Deep neural networks for detection of waste in the deep ocean floor

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Abbreviated abstract: In this work we train deep neural networks based on YOLO architectures for automatic detection of waste in the ocean floor. The dataset includes thousands of natural images captured by remotely operated vehicles (ROVs) with annotated locations of waste, marine life and ROV (Fulton, Hong et al, 2019). The models trained are based on the Yolov5 architecture (Ultralytics, 2021) and show better performance than the previously implemented Yolov2. Performance is further improved by including images from external datasets.

Main Reference:

– M. Fulton, J. Hong, M. J. Islam and J. Sattar, "Robotic Detection of Marine Litter Using Deep Visual Detection Models," 2019 International Conference on Robotics and Automation (ICRA), 2019, pp. 5752-5758, doi: 10.1109/ICRA.2019.8793975.

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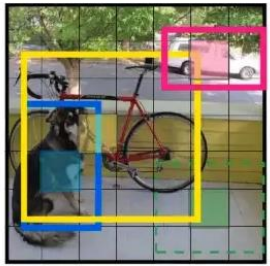
Marine Debris, Object Detection and Main Reference

- Plastic in deep Ocean seafloor
- Difficult do redeem this plastic in deep sea

- Object detection models are trained to locate and classifiy objects.
- Speed models: YOLO (You Only Look Once), Redmond et al (2016); SSD (Single Shot Multibox detection), Wei Liu, et al (2015).
- Precision models: R-CNN, Ross Girshick et al (2014); Faster R-CNN, Shaoqing Ren et al (2016); and others.



YOLO divides the image in a SxS cell grid , Redmond et al (2016)

Create a model able to distiguish plastic from marine life in real time useful to collect marine debris with ROVs (Remote Operated Vehicles).Fulton, et al (2019) compare YOLOv2 with other object detection models.

Goals of the project:

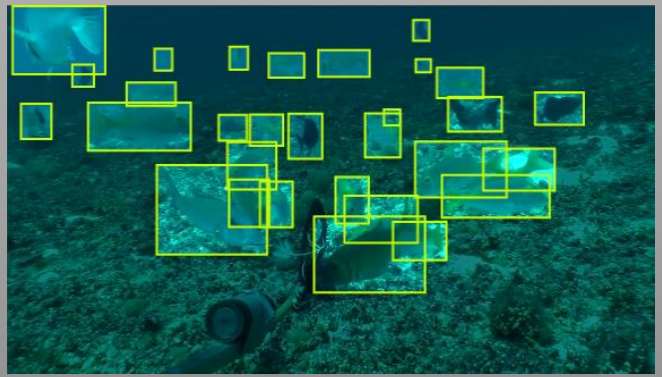
- Implement a more recent model;
- Improve the marine life detection;
- Improve the multiple detections and their precisions.

Improvements

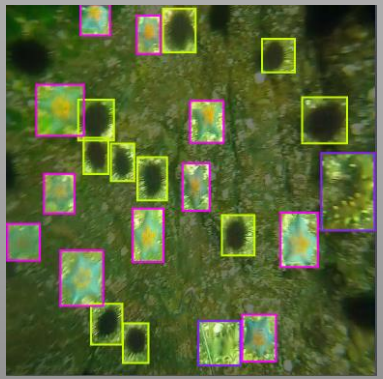
YOLOv2 ⟶ YOLOv5

Trash ICRA19

Fishes Dataset

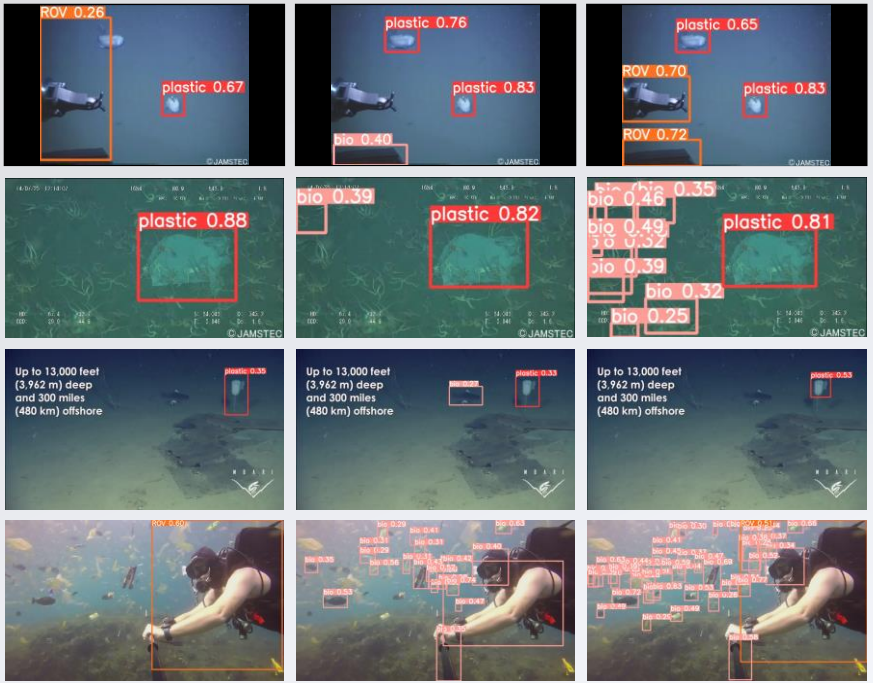


Other marine lifes Dataset



Results and goals

(1) (2) (3)



Mean Avaerage Precision (Map@0,5)	Trash ICRA19 (1)	Trash + Fishes (2)	Trash + Fishes + Marine life (3)
Plastic	0,858	0,838	0,835
Bio	0,0155	0,247	0,0808
ROV	0,328	0,467	0,41
All	0,401	0,517	0,442

Next goal:

- Repair the classifier part. Because of this!

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