SUSTech Southern University of Science and Technology

Underwater Animal Detection Vehicle

Group A of OCE210

Presenter：Gan Liu

2024.3.13

Content

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- Background
- Experiment
- Result
- Future work

Background

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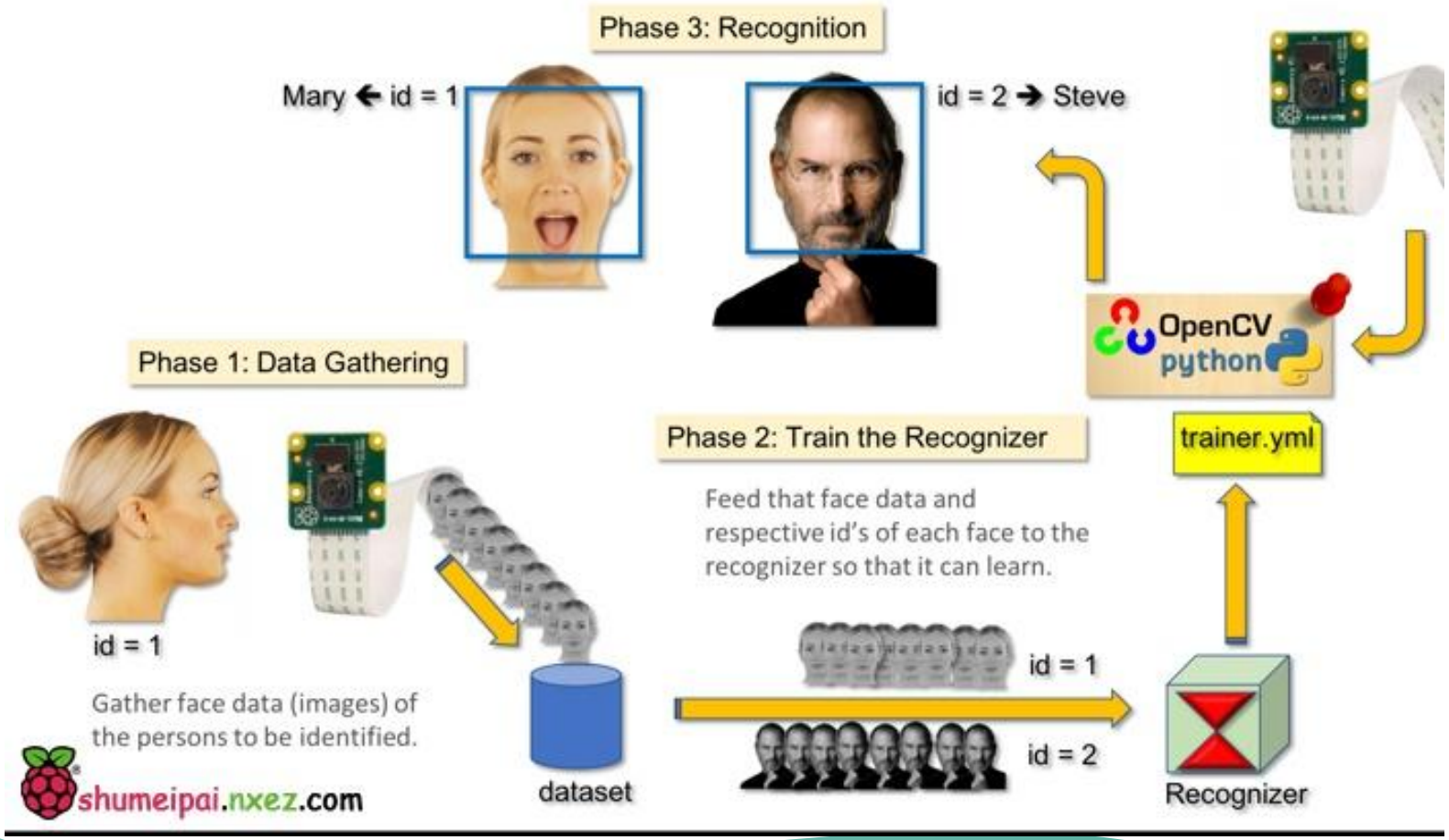
Collocting infomation of underwater organism is hard.

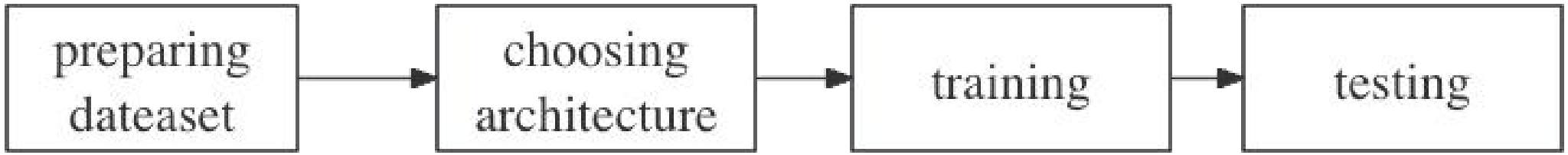
Developing an efficient underwater identification system.

Background


Phase 3: Recognition
Mary ← id = 1
id = 2 → Steve
OpenCV
python
Phase 1: Data Gathering
Phase 2: Train the Recognizer
trainer.yml
Feed that face data and respective id's of each face to the recognizer so that it can learn.
id = 1
Gather face data (images) of the persons to be identified.
id = 1
id = 2
shumeipai.nxez.com
dataset
Recognizer

Experiment-AI model development

goal: an AI model that can do organisms detection in real-time



Experiment

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preparing datasets

000002.xml

000002 〉 No Selection

```xml
<?xml version="1.0" ?>
<annotation>
    <frame>12-10GP020193002</frame>
    <object>
        <name>holothurian</name>
        <bndbox>
            <xmin>707</xmin>
            <ymin>414</ymin>
            <xmax>837</xmax>
            <ymax>568</ymax>
        </bndbox>
    </object>
    <object>
        <name>echinus</name>
        <bndbox>
            <xmin>356</xmin>
            <ymin>535</ymin>
```

