Team07 Simulation-Based Autonomous Driving In Crowded City Final Report

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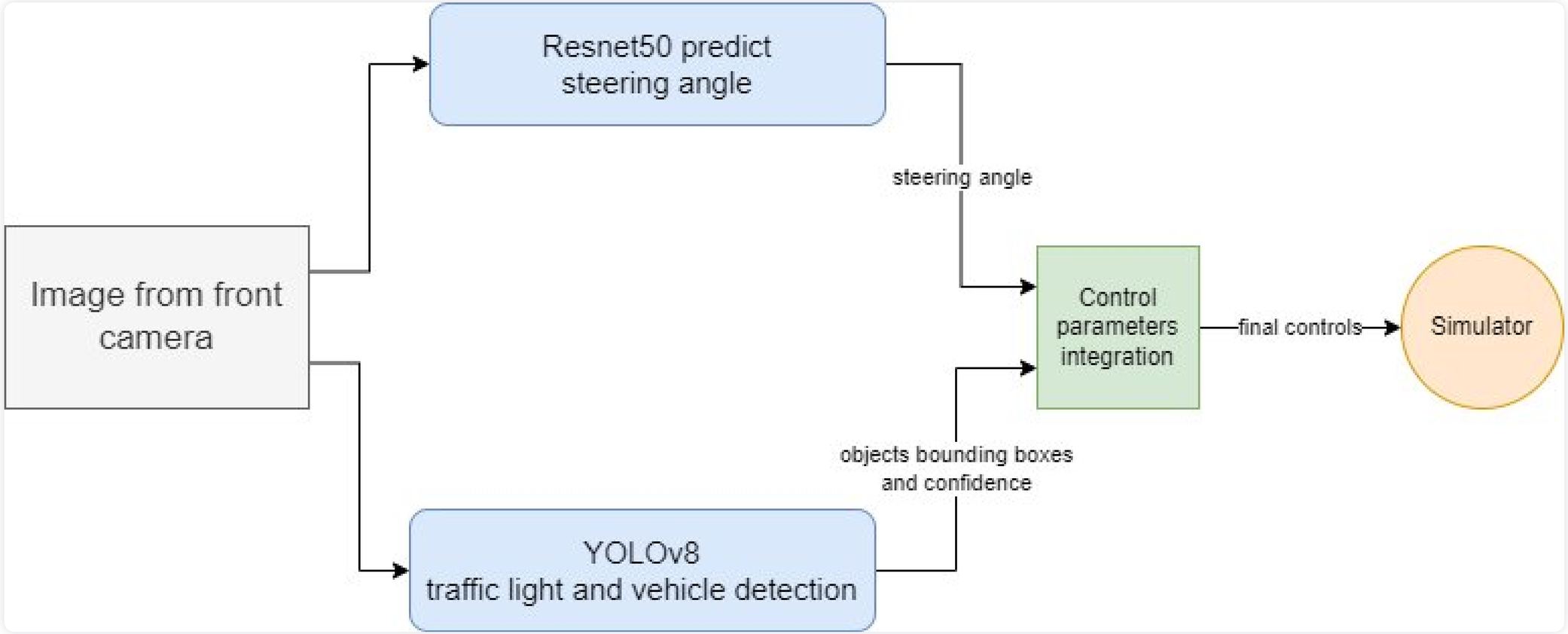
CONTENTS

System Architecture

- end to end autonomous driving project structure



Data Preparation

- Data unbalancing: the amount of image data with steering_angle=0 is significantly higher than image with steering_angle!=0.
- write a script to solve data unbalancing

