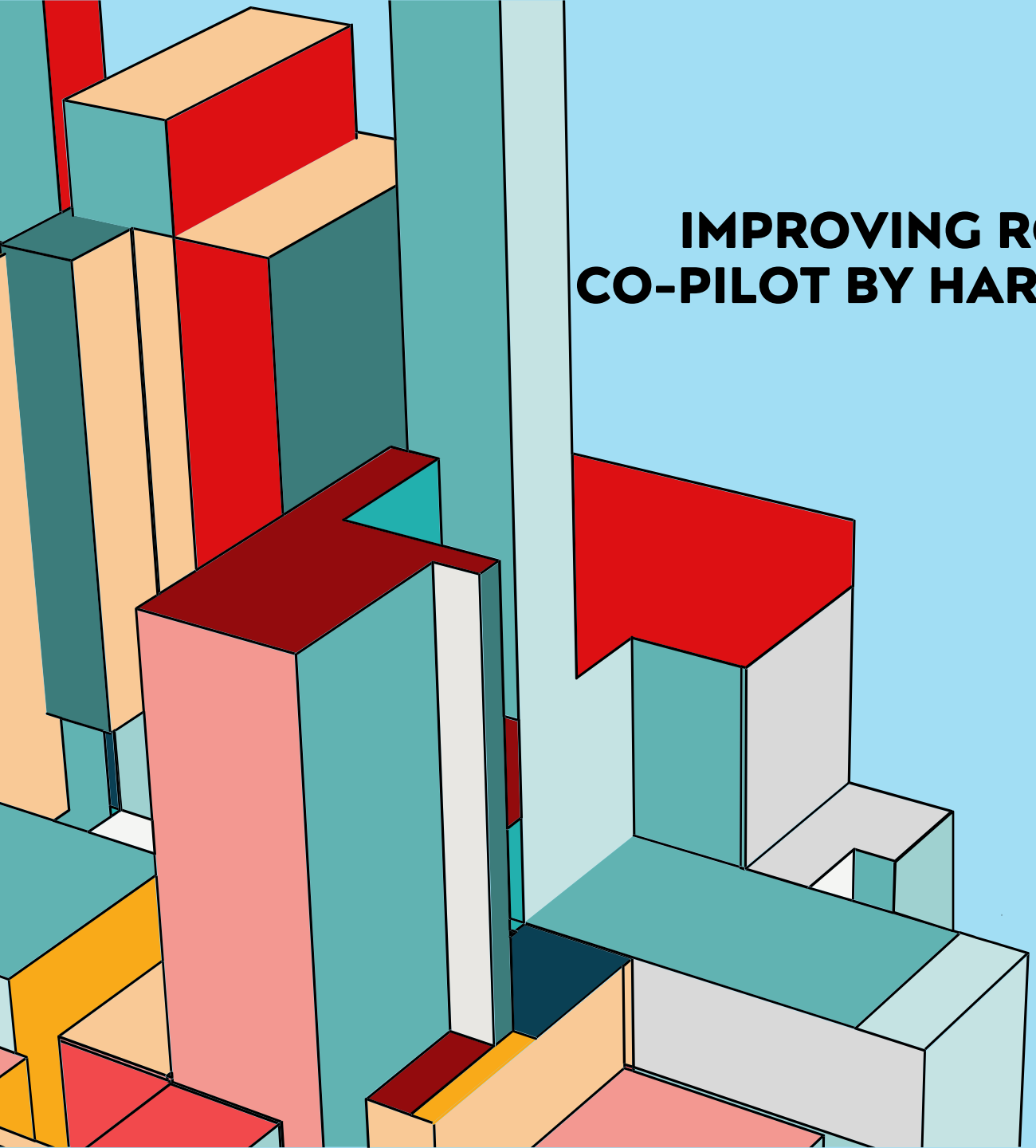

IMPROVING ROAD AWARENESS WITH A REAL-TIME CO-PILOT BY HARNESSING THE POWER OF DASHCAMS

Adrian John

CSC 752 - Computer Vision

Supervised by: Dr. Lina Chato

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0:00:04 0:21:10

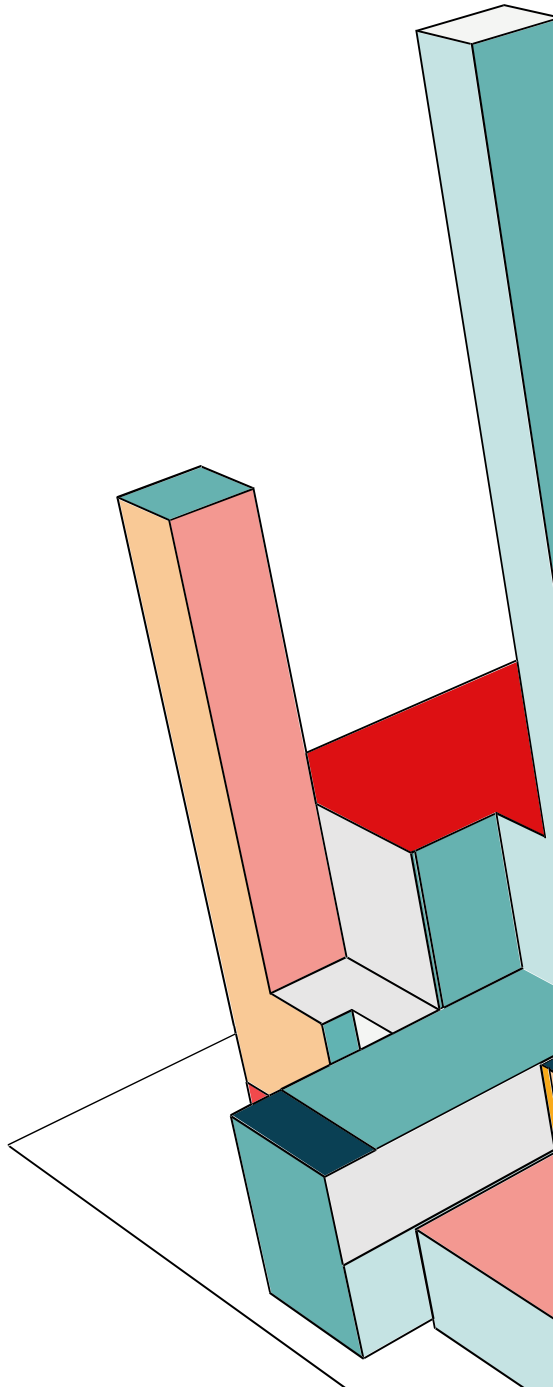
output_video

GOAL

The primary goal of this project is to improve a driver's situational awareness at a low cost by providing real-time alerts about nearby traffic signs, crosswalks, and speed limits using dash-cam footage and machine learning to reduce motor vehicular accidents.