Experiment

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choosing model architecture

EfficientDet

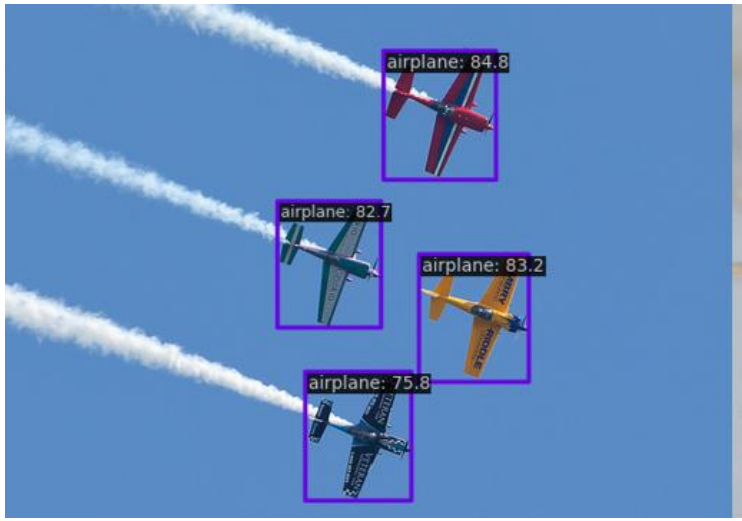
Paper arXiv.1911.09070 | Open in Colab | TF Hub Models

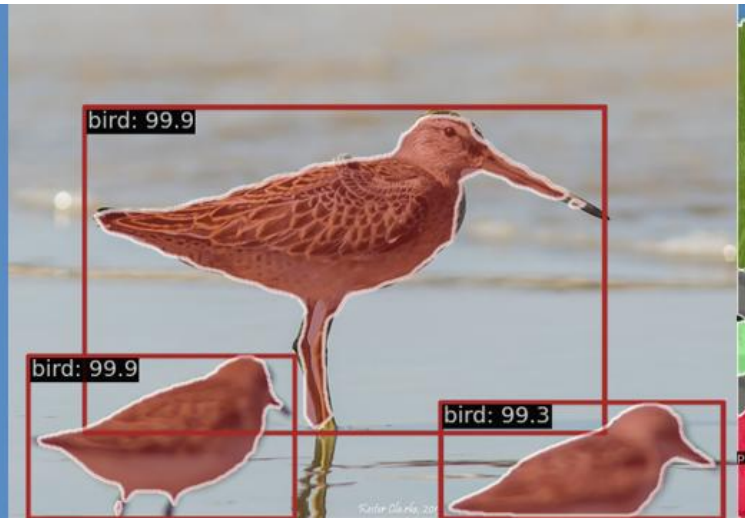
[1] Mingxing Tan, Ruoming Pang, Quoc V. Le. EfficientDet: Scalable and Efficient Object Detection. CVPR 2020. Arxiv link: https://arxiv.org/abs/1911.09070

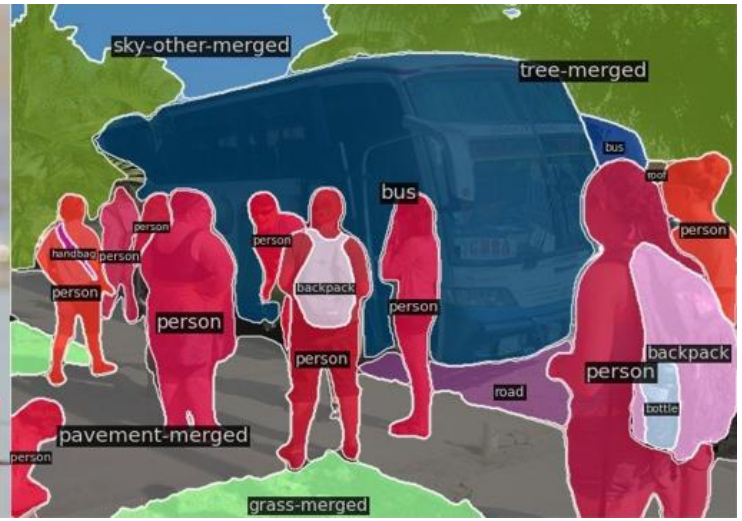
MMDetection

OpenMMLab website HOT OpenMMLab platform TRY IT OUT

pypi v3.3.0 | docs latest | build failing | codecov 64% | license Apache-2.0 | open issues 12% | issue resolution 4 d | OpenXLab Demo







Experiment

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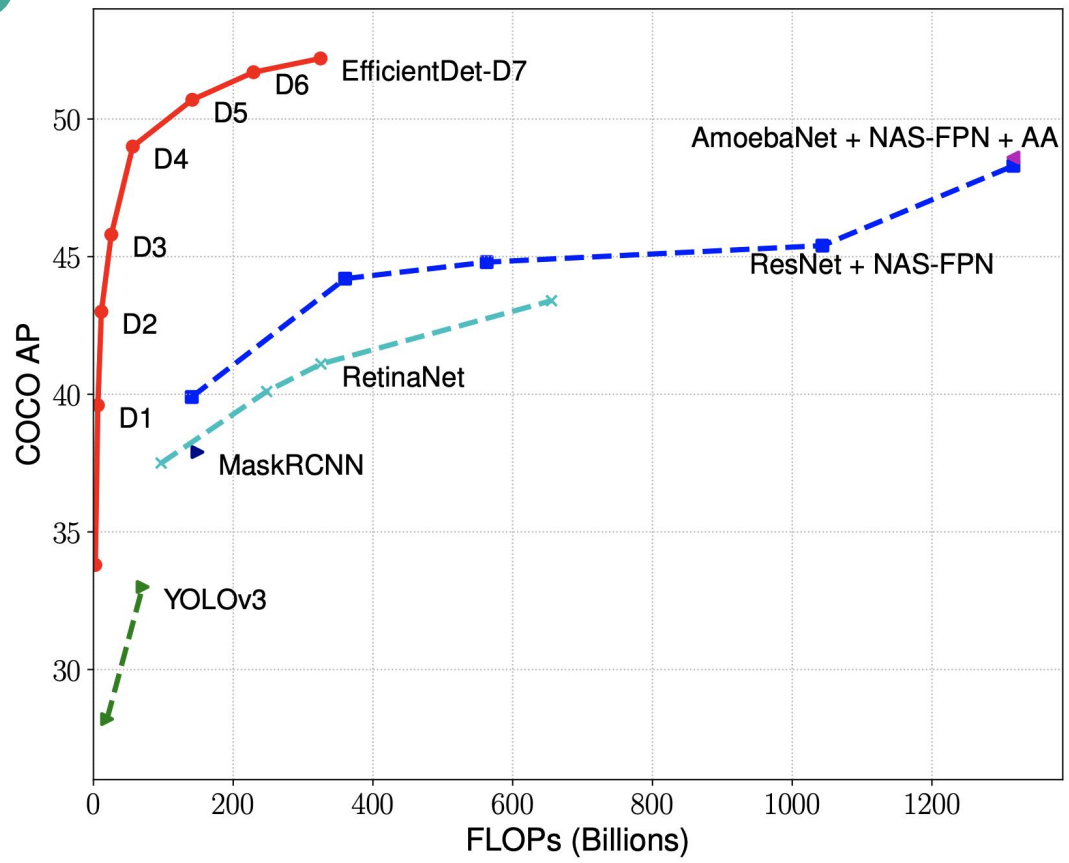

arXiv > cs > arXiv:1911.09070

Computer Science > Computer Vision and Pattern Recognition

[Submitted on 20 Nov 2019 (v1), last revised 27 Jul 2020 (this version, v7)]

