

An abstract graphic on the left side of the slide consists of several 3D rectangular blocks of various colors (red, orange, teal, light blue, and white) arranged in a staggered, overlapping fashion, creating a sense of depth and perspective. The background of the slide is a solid light blue.

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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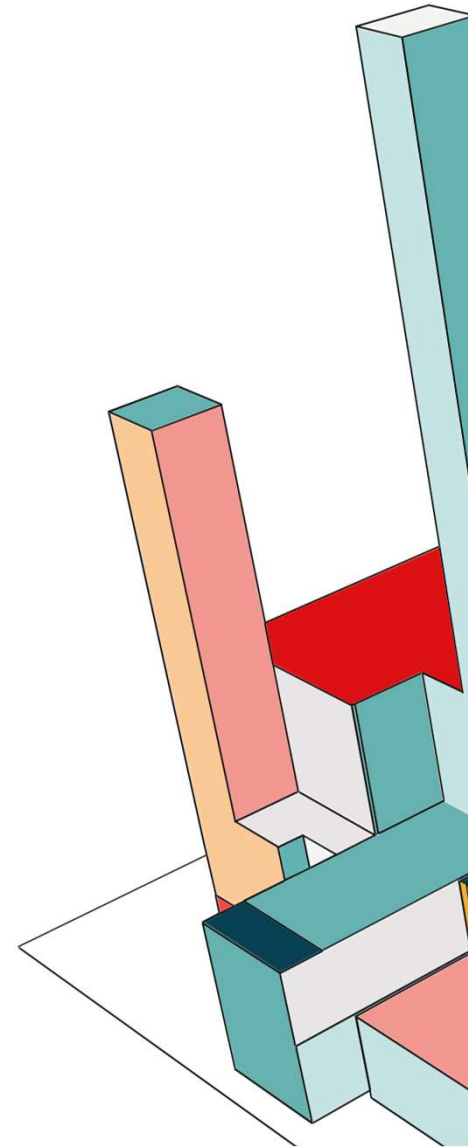
GOAL

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-pilot accessible and available for everyone to use



DATA

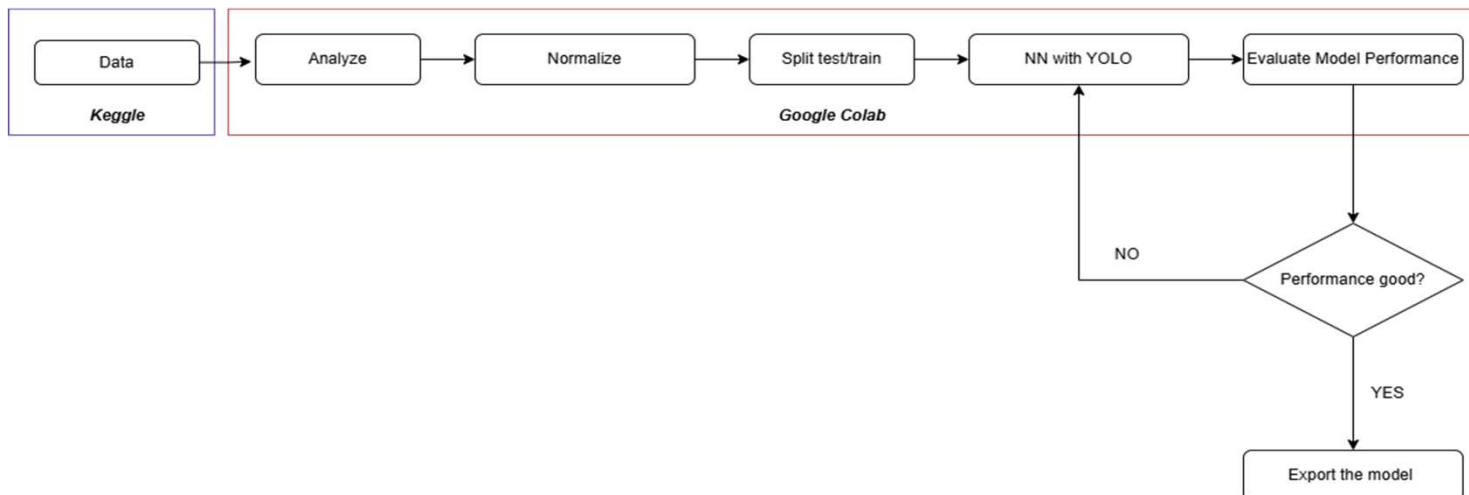
- 877 png image
- Annotations in XML
- Extraction
- Split 80 / 20
- Classes
 - Stop signs
 - Speed limit
 - Traffic lights
 - Cross walks



