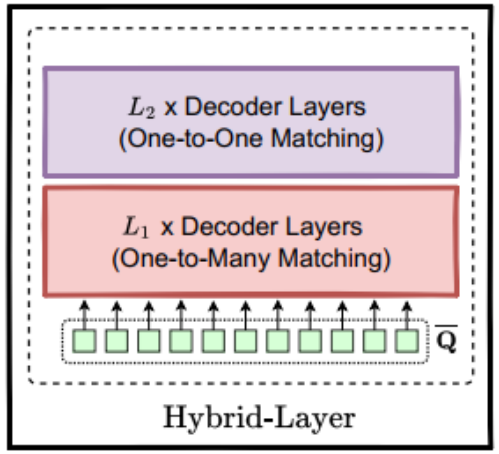
- Deformable-DETR typically only selects less than 30 queries from a pool of 300 queries
- Nearly 99% of the COCO images consist of less than 30 bounding boxes annotations
- Make queries suffer from very limited localization supervision

One-to-Many matching

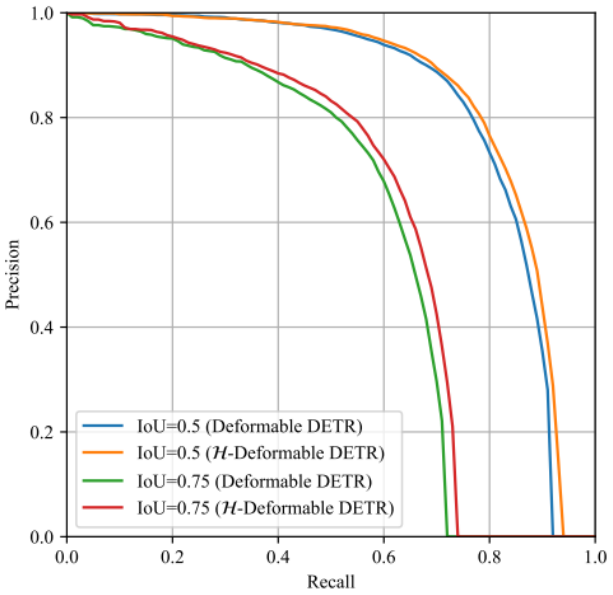








- Hybrid-Branch:
  - Training: One-to-one matching branch & One-to-many matching branch
  - Eval: One-to-one matching branch only
- Hybrid-Epoch:
  - One-to-many matching training epochs first
  - One-to-one matching training epochs then
- Hybrid-Layer:
  - One-to-many matching decoder layers first
  - One-to-one matching decoder layers then



method	inference GLOPs	train time (average)	inference FPS	# epochs		
				12	24	36
Deformable-DETR	268G	65min	6.7	43.7	46.4	46.8
Deformable-DETR[1.3 x]	268G	65min	6.7	44.6	46.3	46.7
Deformable-DETR[†]	282G	75min	6.3	44.1	46.6	47.1
Deformable-DETR[† 1.15 x]	282G	75min	6.3	44.5	46.7	46.9
Deformable-DETR+Hybrid-Branch	268G	80min	6.7	45.9	47.6	48.0
Deformable-DETR+Hybrid-Epoch[†]	282G	95min	6.3	45.5	47.0	47.9
Deformable-DETR+Hybrid-Layer[†]	282G	100min	6.3	45.6	47.9	48.0

2D Object detection results

- COCO

method	backbone	# epochs	AP	AP_S	AP_M	AP_L
Deformable-DETR	R50	12	47.0	29.1	50.0	61.6
H-Deformable-DETR	R50	12	$48.7_{+1.7}$	31.2	51.5	63.5
Deformable-DETR	Swin-L	36	56.3	39.2	60.4	71.8
H-Deformable-DETR	Swin-L	36	$57.1_{+0.8}$	39.7	61.4	73.4

