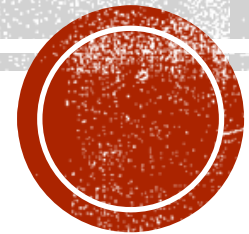


OBJECT DETECTION AND SAFE DISTANCE COMPUTATION

Haider Hussain

Muhammad Qasim Rashid

Pratham Shah



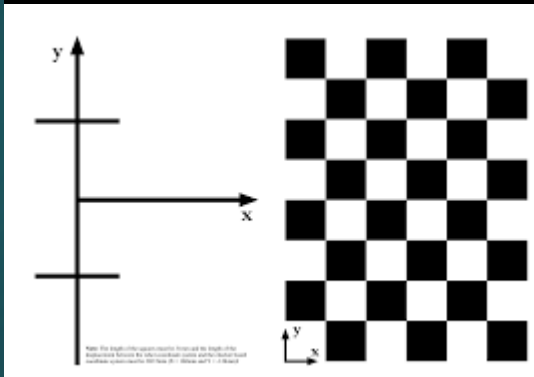


MODEL NAME: DUCKDUCKGOPLS
MODEL VERSION: DB21



INITIAL PROCEDURE AND CHALLENGES:

- INSTALLED DUCKIETOWN
- FLASHED SD CARD FOR DB19 MODEL
- COMPLETED WHEEL AND CAMERA CALIBRATION ON DB19
- SD CARD GOT ERASED
- HAD TO FLASH SD CARD AGAIN FOR DB21
- HAD TO REPLAN OUR PROJECT BASED ON DB21
- COMPLETED WHEEL AND CAMERA CALIBRATION USING DB21



FOR CAMERA CALIBRATION



WHAT IS OBJECT DETECTION AND SAFE DISTANCE COMPUTATION?

- ▶ *Object Detection*: is a task related to machine learning computer vision and image processing that aims to find objects of certain classes in images or videos
- ▶ *Safe distance Computation*: Determining the distance from a camera to the object using machine learning, computer vision and image processing

TECHNOLGIES AND SOFTWARE USED

- ▶ *Python*: important files like train.py detect.py and detect_and_publish.py and safe_dist.py
- ▶ *YOLOV5*: object detection model we used
- ▶ *ROBOFLOW*: dataset creation
- ▶ *VOTT*: annotation tool
- ▶ *ROS NOETIC*

After having our data sets labelled and generated we performed object detection using YOLOv5

YOLOv5: a convolutional neural network (CNN) that detects objects in real-time with great accuracy

Our Model has been trained on 4151 images and 100 epochs, with an overall accuracy of 81.7 %.



CHALLENGES DURING OBJECT DETECTION

- ▶ After running the command for training our dataset initially we got the following error message

QR code 0.57

DDuckie 0.38

Duckie 0.72





```
Epoch   GPU_mem  box_loss  obj_loss  cls_loss  Instances      Size
0% 0/35 [00:16<?, ?it/s]
Traceback (most recent call last):
  File "/content/yolov5/train.py", line 642, in <module>
    main(opt)
  File "/content/yolov5/train.py", line 531, in main
    train(opt.hyp, opt, device, callbacks)
  File "/content/yolov5/train.py", line 286, in train
    for i, (imgs, targets, paths, _) in pbar: # batch -----
  File "/usr/local/lib/python3.10/dist-packages/tqdm/std.py", line 1178, in __iter__
    for obj in iterable:
  File "/content/yolov5/utils/dataloaders.py", line 172, in __iter__
    yield next(self.iterator)
  File "/usr/local/lib/python3.10/dist-packages/torch/utils/data/dataloader.py", line 634, in __next__
    data = self._next_data()
  File "/usr/local/lib/python3.10/dist-packages/torch/utils/data/dataloader.py", line 1329, in _next_data
    idx, data = self._get_data()
  File "/usr/local/lib/python3.10/dist-packages/torch/utils/data/dataloader.py", line 1285, in _get_data
    success, data = self._try_get_data()
  File "/usr/local/lib/python3.10/dist-packages/torch/utils/data/dataloader.py", line 1133, in _try_get_data
    data = self._data_queue.get(timeout=timeout)
  File "/usr/lib/python3.10/queue.py", line 180, in get
    self.not_empty.wait(remaining)
  File "/usr/lib/python3.10/threading.py", line 324, in wait
    gotit = waiter.acquire(True, timeout)
  File "/usr/local/lib/python3.10/dist-packages/torch/utils/data/_utils/signal_handling.py", line 66, in handler
    _error_if_any_worker_fails()
RuntimeError: DataLoader worker (pid 7891) is killed by signal: Killed.
```