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MODEL

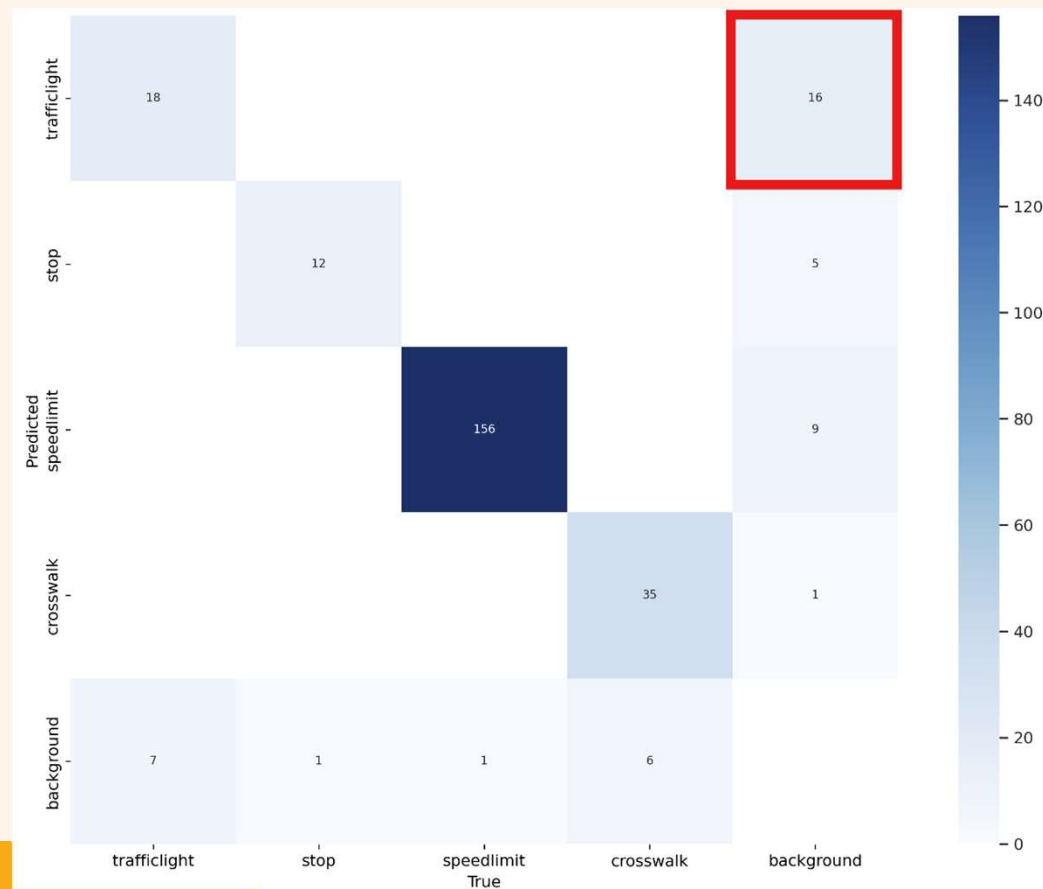
- Pre-trained YOLO (You Only Look Once) model, known for real-time object detection.
- YOLO v11 can detect over 80 object classes.
- Model starts with YOLO11 weights and updates during training
- No modifications was made to the architecture of the neural network



