

VespAlert

23rd March 2022

MODELS

Segmentation

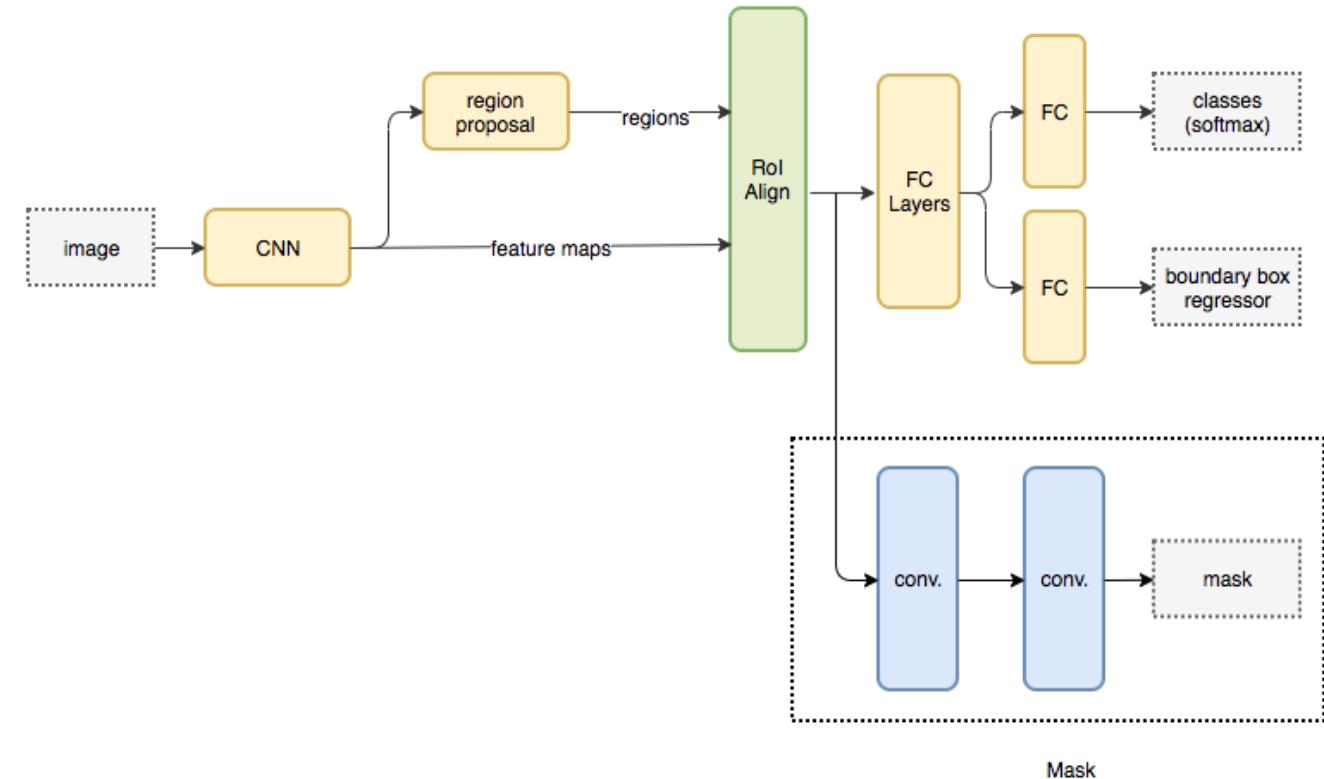
- Learn polygon masks directly
- Mask R-CNN
- State-of-the-art: Detectron2

Bounding box object detection

- Two stages:
 1. Object detection
 2. Classification
- Transfer learning from COCO
- State-of-the-art: YOLOv5