EfficientDet: Scalable and Efficient Object Detection

Mingxing Tan, Ruoming Pang, Quoc V. Le

Experiment

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Training

```
CUDA out of memory. Tried to allocate 324.00 MiB (GPU 0; 14.58 GiB total capacity; 12.31 GiB al
ready allocated; 261.56 MiB free; 13.34 GiB reserved in total by PyTorch)
100%|                                                                                | 312/312 [03:49<00:00,  1.36it/s]
Val. Epoch: 4/500. Classification loss: 1997.37586. Regression loss: 5.36046. Total loss: 2002.
73632
  0%|                                                                                | 0/312 [00:00<?, ?it/s]
```

Experiment

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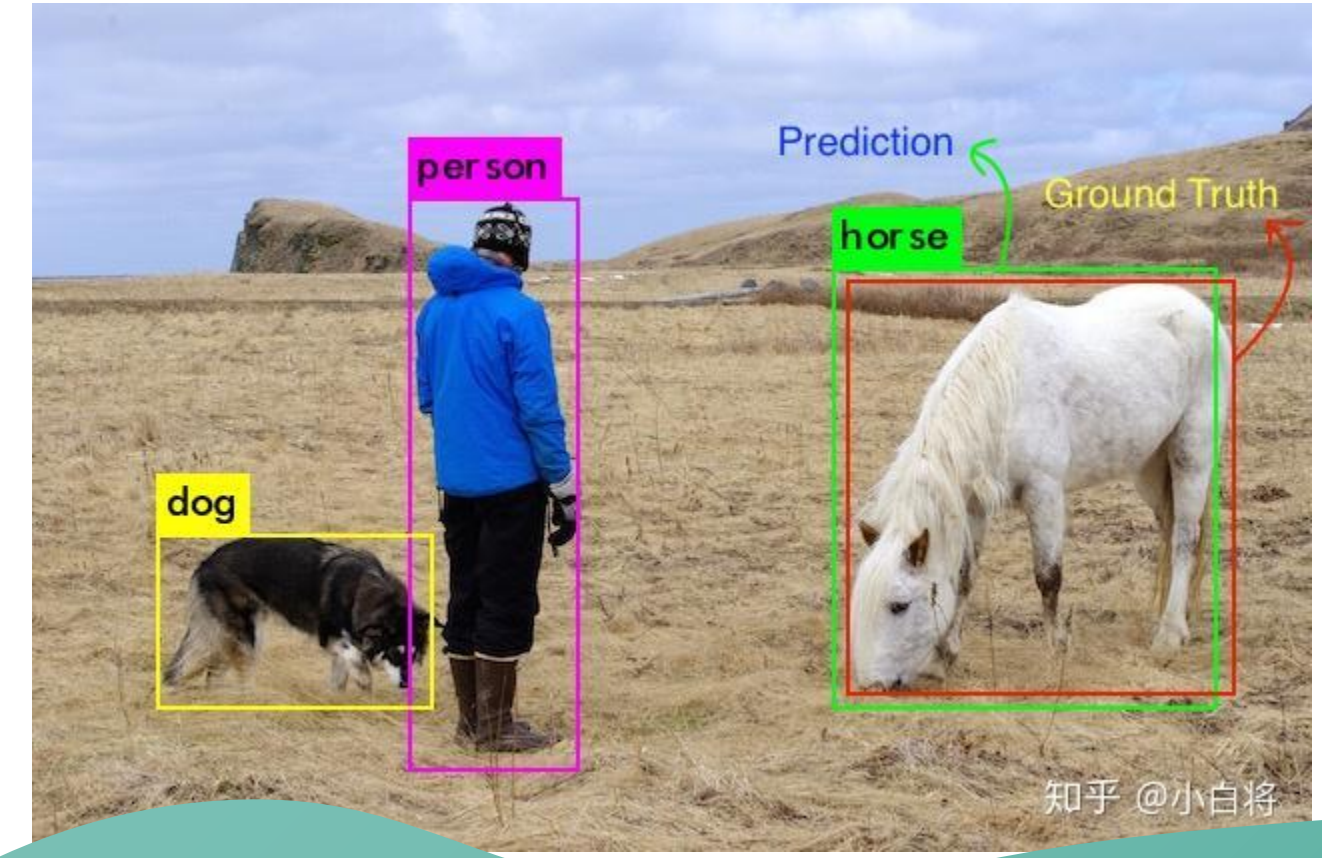
Evaluating using mAP(mean average precision)