INTRODUCTION

- Motor vehicle accidents led to ~42,795 fatalities in the U.S. in 2022.
- Major causes are speeding and distractions
- Auto co-pilot systems have been proven to reduce accidents but are expensive
- We want to implement a co-piliot accessible and available for everyone to use



DATA

- 877 png image
- Annotations in XML
- Extraction
- Split 80 / 20
- Classes
  - Stop signs
  - Speed limit
  - Traffic lights
  - Cross walks

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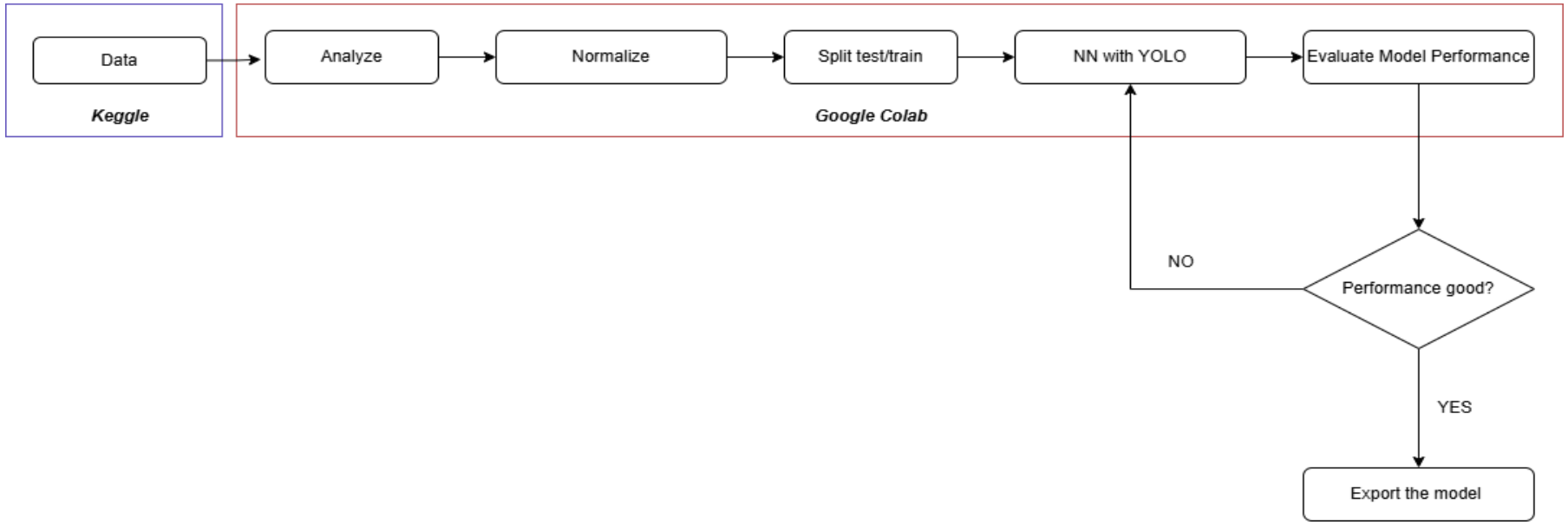
MODEL