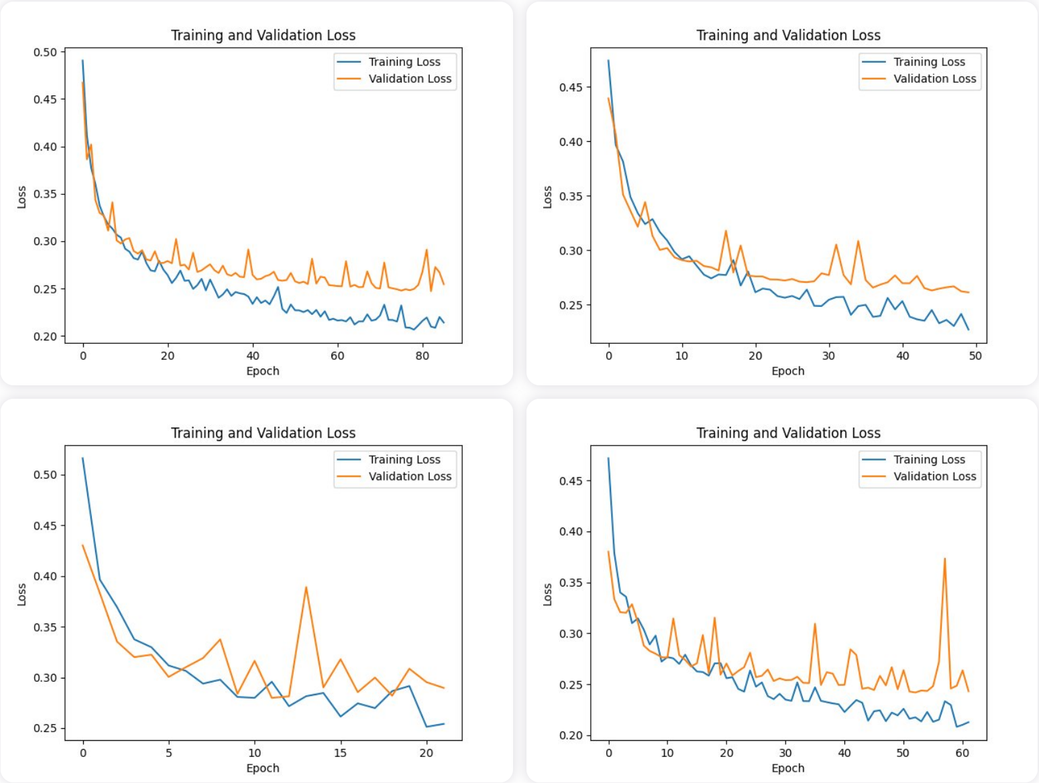
```python
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split

# 步骤1: 读取数据
column_names = ['Image_path', 'throttle', 'brake', 'steering', 'velocity']
data = pd.read_csv( filepath_or_buffer: 'VehicleData.txt', sep=' ', names=column_names, header=None)
print(data.shape)
# 步骤2: 分离出steering angle不为0的数据和为0的数据
non_zero_steering = data[data['steering'] != 0]
zero_steering = data[data['steering'] == 0]

# 步骤3: 从steering angle为0的数据中随机选择同等数量的项
zero_steering_sample = zero_steering.sample(n=len(non_zero_steering))

# 步骤4: 合并数据
final_data = pd.concat([non_zero_steering, zero_steering_sample])

# 步骤5: 分为训练集和验证集
train_set, test_set = train_test_split( *arrays: final_data, test_size=0.2)  # 以80%训练集，20%验证集的比例分割

# 可选: 保存结果到文件
train_set.to_csv('train_set.csv', index=False)
test_set.to_csv('test_set.csv', index=False)

print("训练集和验证集已生成并保存。")
```

Model Architecture

- Resnet50
- Freeze feaure extraction layers
- change fc lager's output channel to 1

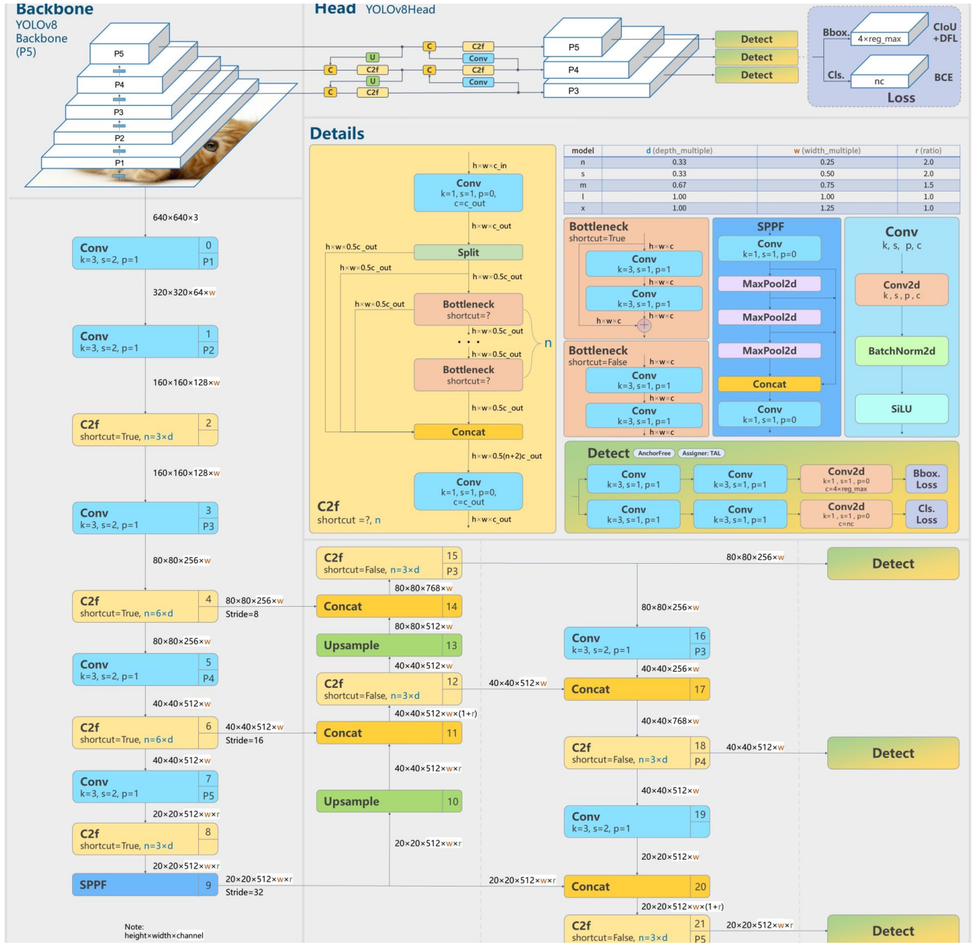
Training Process

- MSE loss
- Adam Optimizer
- batch size :128
- lr: 0.0005
- early stopping at epoch 85