$$IoU = \frac{\text{Intersection}}{\text{Union}}$$

Result

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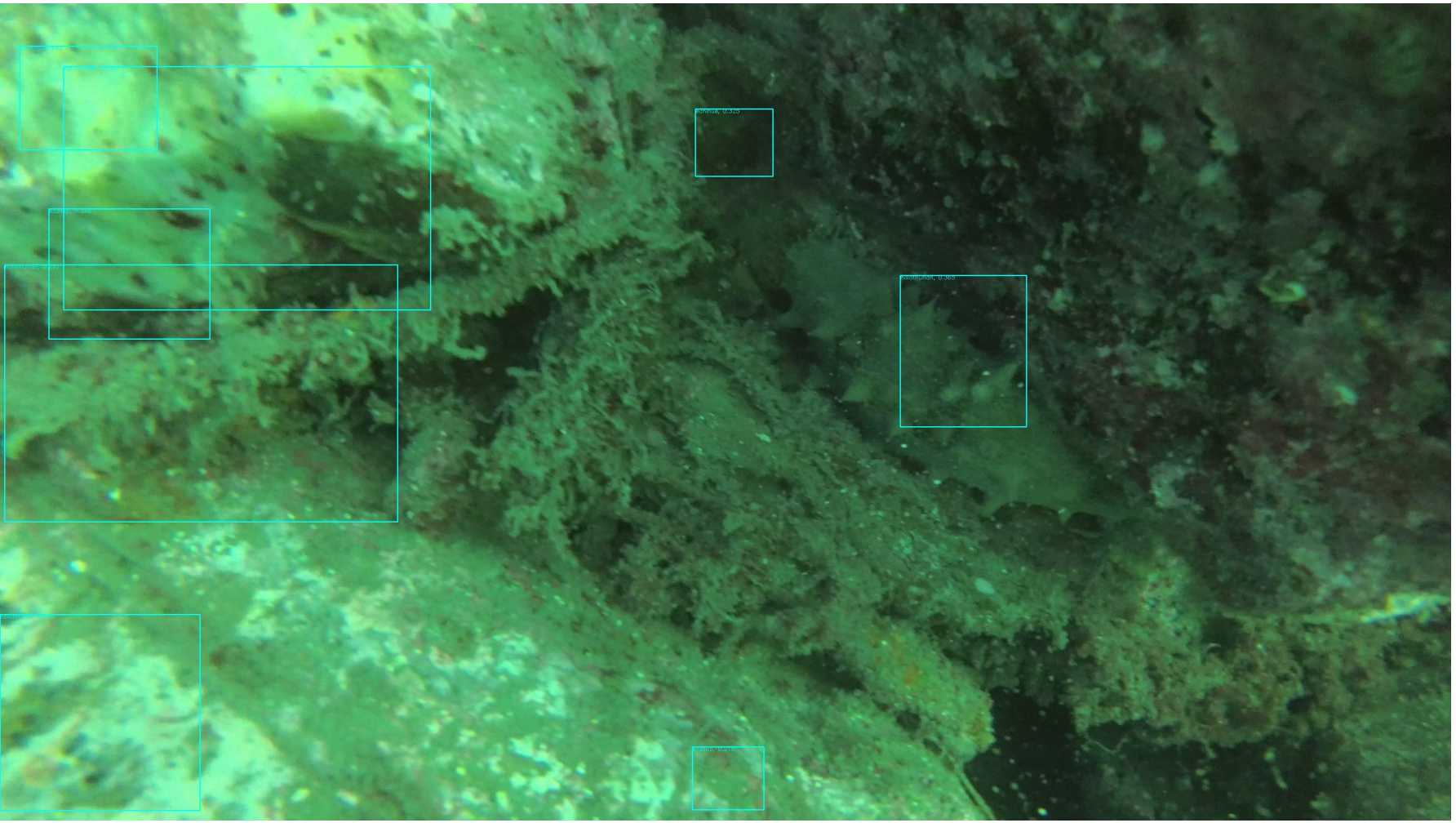

First Trial

good news:
recognized the sea cumber!

to be improved:
reduce the number of
false detections

Result

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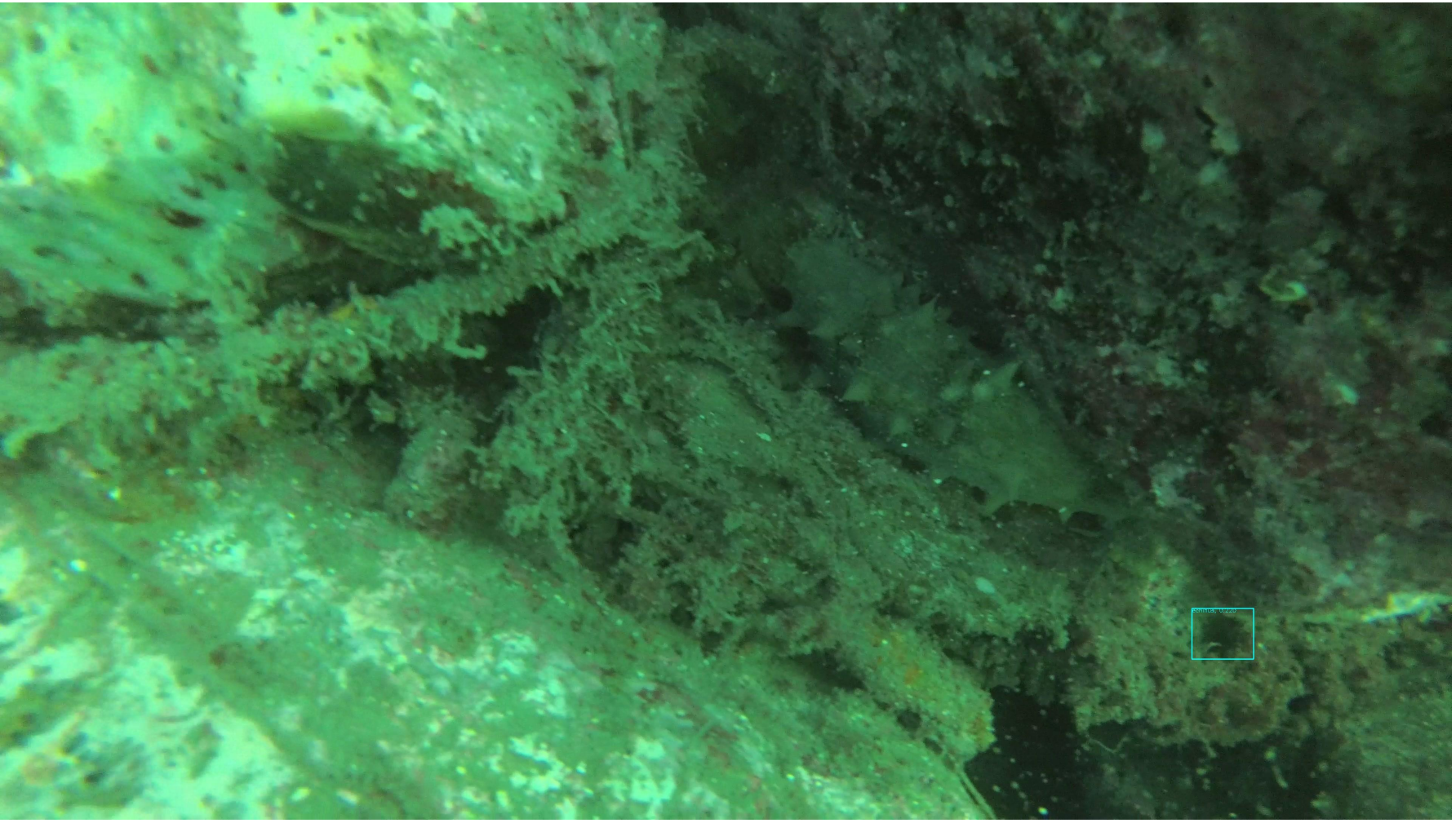

