Project Report: Object Detection and Safe Distance Computation
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Introduction:

The Project Aims to perform object detection and safe distance computation on our Duckiebot (DB19). We have trained our model on different environments i.e. color, contrast etc.

Training and model preparation (Object Detection):

Our model is trained on a total of 4151 images taken from the camera and duckietown GitHub. We annotated our data using voTT, which is essentially data labelling and then used roboflow to generate a bigger data set from our annotated images. We used a batch size of 3 due to graphics and our laptop limitations and implemented that on 100 epochs to reach an optimum level of accuracy.

1. For starters, we made a custom data training file called "data.yaml" and developed it to train with 7 classes, namely: ['Duckie', 'Duckiebot', 'Intersection sign', 'QR code', 'Signal sign', 'Stop sign', 'Traffic light'].
2. Then we used yolov5's algorithm to train our model using the "train.py" file.
3. Once our model was trained, we then customized yolov5's "detect.py" to meet our goals of object detection.
4. Then, we developed a "detect_and_publish.py" file which is basically the file we use to publish our object detection node. We took a frame by frame approach where frames were captured simultaneously in real time, our detection models were run on the frame and results published in a sequential manner.
5. duckduckgopls.launch: This is a launch file that launches the publisher.py at the cd70 node

Safe Distance Computation Algorithm:

1. Developed a "safe_distance.py" file which measures distance between the duckiebot and an object using Computer Vision algorithms and publishes data in real time.

Conclusion

To conclude, we are proud to say that our model worked according to our expectations, with an accuracy of 0.817. The object detection algorithm could have been improved to reduce latency with efficient implementation and leveraging latest models of object detection namely yolov8 and TensorFlow. Safe distance computation was also a success since we were able to execute our ideas with an error of only 0.1cm.