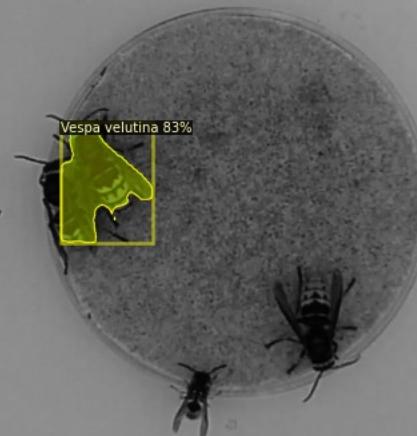
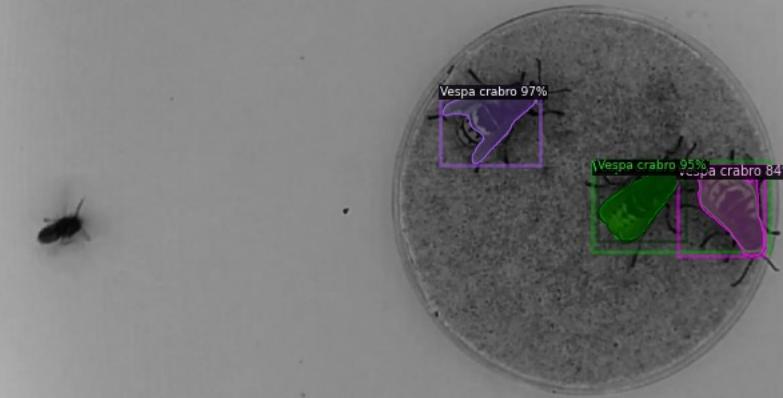
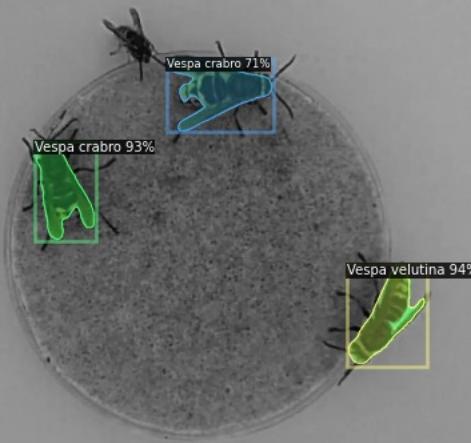
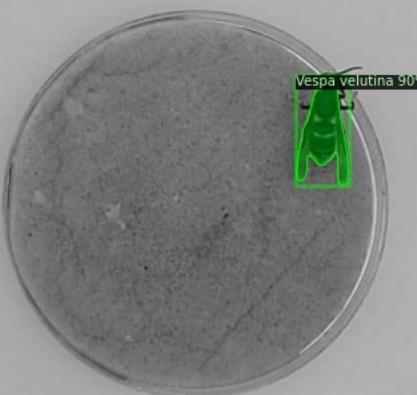
STEP I: MASK R-CNN