Second trial

good news:
reduced the number of false detections

to be improved:
cannot detect the organism

Result

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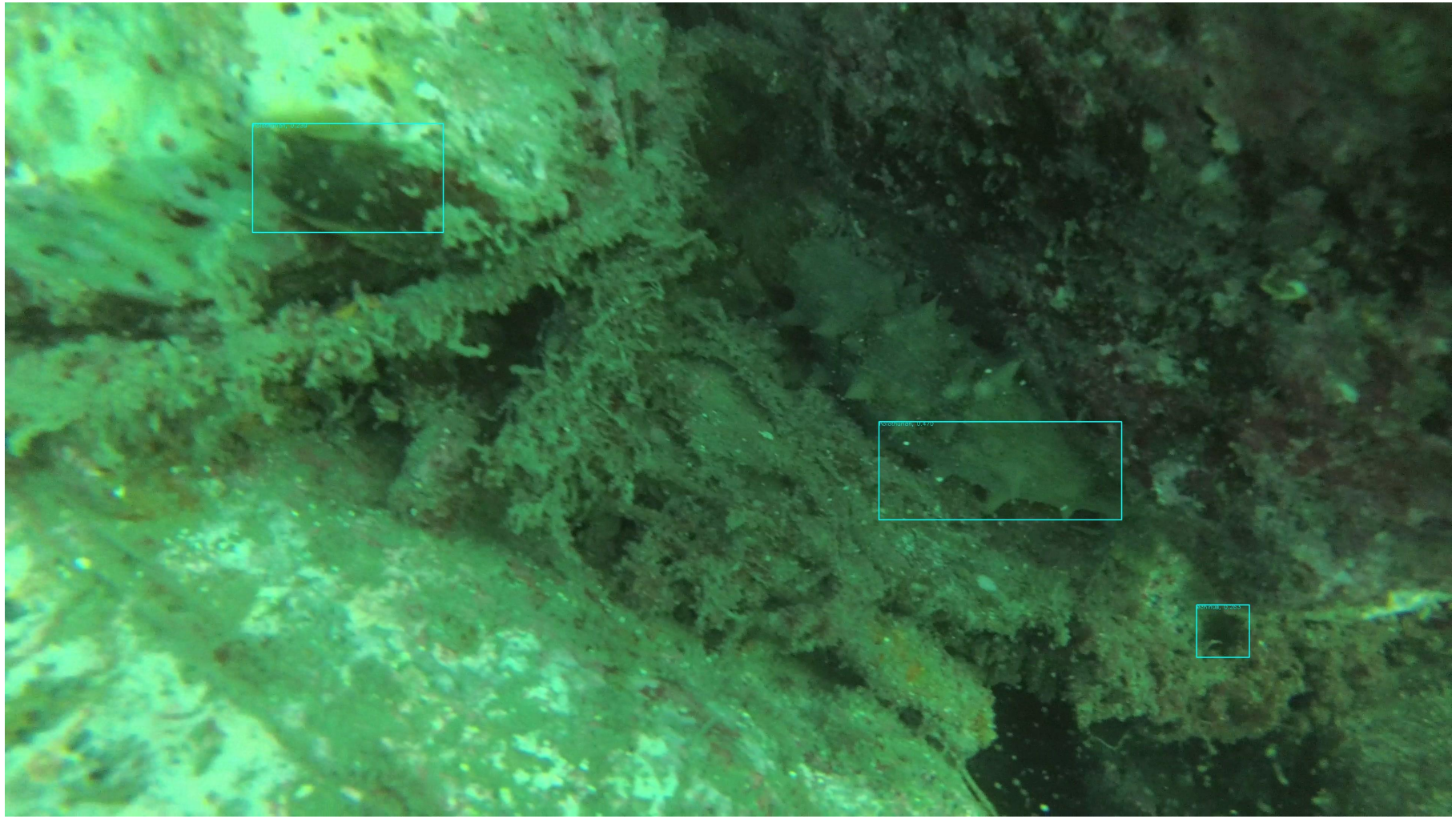

Result

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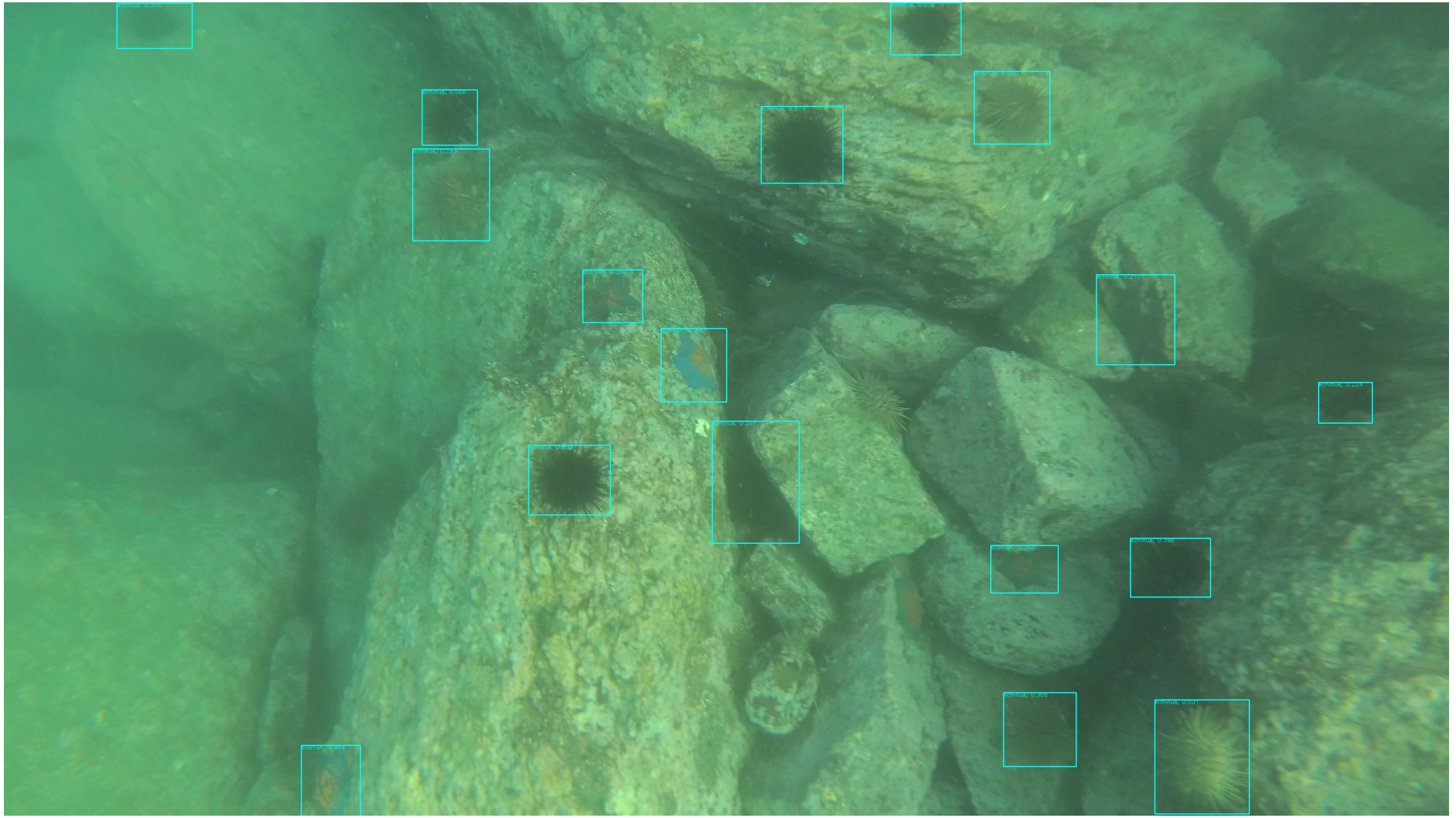
Result