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

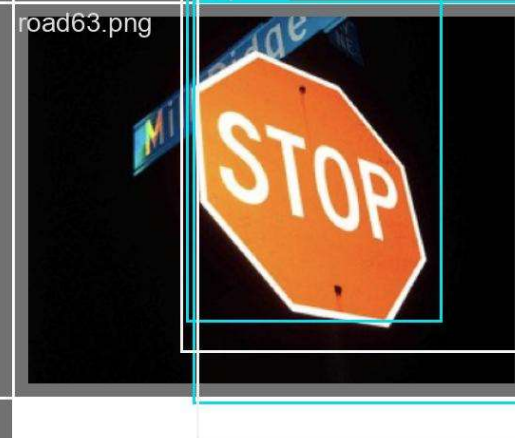
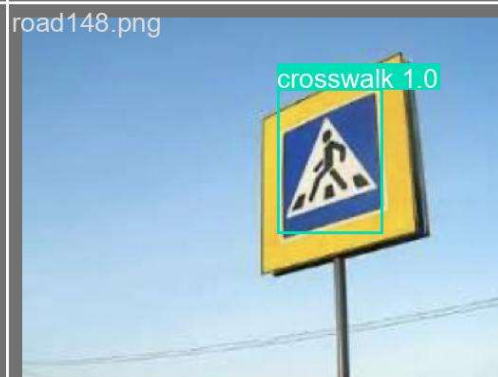


YOLO BASE WEIGHTS



YOLO NEW WEIGHTS





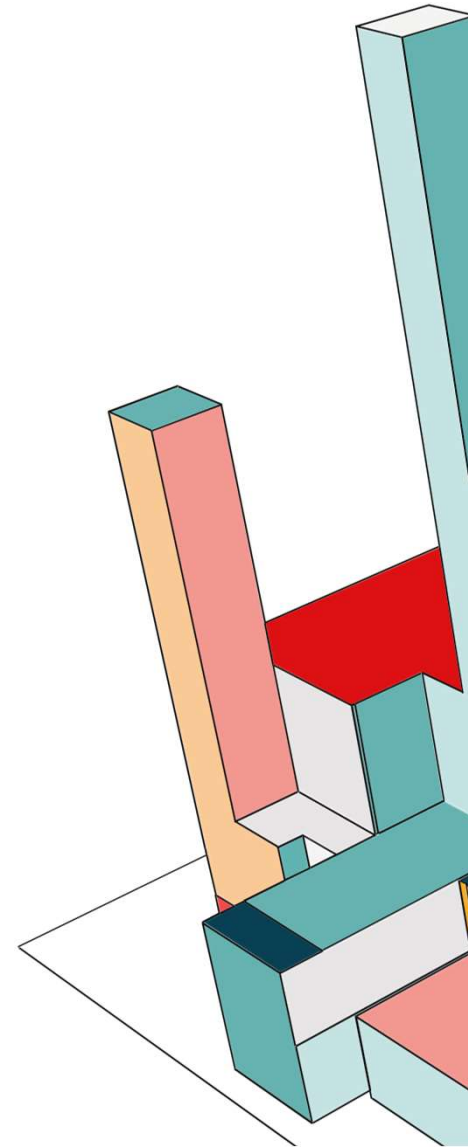
TO BE COMPLETED BY WEEK 16



- Build a demo to demonstrate the model performing on video data
- Improve the performance on the traffic light predictions
- More evaluation of the model performance
- Implement K-Fold cross validation

FUTURE DIRECTION / CV ENHANCEMENTS

- Capture the vehicle speed and compare it to the actual speed limit
- Capture colors from traffic light
- Consider other factors like pedestrians
- Factor distance between car and objects



KEY REFERENCES

Ao, B., Ren, J. and Guo, C. (2019) 'Impact of image corruptions on the reliability of traffic sign recognition using machine learning technique', Proceedings of the 2019 3rd International Conference on Compute and Data Analysis, pp. 6-8. doi:10.1145/3314545.3314547.

Kanchana, B. et al. (2021) 'Computer Vision for autonomous driving', 2021 3rd International Conference on Advancements in Computing (ICAC) [Preprint]. doi:10.1109/icac54203.2021.9671099.