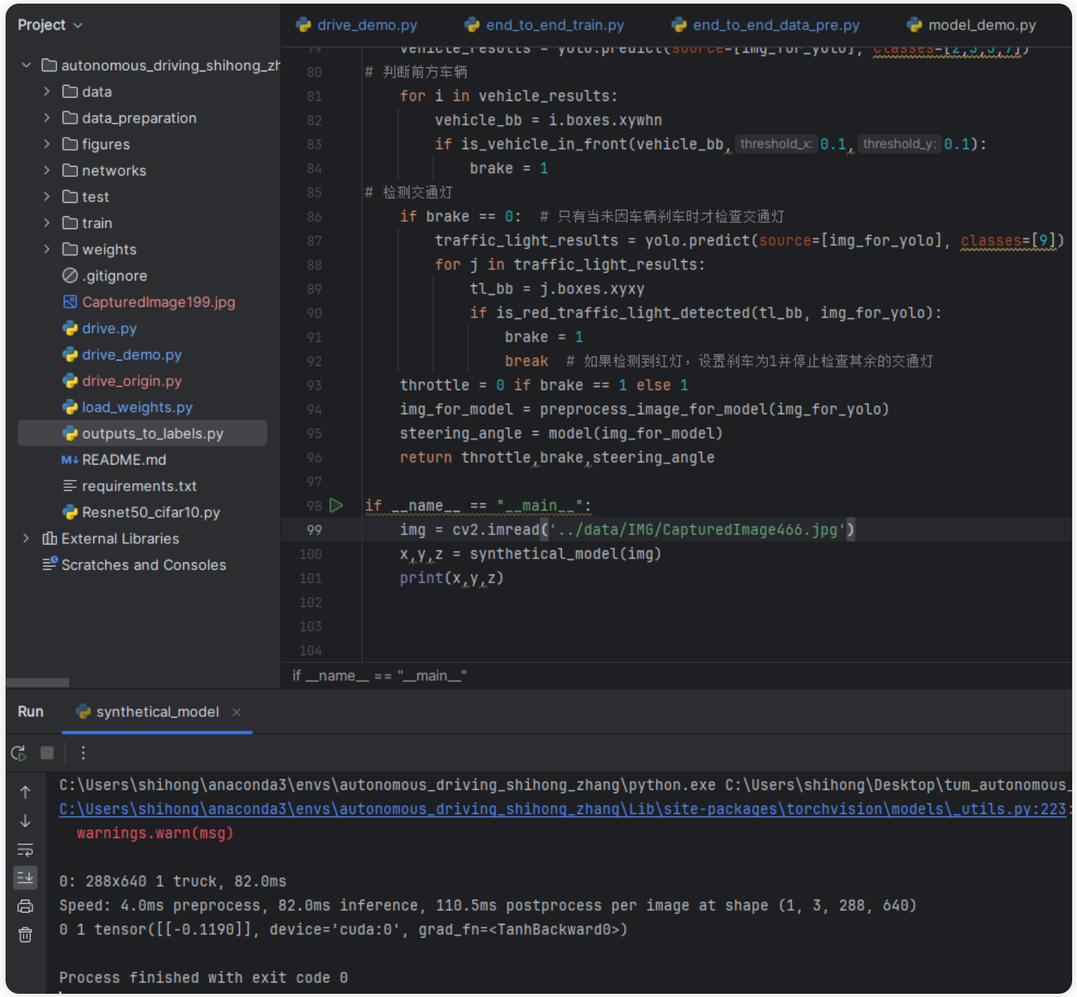
YOLOv8 Model

get pre-trained yolov8 directly from ultralytics



Synthetical Inference

- combine the results from resnet and yolov8
- implement yolov8 for vehicle detection and output bbs if exist
- if brake=0,implement yolov8 for red light detection and output bbs if exist
- define a funtion to recognise if there is any vehicle in front of the car, iuput bbs from last step(2 thresholds)
- define a function to recognise if there is any red light in the img, input bbs and original img
- implement resnet to img and get steering_angle as output
- define a logic to predict throttle, brake and steering_angle.



Conclusions and Future Direction

- this project has achieved a base function of autonomous driving
- real world is much more sophisticated
- only vehicle and traffic light were taken into consideration
- In next step, more complicated circumstances like pedestrian, weather condition should be added

THE END

THANKS