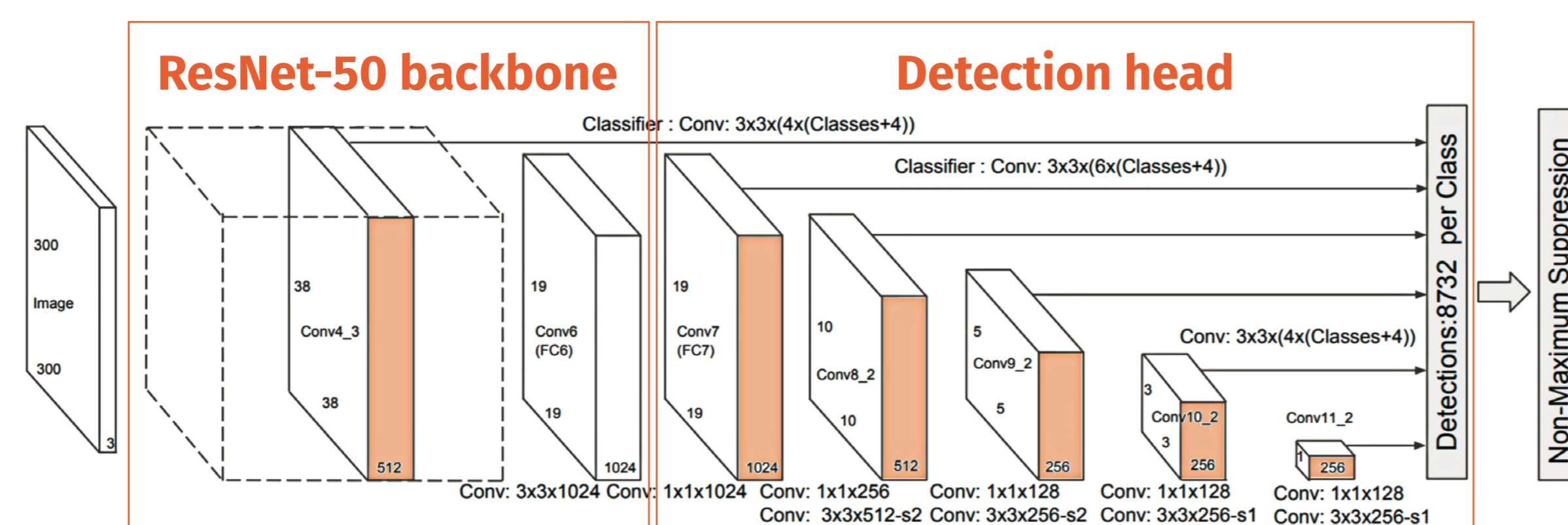


E1.3.3a goal: provide reference implementation for camera-only 2D bounding box pedestrian detector

Selection (2019): SSD-300

- traditional single-stage object detector with anchor boxes and “simple” structure
- well-documented code availability



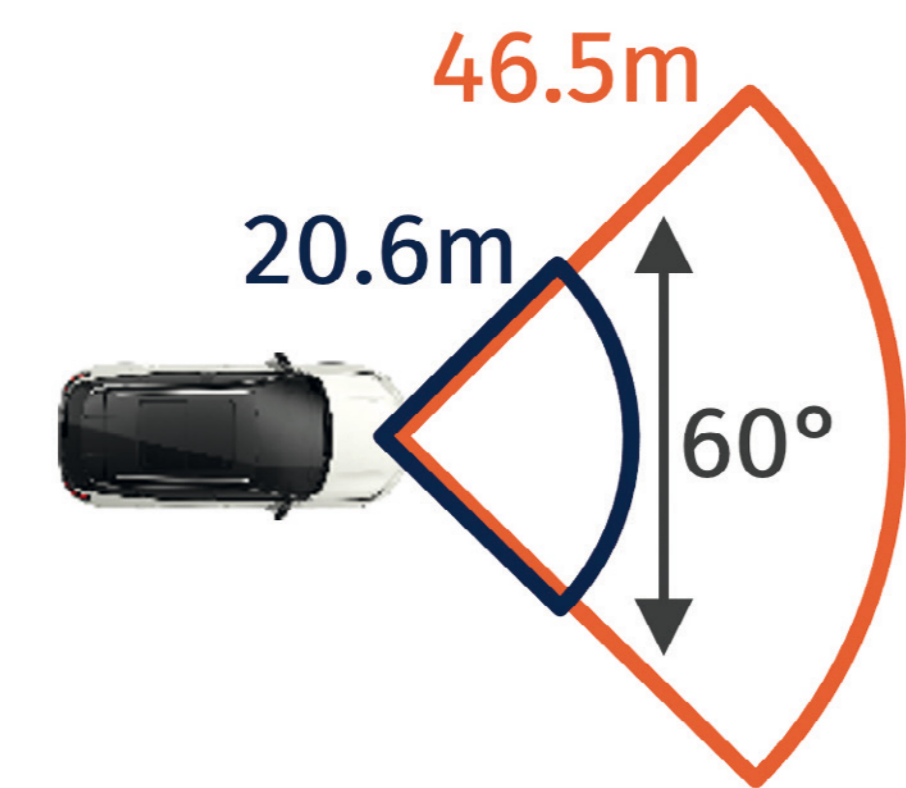
Necessary adaptations with synPeDS:

Deal with many small or severely occluded pedestrians, no occlusion info...

- developed **heuristic occlusion value** from number of instance pixels and bounding box size (jointly with E1.2.3)
- defined **non-difficult setting** for training: height>33px AND occlusion_est>0.8

Develop meaningful evaluation metrics

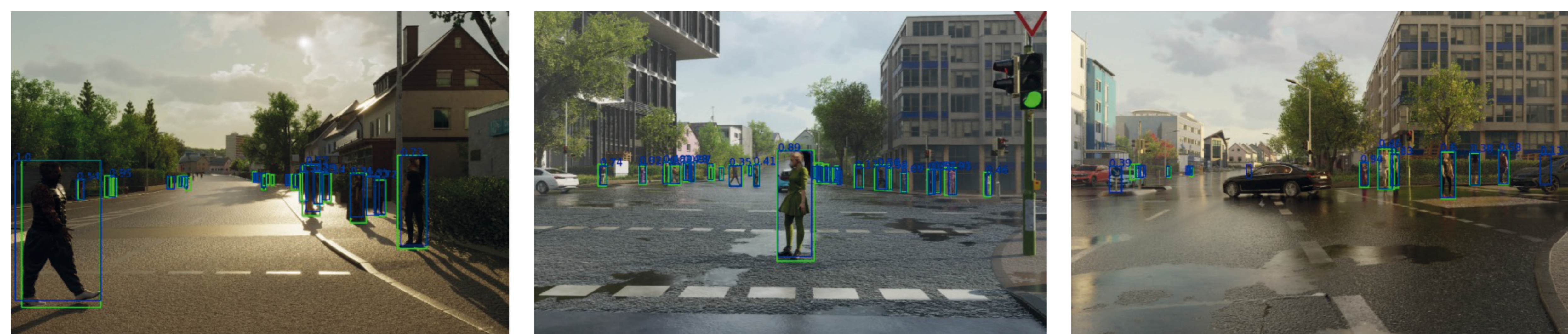
- from single aggregated metric (mAP) to **base metrics & precision-recall curve** (jointly with E1.2.7 and P1)
- **Safety relevant pedestrian cat. A/B** definition (jointly with P1)



based on distance bands of pedestrian braking assistant
based on pedestrian position in semantic bird's eye view map

n conditions	Cat. A	Cat. B
occlusion_est	<0.8	<0.8
within_brake_dist	<30kph	<50kph
semantic_area	ε {road, crossing, sidewalk_near_crossing}	ε {road, crossing, sidewalk_near_crossing, sidewalk}

* all threshold values only exemplary



Example inference results of r4 (conf=0.1): different light conditions, crowded scenes, FPs, ...

Release overview:

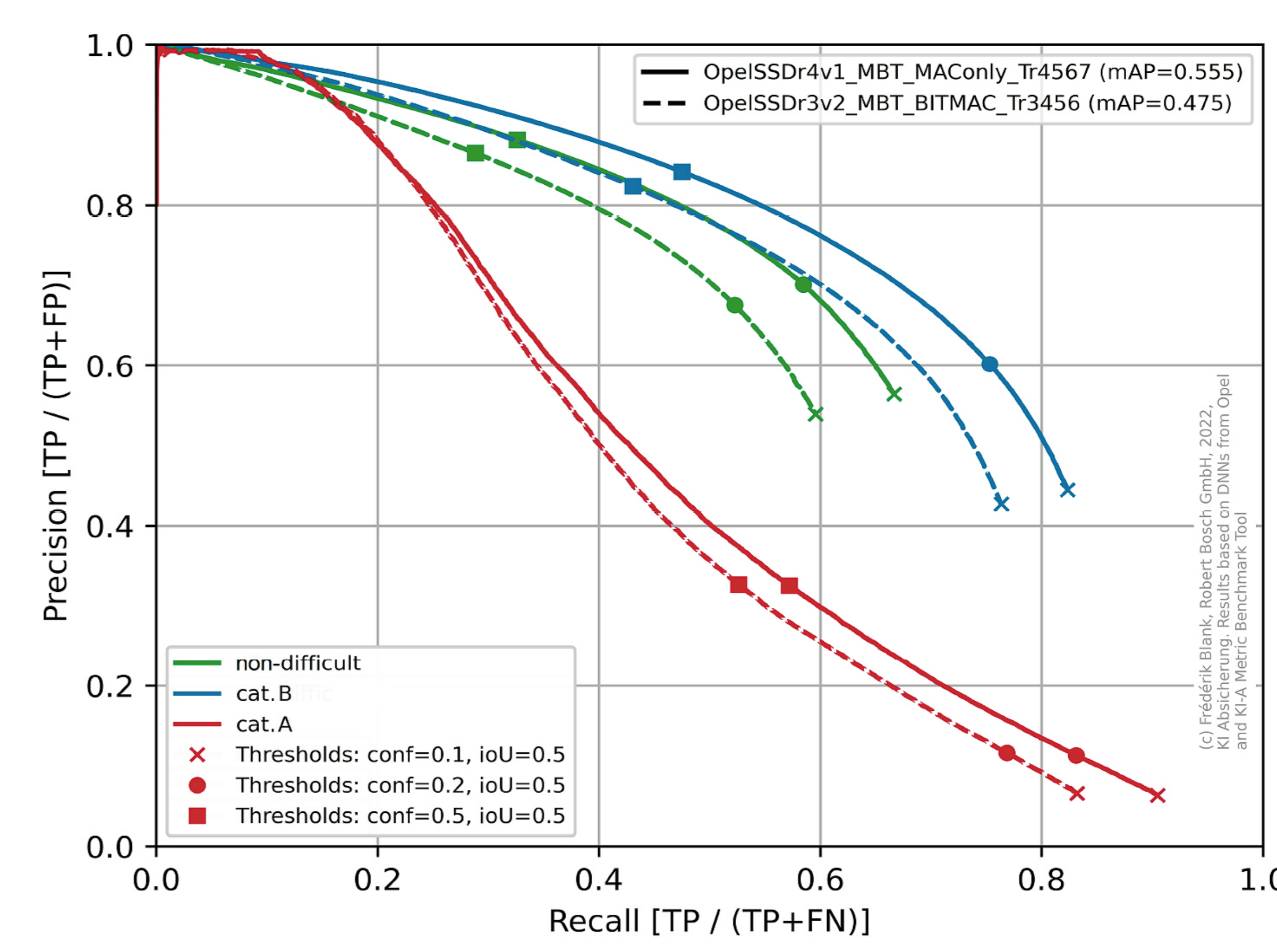
- r3v1 (BIT Tr3-4 and MV Tr4)
- r3v2 (BIT Tr3-5 and MV Tr4-5)
- r4 (MV Tr4-7)

Key actions and learnings from r3v1 to r3v2:

- Verified correct implementation
- Thorough analysis and ablation studies
- Reverted to pretrained backbone instead of from-scratch training
- Optimized aspect ratio and number of anchor boxes

	Non-difficult	Cat. B	Cat. A
#TP	925,713	553,348	45,412
#FP	715,558	691,180	671,768
#FN	463,042	118,704	4,776
Precision	0.564	0.445	0.063
Recall	0.667	0.823	0.905
mAP	0.555	0.682	0.475

Base metrics for r4 in 101,947 test images (conf=0.1)



Precision-recall curve / * Evaluation scripts provided by Bosch

Conclusion and discussion

- Cat. A best recall performance
- Imbalance of #TP results in worse cat. A precision performance, needs #FP adjustment for fair comparison
- Future work: careful design of distance bands and safety relevance, also to be considered in weighted training