MASK R-CNN



07/11/2021
12:55:56

MASK R-CNN: RESULTS



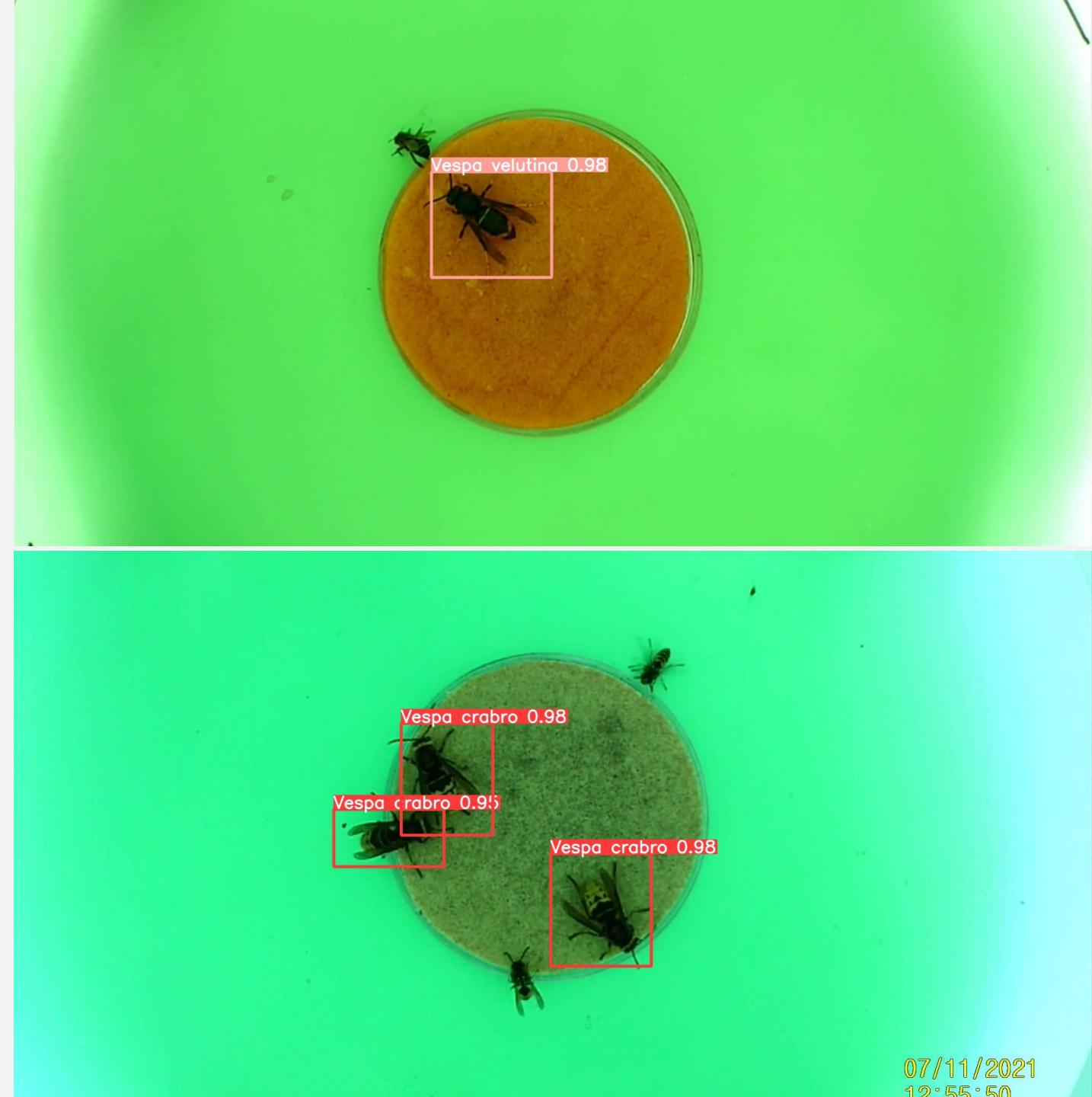
07/11/2021
12:55:48

MASK R-CNN: RESULTS

```
[03/09 09:58:25 d2.evaluation.fast_eval_api]: Evaluate annotation type *segm*
[03/09 09:58:25 d2.evaluation.fast_eval_api]: COCOeval_opt.evaluate() finished in 0.05 seconds.
[03/09 09:58:25 d2.evaluation.fast_eval_api]: Accumulating evaluation results...
[03/09 09:58:25 d2.evaluation.fast_eval_api]: COCOeval_opt.accumulate() finished in 0.01 seconds.
Average Precision (AP) @[ IoU=0.50:0.95 | area=   all | maxDets=100 ] = 0.330
Average Precision (AP) @[ IoU=0.50 | area=   all | maxDets=100 ] = 0.491
Average Precision (AP) @[ IoU=0.75 | area=   all | maxDets=100 ] = 0.423
Average Precision (AP) @[ IoU=0.50:0.95 | area= small | maxDets=100 ] = -1.000
Average Precision (AP) @[ IoU=0.50:0.95 | area=medium | maxDets=100 ] = 0.380
Average Precision (AP) @[ IoU=0.50:0.95 | area= large | maxDets=100 ] = 0.104
Average Recall    (AR) @[ IoU=0.50:0.95 | area=   all | maxDets= 1 ] = 0.408
Average Recall    (AR) @[ IoU=0.50:0.95 | area=   all | maxDets=10 ] = 0.498
Average Recall    (AR) @[ IoU=0.50:0.95 | area=   all | maxDets=100 ] = 0.498
Average Recall    (AR) @[ IoU=0.50:0.95 | area= small | maxDets=100 ] = -1.000
Average Recall    (AR) @[ IoU=0.50:0.95 | area=medium | maxDets=100 ] = 0.519
Average Recall    (AR) @[ IoU=0.50:0.95 | area= large | maxDets=100 ] = 0.267
[03/09 09:58:25 d2.evaluation.coco_evaluation]: Evaluation results for segm:
| AP      | AP50    | AP75    | APs     | APM     | AP1     |
|:-----:|:-----:|:-----:|:-----:|:-----:|:-----:|
| 33.004 | 49.082 | 42.289 | nan     | 37.984 | 10.356 |
[03/09 09:58:25 d2.evaluation.coco_evaluation]: Some metrics cannot be computed and is shown as NaN.
[03/09 09:58:25 d2.evaluation.coco_evaluation]: Per-category segm AP:
| category | AP      | category | AP      |
|:-----:|:-----:|:-----:|:-----:|
| Vespa crabro | 37.664 | Vespa velutina | 28.343 |
OrderedDict([('bbox', {'AP': 37.59848142934024, 'AP50': 49.70858054997915, 'AP75': 43.94482209544396, 'APs': nan, 'APm': 57.74879219484815, 'APl': 8.11128935938183, 'AP-Vespa crabro': 44.16071617313686, 'AP-Vespa velutina': 31.0362466855436}), ('segm', {'AP': 33.00391862477824, 'AP50': 49.0823335711826, 'AP75': 42.28935343843423, 'APs': nan, 'APm': 37.98414885978968, 'APl': 10.356274360721596, 'AP-Vespa crabro': 37.664387559266125, 'AP-Vespa velutina': 28.34344969029034}))
```

