Project Report: Object Detection

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Introduction

This project implements the use of object detection on the duckiebot 19 system. The robot used is the duckiebot model 19 called cd70. The model is trained to detect and identify objects around the duckiebot in the duckietown simulated environment.

Libraries

We imported necessary libraries such as 'os', 'cv2', 'numpy', 'rospy', 'torch'. These libraries provide various functionalities required for image processing, object detection, and interaction with the duckiebot.

Model Training

The dataset was generated by collecting 1000+ plus images from the duckiebot and the online logs. The images were annotated using Roboflow and the dataset was generated by setting valid, train and test images. Then the dataset was used to train the Yolov5 model with batch size 3 and epoch 50 in order for it to detect the selected objects. The objects included: Ducks, Duckiebots, Stop signs, Qr Codes.

1. *Classes.yaml:* The classes.yaml file was created to define the classes and their numbers for model training.

2. *Train.py:* This file was already created by the administrators of Yolov5 and we modified it in order to train our model on our custom dataset.

3. *New_Yolov5.yaml:* This file was created to serve as the configuration file for the training of Yolov5. It includes parameters, anchors, backbone and head.

4. *Publisher.py:* This code is a Python script that implements an object detector using the YOLOv5 model in a ROS (Robot Operating System) environment. The Object_Detector class is defined, which encapsulates the functionality of the object detector. The callback method is defined within the Object_Detector class. It is the callback function that will be executed when a new image message (Image) is received. It converts the image message to a OpenCV image (cv_image), performs object detection using the detect function from the YOLOv5 project, and publishes the detected image using the ROS publisher. The

subscriber method is also defined within the Object_Detector class. It sets up a ROS subscriber to the specified topic ("/cd70/camera_node/image/raw") and links the callback function to handle incoming image messages.

5. *Cd70_detect.launch:* This is a launch file that launches the publisher.py at the cd70 node.

Result and Conclusion

When the files are run on the duckiebot, the duckiebot with the help of its camera recognizes the objects and detects them. The project combines the model training of Yolov5 and ros/python files to implement object detection which can be used with object avoidance models to prevent accidents in real life and simulated environments.