

Exploring Image Preprocessing for Improved Vehicle Detection using YOLOv5

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Motivation



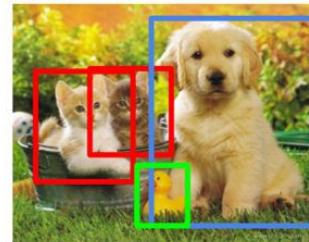
[1]

- **Vision Zero Initiative:** A goal to achieve zero road traffic deaths first proposed in Swedish parliament, adopted by the USDOT [1]
- **Supporting Applications:**
 - Autonomous driving
 - Traffic surveillance
 - Smart city integration
- **Commitment of Car Manufacturers:**
 - Tesla, GM [2], Volvo, Audi, Mercedes, and BMW striving for accident-free vehicles

Background Definitions

- **Object Detection:** identify the location of objects in images [3]
- **You Only Look Once (YOLO) version 5:** fast, accurate real-time object detection algorithm [4]
- **Roboflow:** computer vision developer framework [5]

Object Detection



CAT, DOG, DUCK

[3]



[4]



[5]

Topic Description

Vehicle Type
Bus
Heavy 2 axles
Heavy 3 axles
Light 2 axles
Motorcar
Motorcycle
null (No Vehicle)

[6]

YOLOv5 Model on Custom Data Set

- Vehicle Class Specification [6] data set
- Trained using Roboflow's Jupyter notebook

Test images

- Photographed vehicles around campus in daylight and nighttime lighting
- Included null images (no vehicles)

Observed suboptimal object detection in RGB test images.

Would image preprocessing improve the vehicle detection?

Solution Description

- Applied image preprocessing techniques:
 - **Grayscale Conversion (using intensity formula)**
 - **Unsharp Masking (inspired by A2)**



Grayscale Image

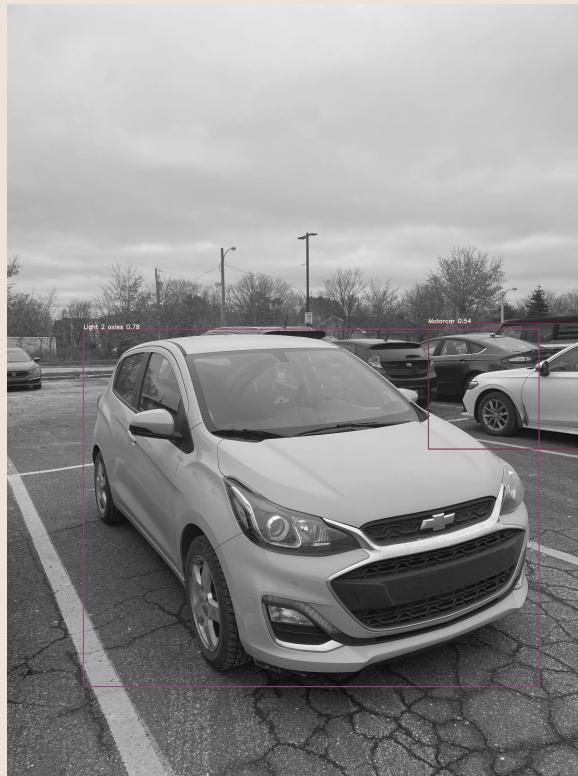


Sharpened Image

Example Results



RGB image result



Grayscale image result



Sharpened image result

Example Results



RGB image result



Grayscale image result



Sharpened image result

Example Results



RGB image result



Grayscale image result

Example Results



Sharpened image result

Summary of Experiment and Results

- The trained YOLOv5 model was run on the 3 sets of the test images taken
- Grayscaled and sharpened images both outperformed RGB in object detection
- Despite improvements, detection was not perfect
 - Build dataset
 - Manual labelling and annotations
- Demonstrated significance of preprocessing in object detection

Demo Time!



[7]

References

- [1] U.S. DEPARTMENT OF TRANSPORTATION Federal Highway Administration. "Zero Deaths and Safe System." [Online]. Available: <https://highways.dot.gov/safety/zero-deaths>. [Accessed: 25 October 2023].
- [2] General Motors. "Path to Autonomous." [Online]. Available: <https://www.gm.com/commitments/path-to-autonomous>. [Accessed: 25 October 2023].
- [3] L. Hulstaert. "A Beginner's Guide to Object Detection." [Online]. Available: <https://www.datacamp.com/tutorial/object-detection-guide>. [Accessed: 25 October 2023].
- [4] G. Jocher. "Yolov5." [Online]. Available: <https://github.com/ultralytics/yolov5>. [Accessed: 25 October 2023].
- [5] Roboflow. "Roboflow." [Online]. Available: <https://roboflow.com/>. [Accessed: 25 October 2023].
- [6] K. Izham. "Vehicle Class Specification Computer Vision Project." [Online]. Available: <https://universe.roboflow.com/khairul-izham-aje9q/vehicle-class-specification/browse?queryText=&pageSize=50&startingIndex=0&browseQuery=true>. [Accessed: 25 October 2023].
- [7] Intel. "Intel RealSense™ Depth Camera D435." [Online]. Available: <https://www.intelrealsense.com/depth-camera-d435/>. [Accessed: 25 October 2023].

Thank you! Questions/Comments?



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