STEP 2:YOLO

YOLO: RESULTS

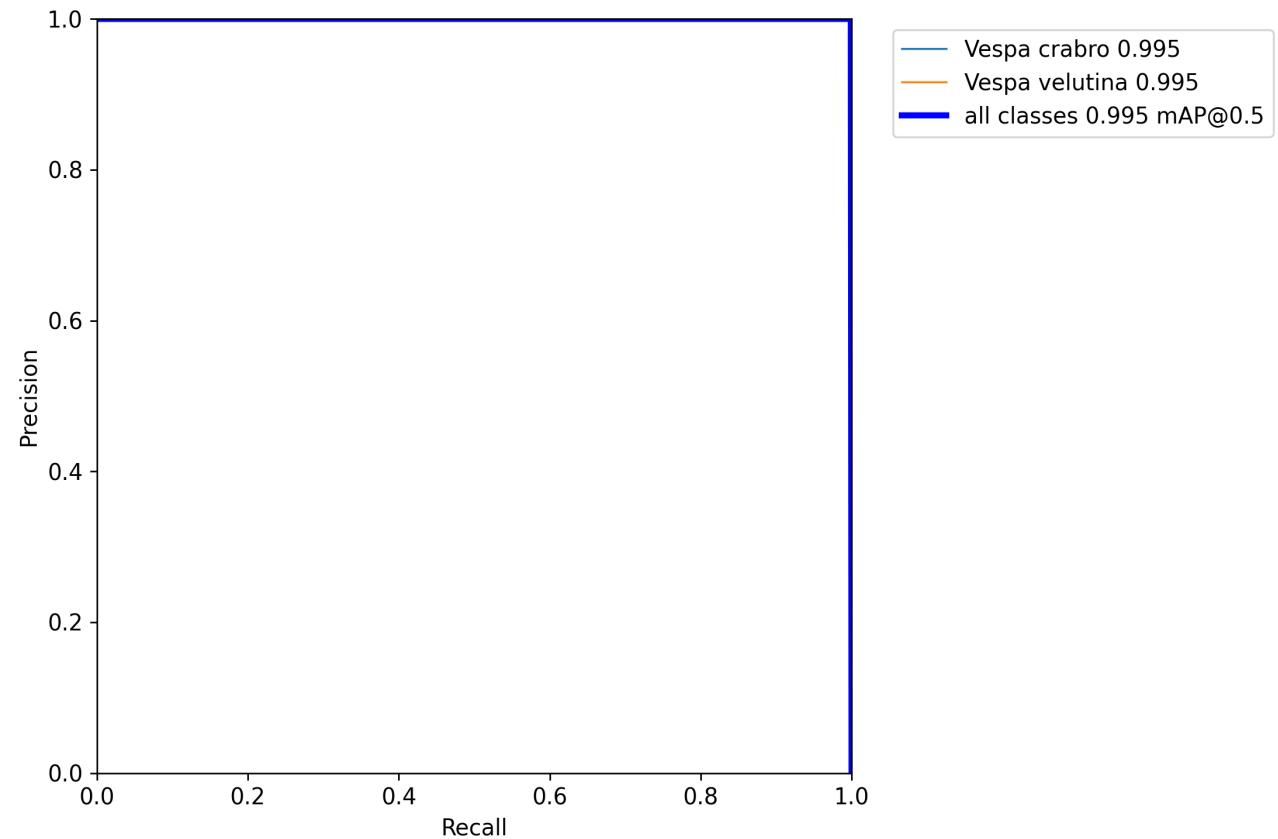


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12:55:50

