

Tihan Hackathon - Milan 2023

Topic - Underwater Object Detection and Classification

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Literature Survey

- As our topic is underwater object detection & classification, we have chosen Faster RCNN , LSTM & yolo models suitable for the task.
- Among the models we have chosen yolo as the best model because it does the detection & classification in one go.
- We have gone through several research papers which are doing object detection using yolo. I have also replicated the results of some papers.

Implementation - Method - 1

- We have taken [DG-Yolo](#) Github , They are doing underwater object detection using yolov3.
- We have taken this github as my reference & we have modified the code by introducing our own image enhancement techniques.
- The model yolov3 is having darknet as the backbone.
- It was trained on URPC 2019 dataset.
- This dataset contains RGB images captured through camera.
- Data Augmentation techniques like Water Quality Transfer (WQT) are being used because the dataset is limited & we can generate alot images using this.
- We have trained the model for 300 epochs on V100 GPU.

Implementation - Results - Method - 1

- After training for 300 epochs in V100 GPU. Below are the results for it:
- Average Precisions:
 - Class '0' (echinus) - AP: **0.736647798837886**
 - Class '1' (starfish) - AP: **0.5825074681705125**
 - Class '2' (holothurian) - AP: **0.379326985027974**
 - Class '3' (scallop) - AP: **0.41007254658974446**
- Overall mAP: **0.42171095972522343**

Implementation - Innovation - Method - 1

- We have added our own image enhancement technique.
- We have also added model compression technique called “Quantization” .
- By this technique, we can reduce the model size there by deploying in the edge devices with having a limited number of resources.
- I have implemented model compression called dynamic quantization, which had reduced the Model size from **240 MB to 70 MB**.
- As you can see we have reduced the model size by $\frac{1}{4}$.
- This is one of the most important technique

Implementation - Method - 2

- We have seen another github [Yolo & MiRnet](#) . They are also doing underwater object detection & classification using yolov8
- We have used MiRnet model for image enhancement technique.
- We trained the model on URPC 2019 dataset.
- The results of this yolov8 model are not good as that of the previous yolov3 model.

Implementation - Impact on autonomous navigation

- These models are very useful in autonomous navigation, because they can easily detect and classify the objects present in the deep sea.
- When a robot is being travelling in the sea, we can deploy this model in it using RoS - Gazebo, we can have data from the robot sensors & can detect what it have seen automatically, there by having easy navigation of the robot.
- Also, We have compressed the model size thereby saving the resources & makes economically useful for the robot to simulate.

**THANK
YOU**