- ▶ Errors were pre-mixed and our model was trained on 20 epochs at first to attain optimized output.



```
Epoch  GPU_mem  box_loss  obj_loss  cls_loss  Instances  Size
17/19      0G    0.04695  0.03337  0.009726    19      416: 100%|██████████| 1202/1202 [14:38<00:00, 1.37it/s]
      Class  Images  Instances  P      R  mAP50  mAP50-95: 100%|██████████| 61/61 [00:36<00:00, 1.66it/s]
      all    365    3607    0.537  0.547  0.48    0.226

Epoch  GPU_mem  box_loss  obj_loss  cls_loss  Instances  Size
18/19      0G    0.04655  0.03333  0.009369     6      416: 100%|██████████| 1202/1202 [14:40<00:00, 1.37it/s]
      Class  Images  Instances  P      R  mAP50  mAP50-95: 100%|██████████| 61/61 [00:36<00:00, 1.69it/s]
      all    365    3607    0.467  0.593  0.474    0.225

Epoch  GPU_mem  box_loss  obj_loss  cls_loss  Instances  Size
19/19      0G    0.04567  0.03293  0.009342     3      416: 100%|██████████| 1202/1202 [14:38<00:00, 1.37it/s]
      Class  Images  Instances  P      R  mAP50  mAP50-95: 100%|██████████| 61/61 [00:37<00:00, 1.64it/s]
      all    365    3607    0.492  0.594  0.482    0.224
```

20 epochs completed in 5.216 hours.

Optimizer stripped from runs/train/yolov5s_results2/weights/last.pt, 14.8MB

Optimizer stripped from runs/train/yolov5s_results2/weights/best.pt, 14.8MB

Validating runs/train/yolov5s_results2/weights/best.pt...

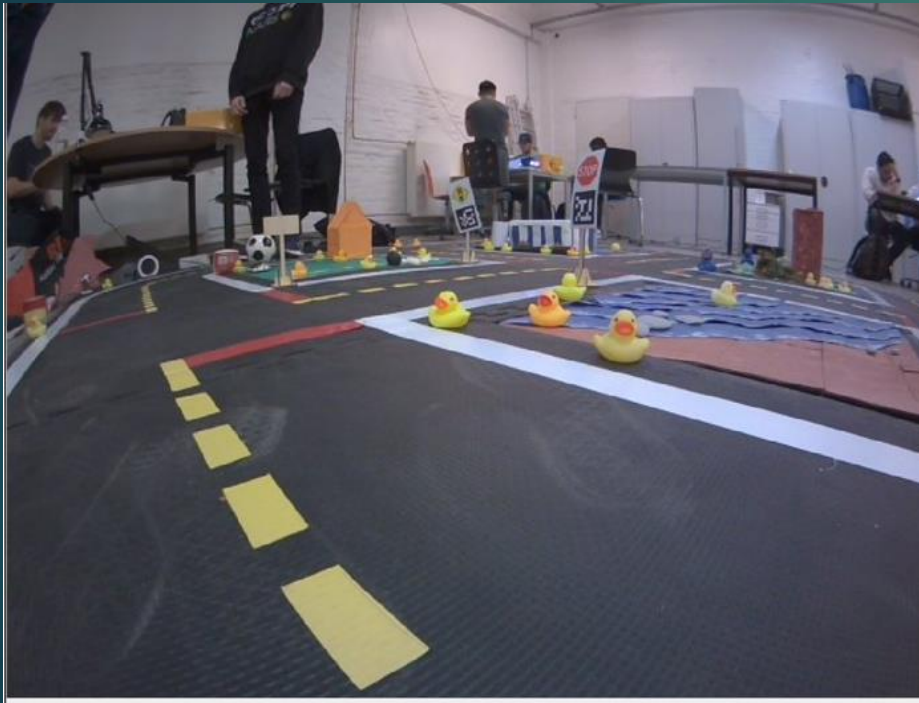
Fusing layers...

