YOLOx Coupled With Multiscale Retinex for Vehicle Detection in Rainy and Foggy Conditions

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Abstract

On-road vehicle detection has become a task of significant importance, especially due to exponentially increasing research on autonomous vehicles during the past few years. Vehicle detection may face several challenges especially due to varying driving conditions and adverse weather conditions including rain, snow, fog, etc. This study proposes the use of YOLOx and multiscale Retinex for vehicle detection in rain and fog. Results exhibit the better performance of YOLOx-s over YOLOx-m and YOLOx-l variants. YOLOx-s has 0.9509 and 0.9524 mAP for rain and fog, respectively. The performance of models is better for foggy weather than rainy weather.

Ⅰ. Introduction

Vehicle detection using video data is an important task for AVs for path planning, vehicle counting, traffic flow, and avoiding collisions. Vehicle detection using video data may face several challenges due to varying traffic conditions where multiple vehicles are to be detected. In addition, adverse weather conditions like rain, snow, fog, and sand storms make vehicle detection challenging. This study adopts YOLOx for improved vehicle detection with multiscale Retinex for image enhancement in rain and fog.

Ⅱ. Method

Figure 1 shows the proposed methodology. YOLOx, a recent addition to the YOLO series is adopted for vehicle detection [1]. Multiscale Retinex is used to remove noise and enhance images affected by rain and fog. Experiments are performed using DAWN, a publicly available dataset. Experiments are performed using 200 images for rain and 300 images for fog.

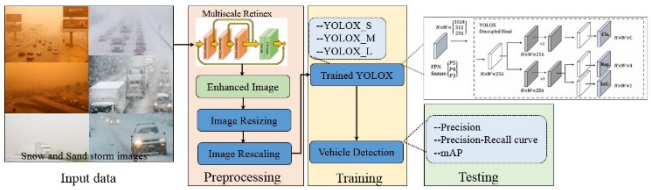


Figure 1. Architecture of the proposed methodology.

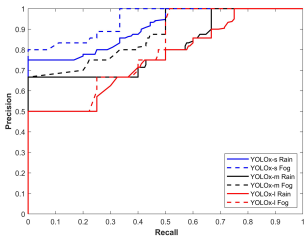
III. Results

Table 1 shows the performance results of YOLOx for all vehicle detection. Table 2 shows mAP for all models for both rain and fog conditions, demonstrating the better performance of the YOLOx-s model over other models.

Table 1. Performance of YOLO in rain and fog.

Model	Parameters (millions)	Average Precision	
		Rain	Fog
YOLOx-s	9.0	0.9509	0.9524
YOLOx-m	25.3	0.9413	0.9393
YOLOx-l	54.2	0.8215	0.9400

Figure 2 illustrates the precision-recall curve of all YOLOX variants for rain and foggy weather. It shows two noteworthy points: the first is the better performance of the YOLOx-s model for object detection while the second is the better performance in foggy conditions.



IV. Conclusion

This study employs YOLOx with a multiscale Retinex for better vehicle detection in rain and fog. Results show an mAP of 0.9509 in rain and 0.9524 in foggy conditions. The model tends to perform better in fog than in rain.

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REFERENCES

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