SUSTech Southern University of Science and Technology



Result

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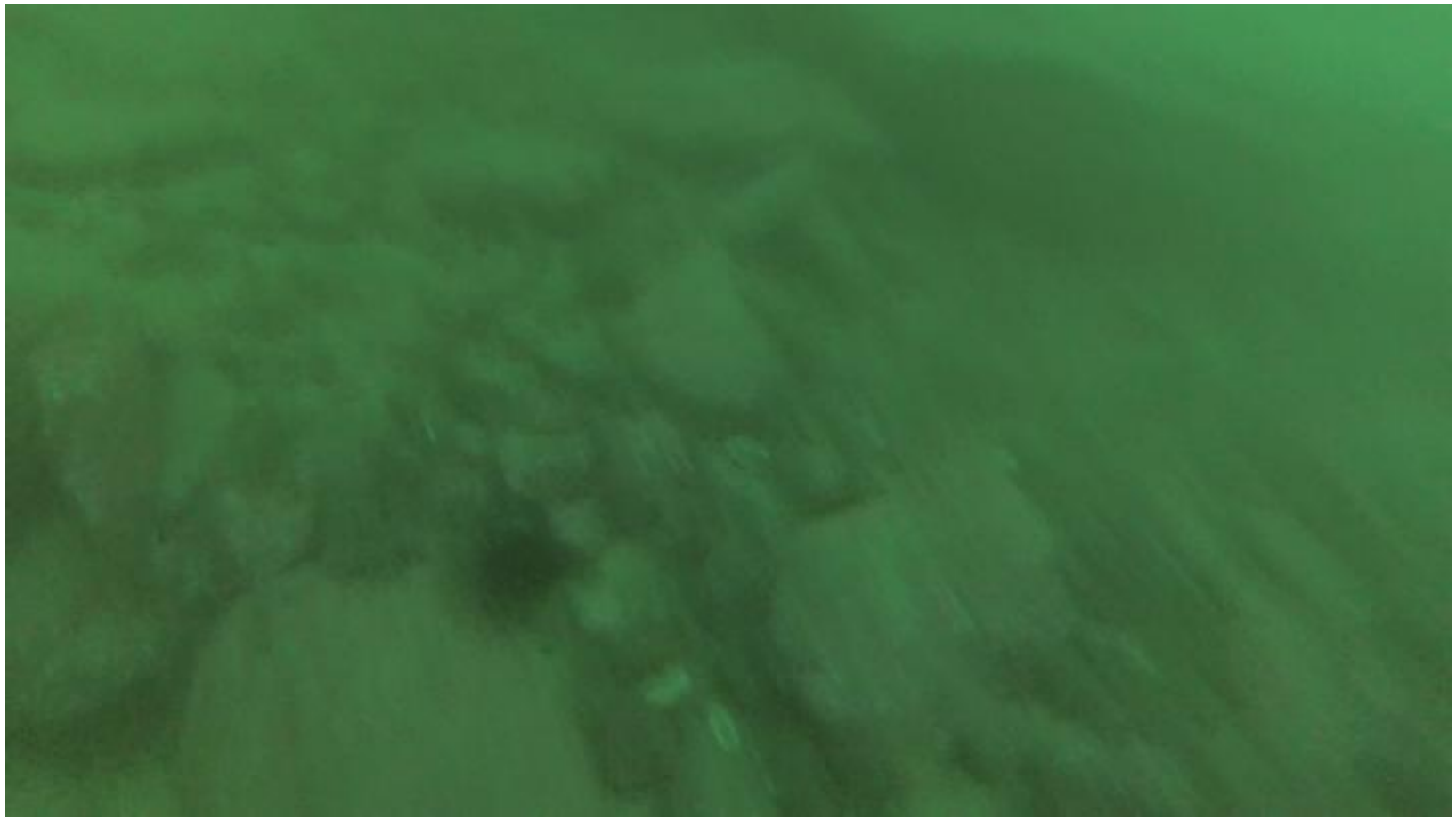