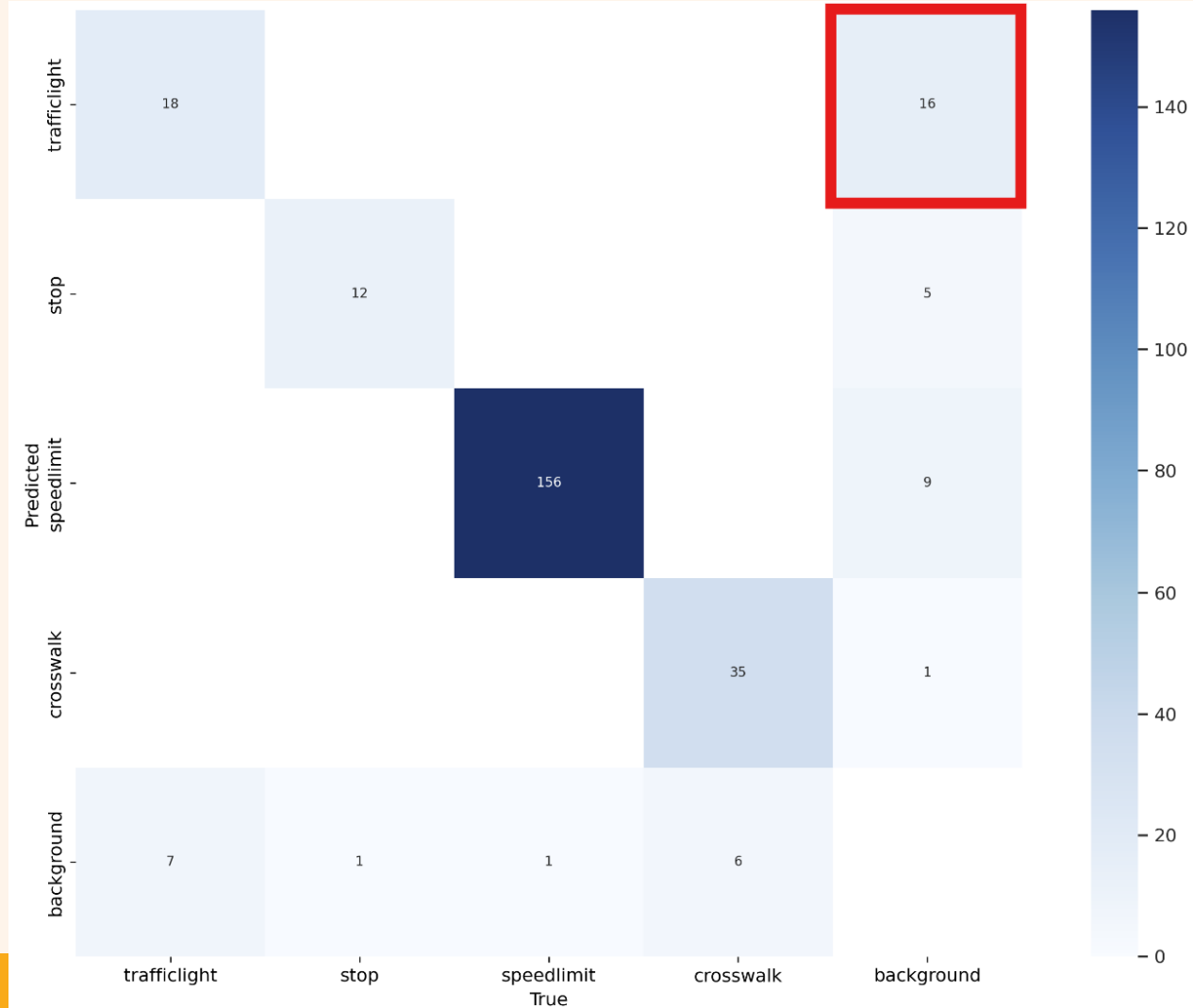
- Pre-trained YOLO (You Only Look Once) model, known for real-time object detection.
- YOLO v11 can detect over 80 object classes.
- Model starts with YOLO11 weights and updates during training
- No modifications was made to the architecture of the neural network