Vespa velutina 0.98



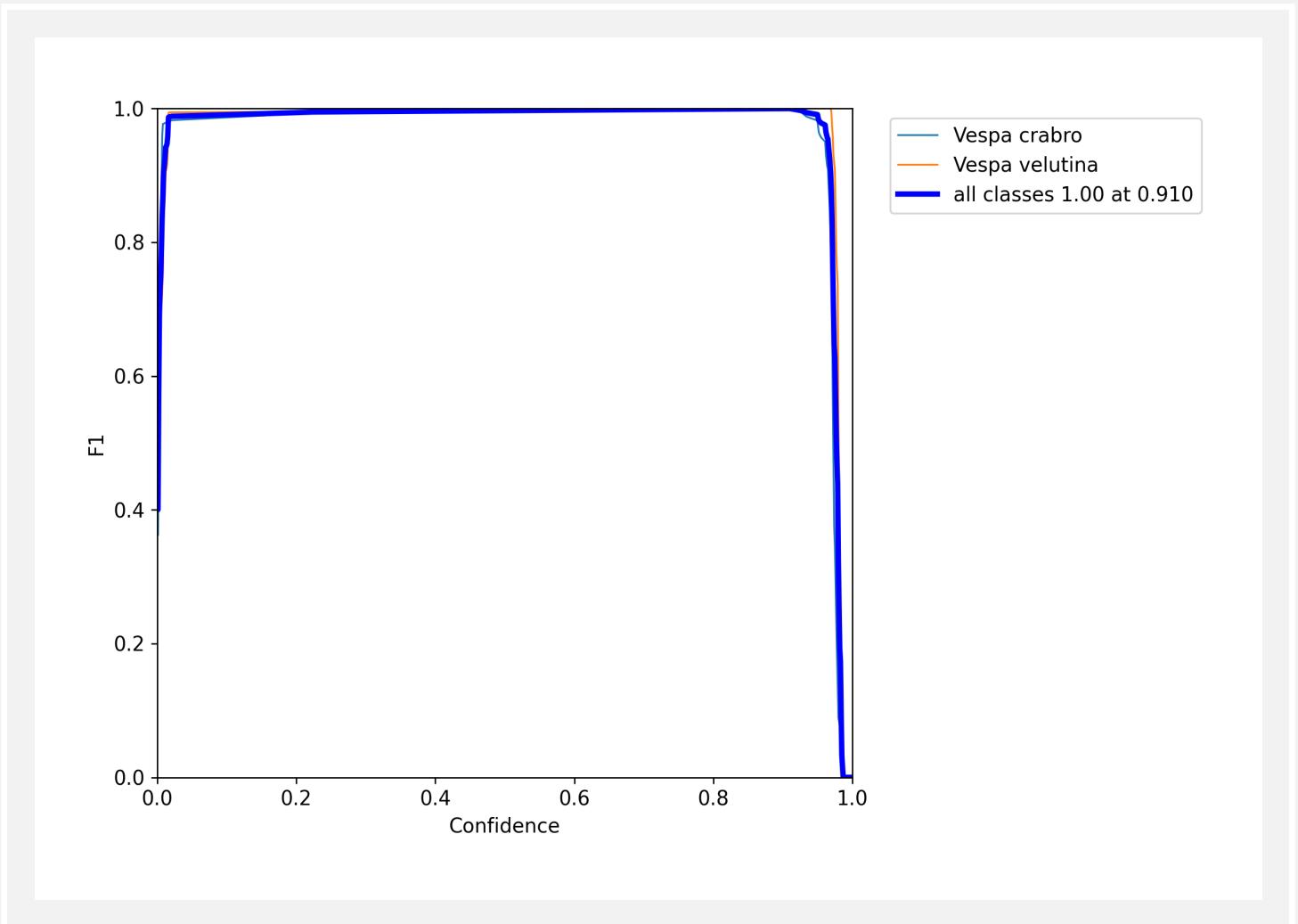
PRECISION- RECALL



F1-CURVE

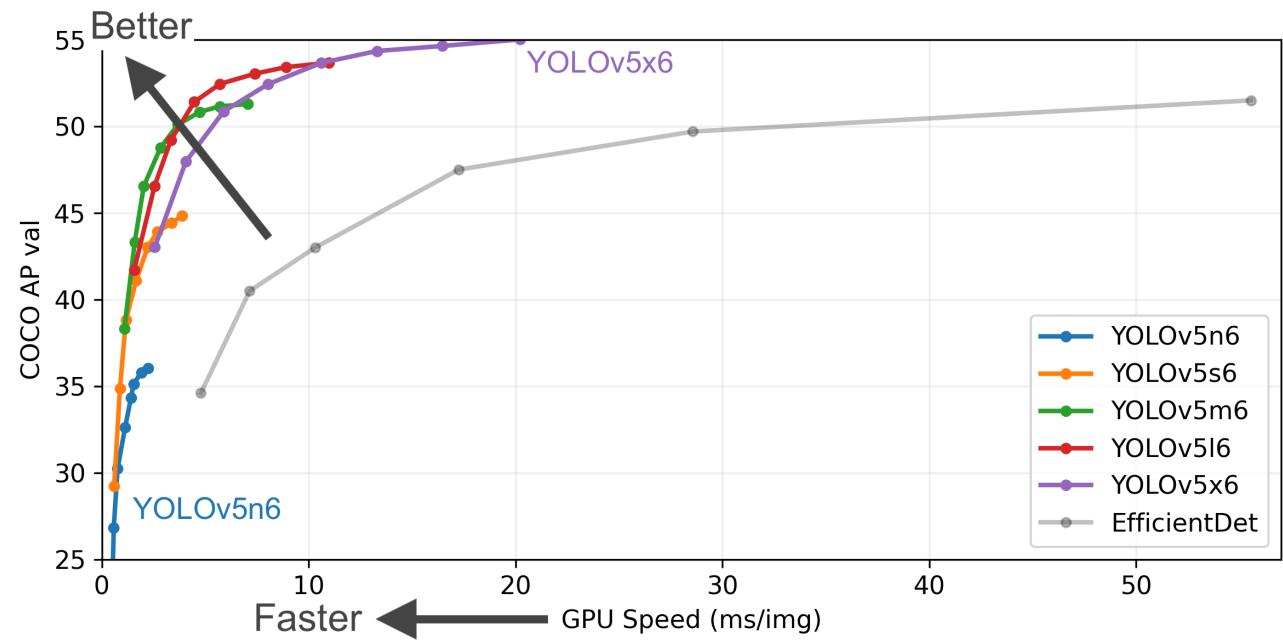
Harmonic mean:

$$F1 = \frac{Precision \times Recall}{Precision + Recall}$$



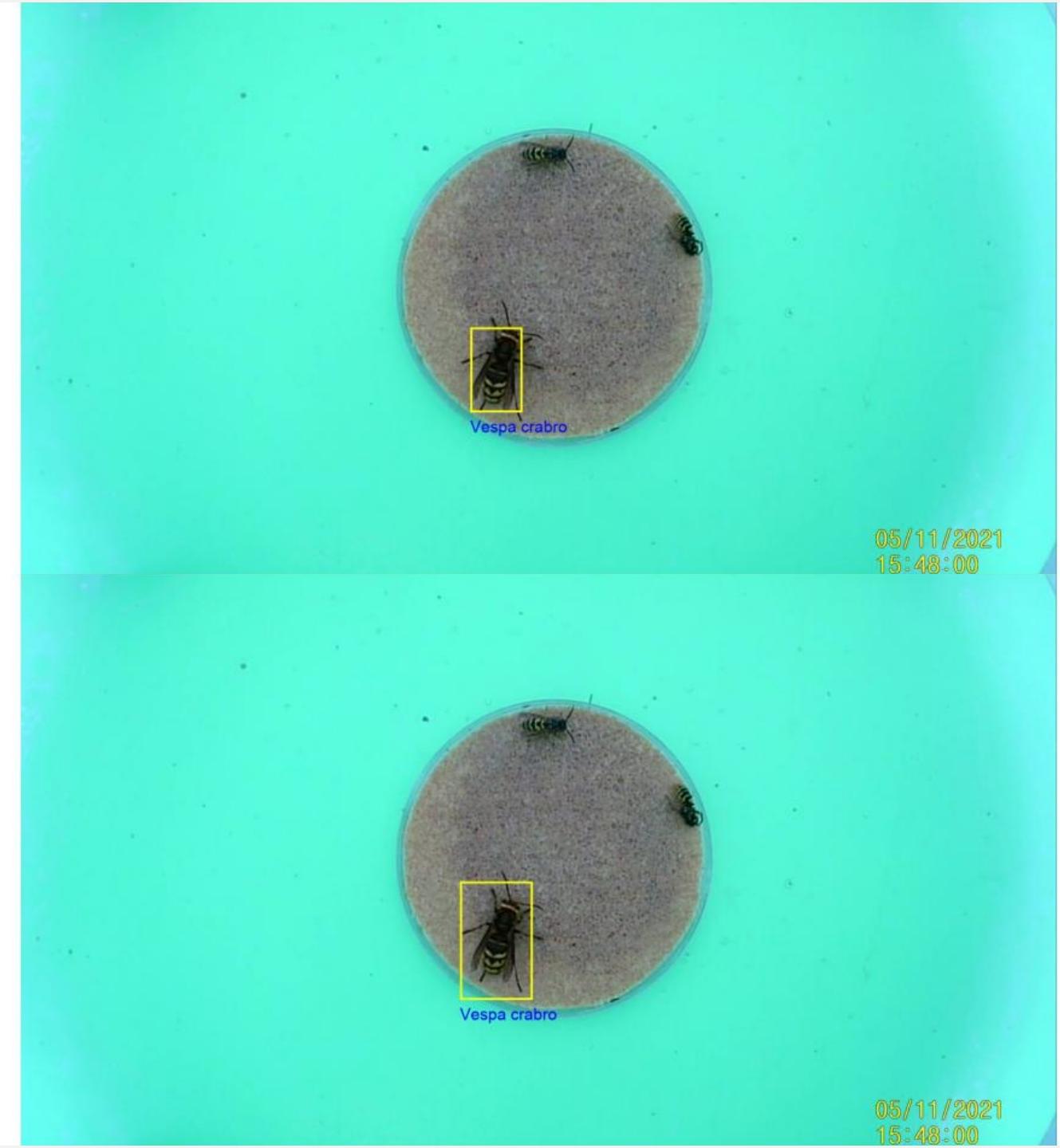
	from	n	params	module	arguments	
0		-1	1	3520	models.common.Conv	[3, 32, 6, 2, 2]
1		-1	1	18560	models.common.Conv	[32, 64, 3, 2]
2		-1	1	18816	models.common.C3	[64, 64, 1]
3		-1	1	73984	models.common.Conv	[64, 128, 3, 2]
4		-1	2	115712	models.common.C3	[128, 128, 2]
5		-1	1	295424	models.common.Conv	[128, 256, 3, 2]
6		-1	3	625152	models.common.C3	[256, 256, 3]
7		-1	1	1180672	models.common.Conv	[256, 512, 3, 2]
8		-1	1	1182720	models.common.C3	[512, 512, 1]
9		-1	1	656896	models.common.SPPF	[512, 512, 5]
10		-1	1	131584	models.common.Conv	[512, 256, 1, 1]
11		-1	1	0	torch.nn.modules.upsampling.Upsample	[None, 2, 'nearest']
12	[-1, 6]	1	0	models.common.Concat	[1]	
13		-1	1	361984	models.common.C3	[512, 256, 1, False]
14		-1	1	33024	models.common.Conv	[256, 128, 1, 1]
15		-1	1	0	torch.nn.modules.upsampling.Upsample	[None, 2, 'nearest']
16	[-1, 4]	1	0	models.common.Concat	[1]	
17		-1	1	90880	models.common.C3	[256, 128, 1, False]
18		-1	1	147712	models.common.Conv	[128, 128, 3, 2]
19	[-1, 14]	1	0	models.common.Concat	[1]	
20		-1	1	296448	models.common.C3	[256, 256, 1, False]
21		-1	1	590336	models.common.Conv	[256, 256, 3, 2]
22	[-1, 10]	1	0	models.common.Concat	[1]	
23		-1	1	1182720	models.common.C3	[512, 512, 1, False]
24	[17, 20, 23]	1	18879	models.yolo.Detect	[2, [[10, 13, 16, 30, 33, 23],	
					Model Summary: 270 layers, 7025023 parameters, 7025023 gradients, 15.9 GFLOPs	