Result

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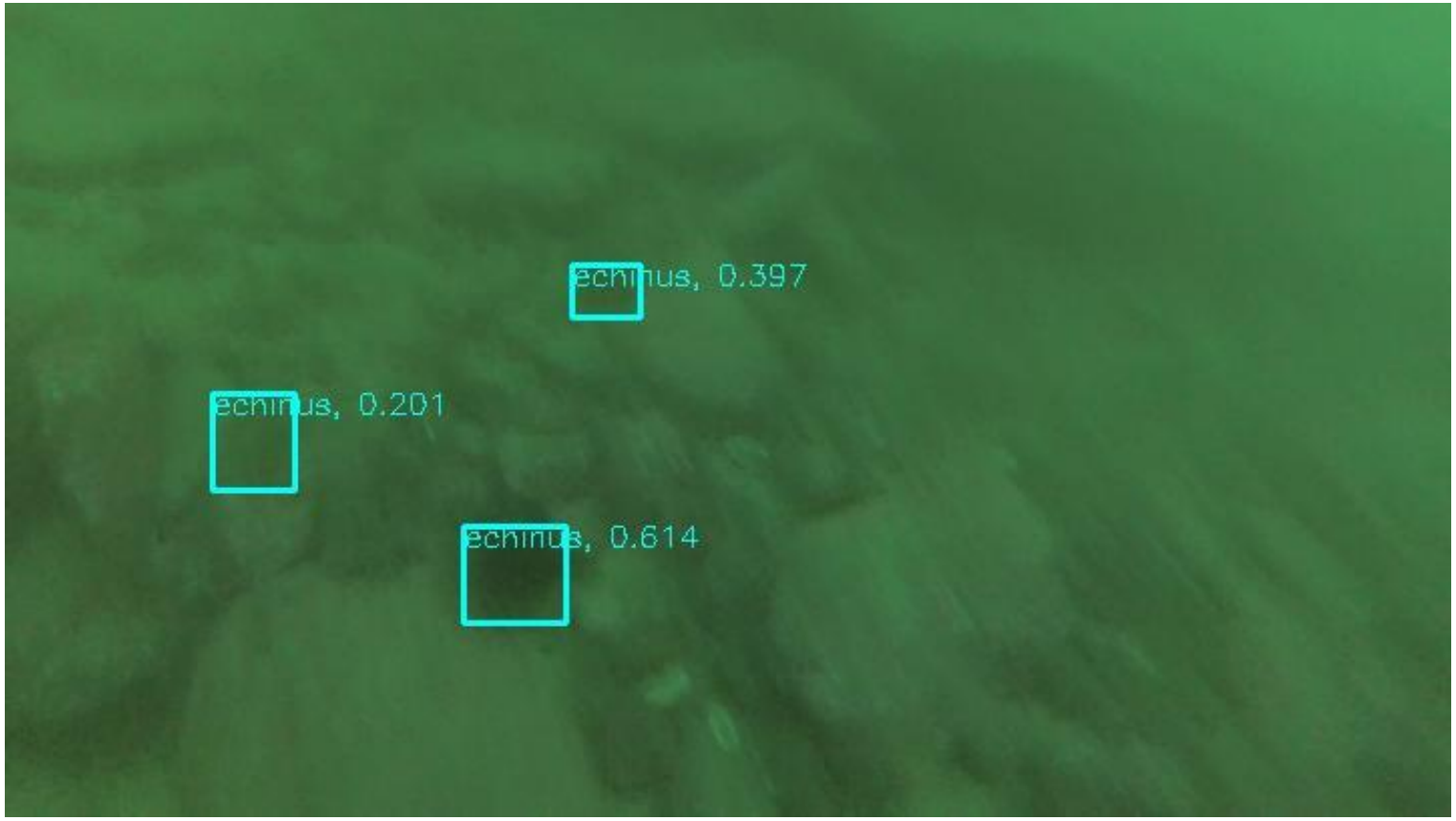

Result

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```
 Average Precision  (AP) @[ IoU=0.50:0.95 | area=   all | maxDets=100 ] = 0.012
 Average Precision  (AP) @[ IoU=0.50      | area=   all | maxDets=100 ] = 0.039
 Average Precision  (AP) @[ IoU=0.75      | area=   all | maxDets=100 ] = 0.003
 Average Precision  (AP) @[ IoU=0.50:0.95 | area= small | maxDets=100 ] = 0.028
 Average Precision  (AP) @[ IoU=0.50:0.95 | area=medium | maxDets=100 ] = 0.028
 Average Precision  (AP) @[ IoU=0.50:0.95 | area= large | maxDets=100 ] = 0.009
 Average Recall     (AR) @[ IoU=0.50:0.95 | area=   all | maxDets=  1 ] = 0.008
 Average Recall     (AR) @[ IoU=0.50:0.95 | area=   all | maxDets= 10 ] = 0.037
 Average Recall     (AR) @[ IoU=0.50:0.95 | area=   all | maxDets=100 ] = 0.083
 Average Recall     (AR) @[ IoU=0.50:0.95 | area= small | maxDets=100 ] = 0.052
 Average Recall     (AR) @[ IoU=0.50:0.95 | area=medium | maxDets=100 ] = 0.114
 Average Recall     (AR) @[ IoU=0.50:0.95 | area= large | maxDets=100 ] = 0.059
```

Result

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```
 Average Precision  (AP) @[ IoU=0.50:0.95 | area=   all | maxDets=100 ] = 0.319
 Average Precision  (AP) @[ IoU=0.50      | area=   all | maxDets=100 ] = 0.598
 Average Precision  (AP) @[ IoU=0.75      | area=   all | maxDets=100 ] = 0.368
 Average Precision  (AP) @[ IoU=0.50:0.95 | area= small | maxDets=100 ] = 0.170
 Average Precision  (AP) @[ IoU=0.50:0.95 | area=medium | maxDets=100 ] = 0.355
 Average Precision  (AP) @[ IoU=0.50:0.95 | area= large | maxDets=100 ] = 0.422
 Average Recall     (AR) @[ IoU=0.50:0.95 | area=   all | maxDets=  1 ] = 0.185
 Average Recall     (AR) @[ IoU=0.50:0.95 | area=   all | maxDets= 10 ] = 0.433
 Average Recall     (AR) @[ IoU=0.50:0.95 | area=   all | maxDets=100 ] = 0.434
 Average Recall     (AR) @[ IoU=0.50:0.95 | area= small | maxDets=100 ] = 0.211
 Average Recall     (AR) @[ IoU=0.50:0.95 | area=medium | maxDets=100 ] = 0.329
 Average Recall     (AR) @[ IoU=0.50:0.95 | area= large | maxDets=100 ] = 0.438
```