- LVIS v1.0

method	backbone	# epochs	AP	AP_S	AP_M	AP_L
Deformable-DETR	R50	24	32.2	23.2	41.6	49.3
H-Deformable-DETR	R50	24	$33.5_{+1.3}$	24.1	42.4	50.2
Deformable-DETR	Swin-L	48	47.0	35.9	57.8	66.9
H-Deformable-DETR	Swin-L	48	$47.9_{+0.9}$	36.3	58.6	67.9

Multi-view 3D object detection results

method	backbone	# epochs	mAP	NDS
PETRv2	VoVNet-99	24	41.04	50.25
PETRv2 (Our repro.)	VoVNet-99	24	40.41	49.69
H-PETRv2	VoVNet-99	24	$41.93_{+1.52}$	51.23
PETRv2 (Our repro.)	VoVNet-99	36	41.07	50.68
H-PETRv2	VoVNet-99	36	$42.59_{+1.52}$	52.38

Multi-person pose estimation results

method	backbone	# epochs	AP	AP_M	AP_L
PETR	R50	100	68.8	62.7	77.7
PETR (Our repro.)	R50	100	69.3	63.3	78.4
H-PETR	R50	100	$70.9_{+1.6}$	64.4	80.3
PETR	R101	100	70.0	63.6	79.4
PETR (Our repro.)	R101	100	69.9	63.4	79.4
H-PETR	R101	100	$71.0_{+1.1}$	64.7	80.2
PETR	Swin-L	100	73.1	67.2	81.7
PETR (Our repro.)	Swin-L	100	73.3	67.7	81.6
H-PETR	Swin-L	100	$74.9_{+1.6}$	69.3	83.3

Multi-object tracking results

method	# epochs	MOTA ↑	IDF1 ↑	IDF1 ↓
MOT17 val				
TransTrack	20	67.1	70.3	15820
TransTrack (Our repro.)	20	67.1	68.1	15680
H-TransTrack	20	$68.7_{+1.6}$	68.3	13657
MOT17 val				
TransTrack	20	74.5	63.9	112137
TransTrack (Our repro.)	20	74.6	63.2	111105
H-TransTrack	20	$75.7_{+1.1}$	64.4	91155

GPU memory & FLOPS

backbone	method	# query [hyper-parameter]	GFLOPs	Training time (min)	GPU memory (M)
ResNet50 (Swin-L)	Baseline	300 [n=300, T=0, K=0]	268.19 (912.29)	65 (202)	5480 (8955)
	Ours	600 [n=300, T=300, K=6]	271.24 (915.34)	71 (205)	5719 (9190)
		900 [n=300, T=600, K=6]	274.03 (918.12)	72 (208)	6045 (9530)
		1200 [n=300, T=900, K=6]	276.82 (920.91)	75 (210)	6528 (10006)
		1500 [n=300, T=1200, K=6]	279.60 (923.69)	78 (213)	7071 (10558)
		1800 [n=300, T=1500, K=6]	282.39 (926.48)	80 (215)	7728 (11203)

Comparison with State-of-the-art

method	framework	backbone	# epochs	AP					
				AP	AP_{50}	AP_{75}	AP_S	AP_M	AP_L
Swin	HTC	Swin-L	36	57.1	75.6	62.5	42.4	60.7	71.1
CBNetV2	HTC	2× Swin-L	12	59.1	-	-	-	-	-
ConvNeXt	Cascade Mask R-CNN	ConvNeXt-XL	36	55.2	74.2	59.9	-	-	-
MViTv2	Cascade Mask R-CNN	MViTv2-L	50	55.8	74.3	64.3	-	-	-
MOAT	Cascade Mask R-CNN	MOAT-3	36	59.2	**77.8**	60.9	-	-	-
Group-DETR	DETR	Swin-L	36	58.4	-	-	41.0	62.5	73.9
DINO-DETR	DETR	Swin-L	36	58.5	77.0	64.1	41.5	62.3	74.0
H-Deformable-DETR	DETR	Swin-L	36	**59.4**	**77.8**	**65.4**	**43.1**	**63.1**	**74.2**

Thanks
Q&A