RESULTS

- Overall good performance
- False Positives for traffic lights

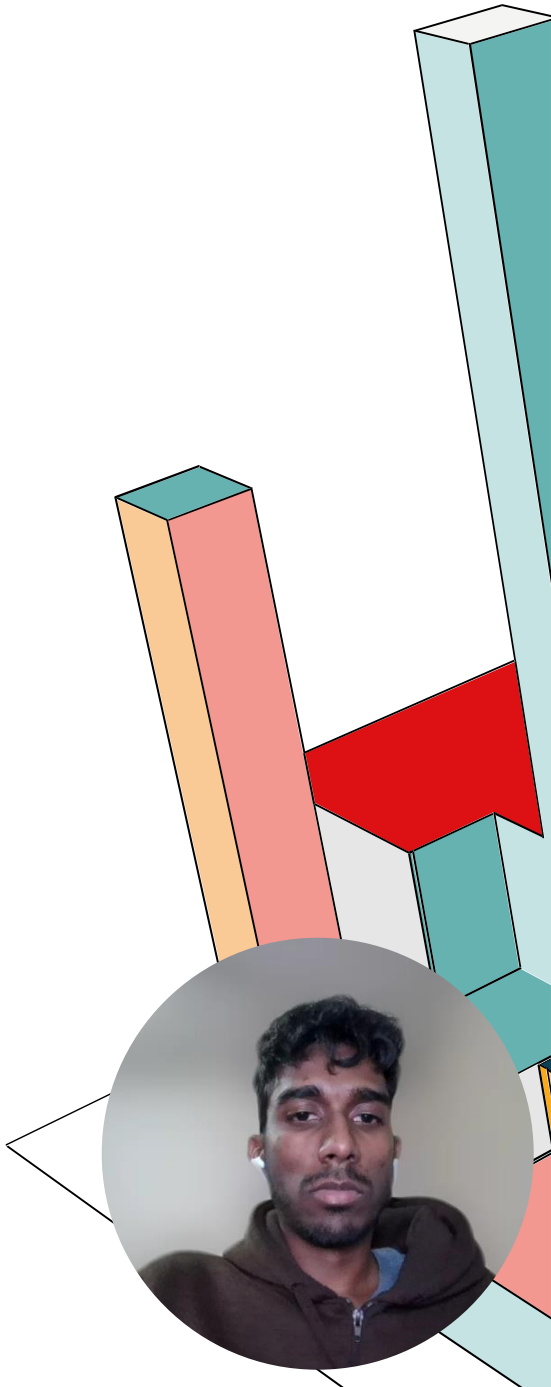
Class	Images	Instances	Precision	Recall
all	176	236	0.837	0.851
trafficlight	18	25	0.648	0.64
stop	13	13	0.77	0.923
speedlimit	137	157	0.958	0.994
crosswalk	36	41	0.972	0.849



YOLO BASE WEIGHTS

YOLO NEW WEIGHTS

road87.png
trafficlight 0.4
stop 1.0
STOP
ALL WAY
road150.png
crosswalk 1.0
depositphotos
road59.png
stop 0.3
STOP
speedlimit 0.3
road72.png
stop 1.0
STOP
road148.png
crosswalk 1.0
road63.png
STOP
road93.png
stop 0.9
STOP
road64.png
stop 0.9
stop 0.4
STOP

CONCLUSION

- This is an affordable solution to help drives be more alert on the road
- Got good performance with YOLO
- Data augmentation is needed to improve dataset diversity
- Investigate speed limit signs