Result

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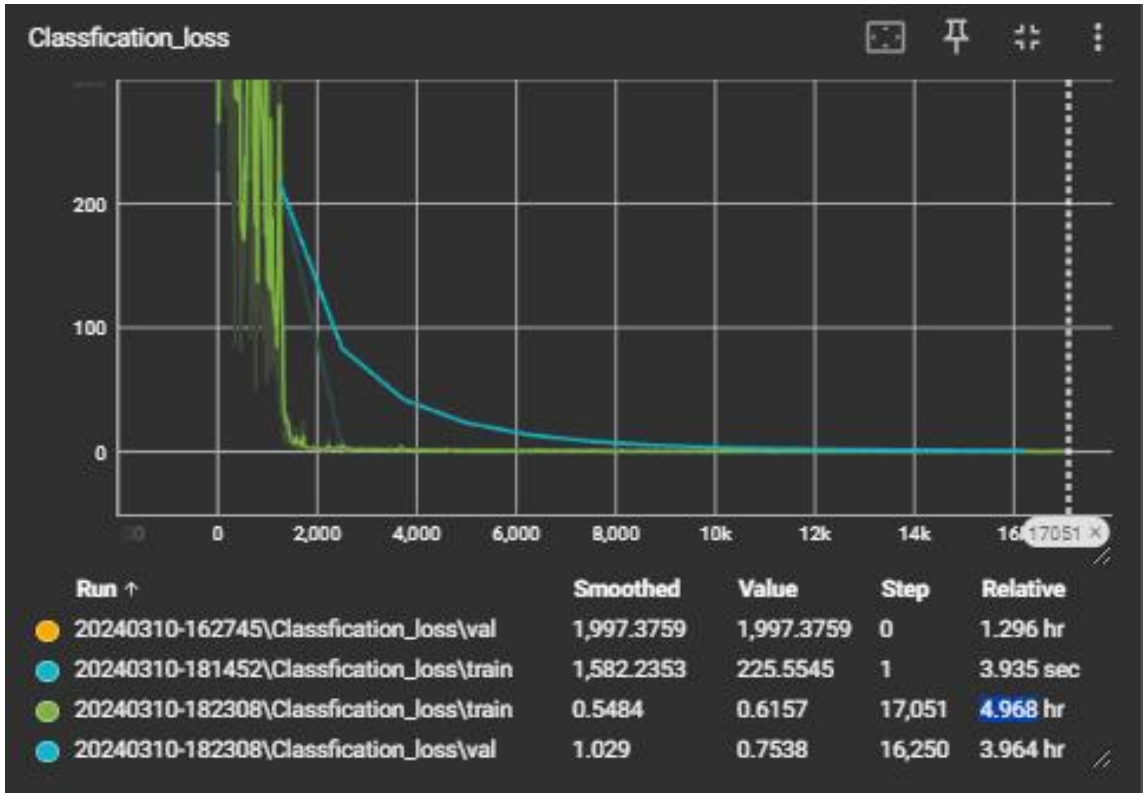
loss convergence during training



Run ↑	Smoothed	Value	Step	Relative
20240310-162745\Classfication_loss\val	1,997.3759	1,997.3759	0	1.296 hr
20240310-181452\Classfication_loss\train	1,582.2353	225.5545	1	3.935 sec
20240310-182308\Classfication_loss\train	0.5484	0.6157	17,051	4.968 hr
20240310-182308\Classfication_loss\val	1.029	0.7538	16,250	3.964 hr

Result

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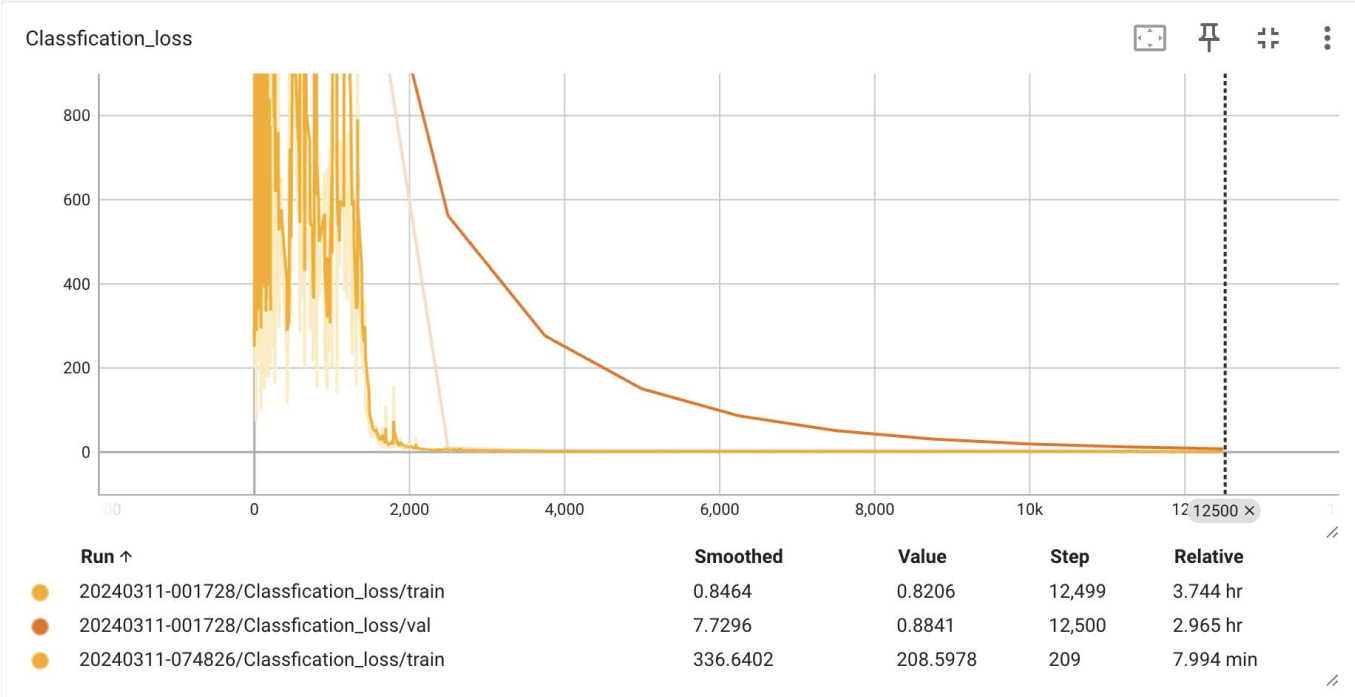
loss convergence during training



Run ↑	Smoothed	Value	Step	Relative
20240311-001728/Classfication_loss/train	0.8464	0.8206	12,499	3.744 hr
20240311-001728/Classfication_loss/val	7.7296	0.8841	12,500	2.965 hr
20240311-074826/Classfication_loss/train	336.6402	208.5978	209	7.994 min

Future work

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- Strenghthen our model (this week)
- Image processing (these 2 weeks)
- Hardware development

Budget

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current used:
cloud server ¥414.46

future budget planning:
cloud server ~¥200
Raspberry Pi~¥500
Controller module ~¥100
Others ~¥300

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Thank You!