YOLO: ARCHITECTURE



BOX EXPANSION

- Top: fit-to-polygon
- Bottom: 40% expansion



BOX EXPANSION

- Top: fit-to-polygon
- Bottom: 40% expansion

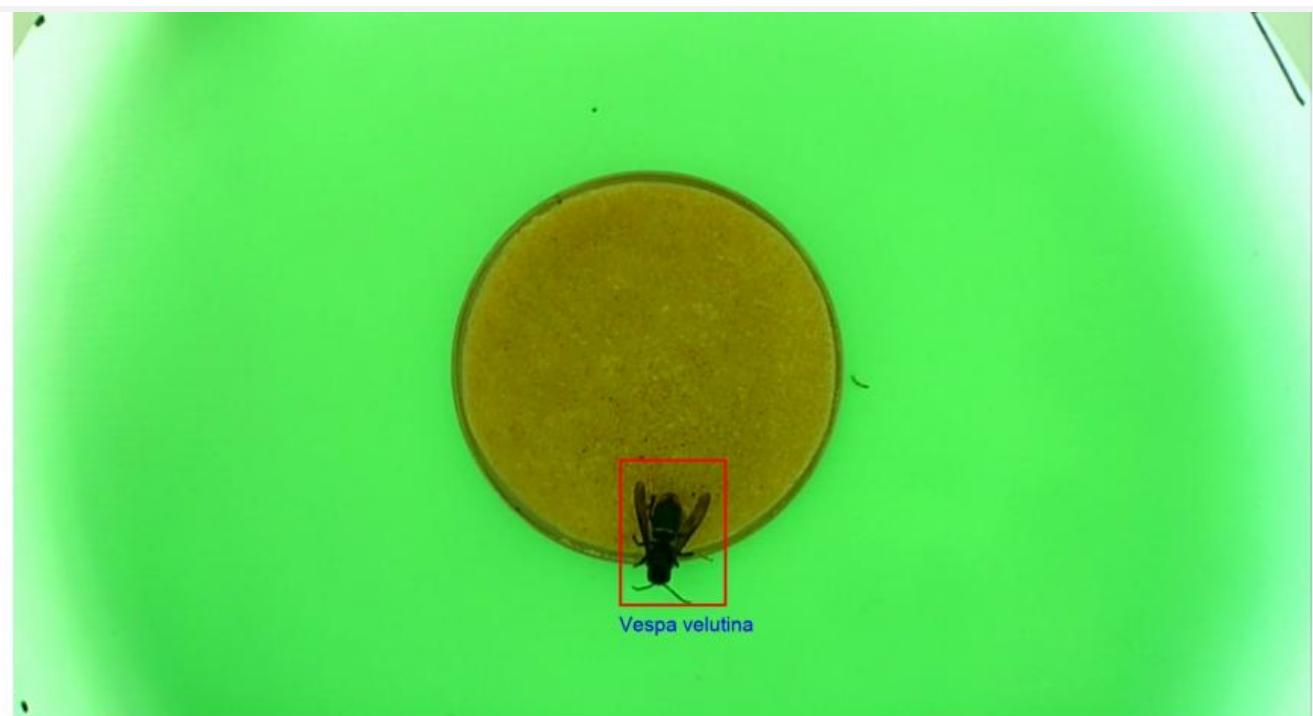
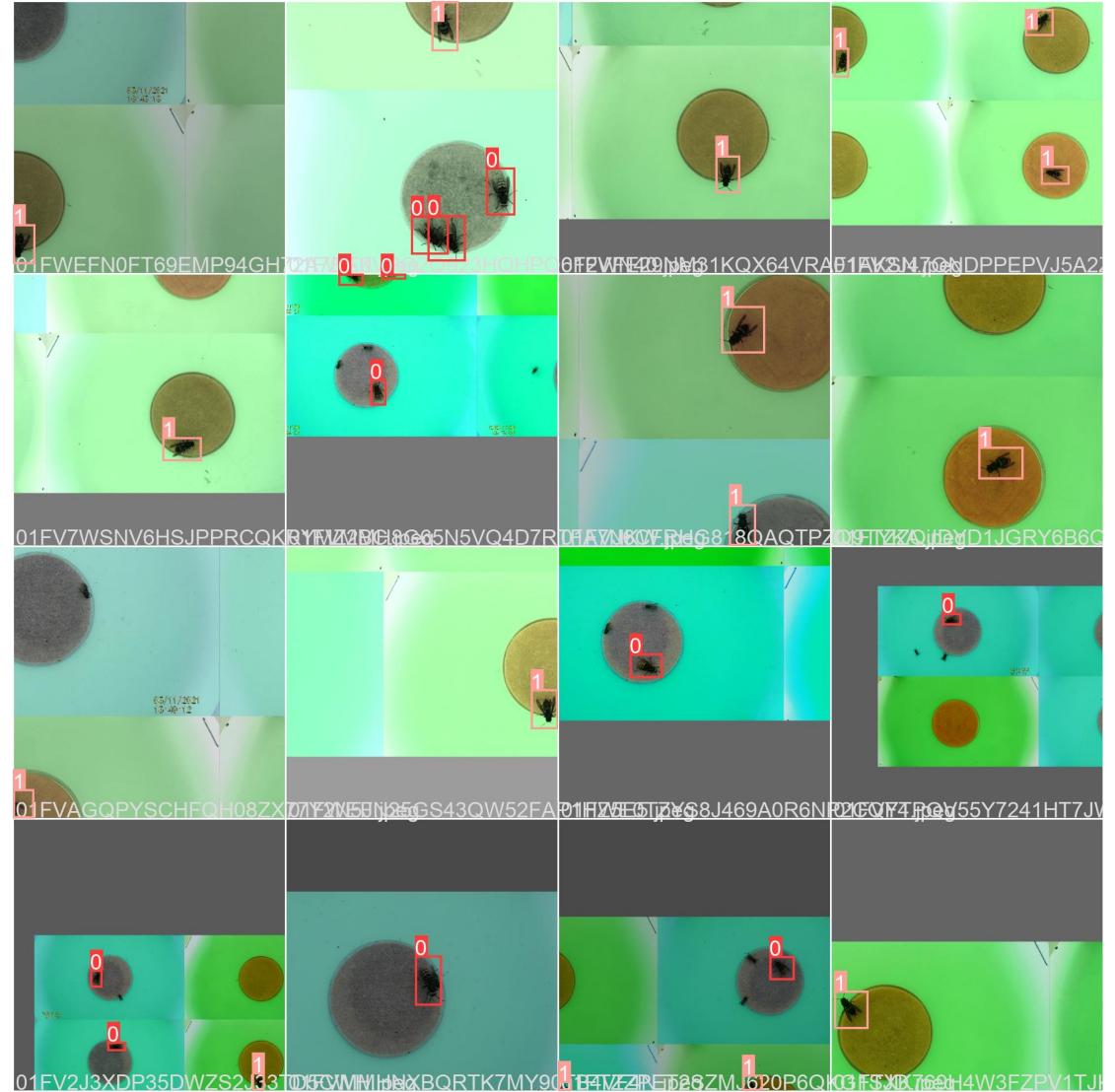
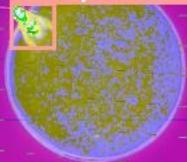