custom_YOLOv5s summary: 182 layers, 7262700 parameters, 0 gradients

```
Class      Images  Instances  P      R  mAP50  mAP50-95: 100%|██████████| 61/61 [00:36<00:00, 1.65it/s]
all         365    3607    0.538  0.551  0.48    0.226
Duckie      365    2052    0.681  0.715  0.736    0.354
Duckiebot   365    114     0.298  0.682  0.488    0.182
Intersection 365    302     0.483  0.858  0.612    0.334
QR code     365    792     0.66   0.785  0.784    0.395
Signal sign 365    148     0.289  0.568  0.286    0.151
Stop sign   365     90      1      0     0.23     0.114
Traffic light 365    109     0.353  0.248  0.221    0.0518
```

*** Results saved to runs/train/yolov5s_results2





- ▶ However when we applied this to our Duckiebot it was not detecting the classes

[illegible]



- ▶ The following is the output we got the model with 100 epochs on the duckiebot after running `detect_and_publish.py`



► Safe distance computation In Action

- We Mathematically modelled to measure the current distance to object and trained our model for boundary conditions using differential equations for safe distance to an object and in case it is violated, the model gives back boundary distance exceeded by the respective amount of distance.



```
halder@halder-Insplron-3501: ~/catkin_ws
halder@... x halder@... x roscore ... x halder@... x halder@... x
[INFO] [1684967749.598020]: Safe distance boundary exceeded by: 4.047638
[INFO] [1684967750.598034]: Safe distance boundary exceeded by: 2.828081
[INFO] [1684967751.597528]: Current Distance to object: 5.356644
[INFO] [1684967752.597538]: Current Distance to object: 7.350072
[INFO] [1684967753.597982]: Current Distance to object: 10.866158
[INFO] [1684967754.598037]: Current Distance to object: 6.068214
[INFO] [1684967755.598071]: Current Distance to object: 8.712039
[INFO] [1684967756.598035]: Safe distance boundary exceeded by: 0.248769
[INFO] [1684967757.597756]: Current Distance to object: 12.670976
[INFO] [1684967758.598029]: Safe distance boundary exceeded by: 0.280054
[INFO] [1684967759.597716]: Current Distance to object: 6.225366
[INFO] [1684967760.598047]: Safe distance boundary exceeded by: 2.168568
[INFO] [1684967761.598071]: Current Distance to object: 14.723243
[INFO] [1684967762.598032]: Current Distance to object: 11.351800
[INFO] [1684967763.598086]: Current Distance to object: 11.545531
[INFO] [1684967764.598088]: Current Distance to object: 8.828652
[INFO] [1684967765.598064]: Current Distance to object: 5.476277
[INFO] [1684967766.598095]: Current Distance to object: 9.878148
[INFO] [1684967767.598077]: Safe distance boundary exceeded by: 2.829790
[INFO] [1684967768.597636]: Current Distance to object: 11.934341
[INFO] [1684967769.598039]: Safe distance boundary exceeded by: 2.687335
```



CONCLUSION

- ▶ After multiple challenges we believe we built a highly accurate model of real time object detection
- ▶ We believe this project encapsulates the field of autonomous driving and can serve as a basis for future projects in this field
- ▶ Repository link:
https://github.com/HHUSSAIN31/Object_Detection-with-Duckiebot



main ▾

1 branch 0 tags

Go to file

Code ▾

About

No description, website, or topics provided.

Readme

0 stars

2 watching

0 forks

Report repository

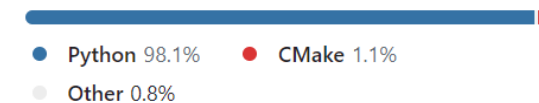
Releases

No releases published

Packages

No packages published

Languages



Haider Qaizar Hussain safe-dist updated

226cc55 yesterday 4 commits

launch	Final	yesterday
scripts	safe-dist updated	yesterday
test	Final	yesterday
train	Final	yesterday
training-images	Final	yesterday
valid	Final	yesterday
.gitignore	Final	yesterday
CMakeLists.txt	Final	yesterday
README.md	readmde.md updated	yesterday
README.roboflow.txt	Final	yesterday
data.yaml	Final	yesterday
package.xml	Final	yesterday

README.md

THANK YOU