IMAGE AUGMENTATION



Vespa velutina



Vespa crabro



Vespa crabro

Vespa crabro

Vespa crabro



Vespa crabro



Vespa crabro

Vespa crabro

Vespa crabro



Vespa crabro



Vespa crabro

Vespa crabro

Vespa crabro



Vespa crabro



Vespa crabro

Vespa crabro

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Results:

Expansion by 0%

Class	Images	Labels	P	R	mAP@.5	mAP@.5:.95
all	170	170	1	1	0.995	0.933
Vespa crabro	170	84	1	1	0.995	0.897
Vespa velutina	170	86	0.999	1	0.995	0.968

Expansion by 10%

all	170	170	1	1	0.995	0.945
Vespa crabro	170	84	1	1	0.995	0.917
Vespa velutina	170	86	1	1	0.995	0.974

Expansion by 20%

all	170	170	1	1	0.995	0.949
Vespa crabro	170	84	1	1	0.995	0.919
Vespa velutina	170	86	0.999	1	0.995	0.98

Expansion by 30%

all	170	170	1	1	0.995	0.952
Vespa crabro	170	84	1	1	0.995	0.921
Vespa velutina	170	86	0.999	1	0.995	0.983

Expansion by 40%

all	170	170	1	1	0.995	0.951
Vespa crabro	170	84	1	1	0.995	0.923
Vespa velutina	170	86	1	1	0.995	0.98

Expansion by 50%

all	170	175	0.995	1	0.995	0.959
Vespa crabro	170	93	0.989	1	0.994	0.936
Vespa velutina	170	82	1	1	0.995	0.983

Expansion by 60%

all	170	170	1	1	0.995	0.953
Vespa crabro	170	84	1	1	0.995	0.93
Vespa velutina	170	86	1	1	0.995	0.977

Expansion by 80%

all	170	170	1	1	0.995	0.955
Vespa crabro	170	84	1	1	0.995	0.929
Vespa velutina	170	86	0.999	1	0.995	0.981

Expansion by 100%

all	170	170	1	1	0.995	0.964
Vespa crabro	170	84	1	1	0.995	0.942
Vespa velutina	170	86	0.999	1	0.995	0.987

Expansion by 150%

all	170	170	1	1	0.995	0.955
Vespa crabro	170	84	1	1	0.995	0.923
Vespa velutina	170	86	0.999	1	0.995	0.988

COMPARE BOX SIZE

TOO GOOD TO BE TRUE?

- Limited hornet specimens
- Background resilience
- Downscaling model size
- Other unknown biases