

1.3 Investigating the Effects of Augmentation Techniques on Interpretability and Performance of Pedestrian Detection Models

Kostadin Cvejovski | Fraunhofer IAIS

Detection

Abstract

This study examines how data augmentation affects the performance and interpretability of pedestrian detection models like Faster R-CNN, SSD, and RetinaNet. Techniques such as Horizontal Flip, AugMix, CutMix, Cutout, and Gaussian Noise were tested on CityPersons, EuroCity Persons, and Caltech datasets. It reveals that there is no consistent link between a model's performance and its interpretability, indicating the need for careful augmentation choices based on the model, dataset, and the desired balance between performance and interpretability. This opens new avenues for research in "performance vs interpretability" in pedestrian detection.

Objectives

- Investigate the impact of different data augmentation techniques on pedestrian detection models.
- Analyze how these techniques affect both model performance and interpretability.

Methodology

- Object detection models: Faster R-CNN, RetinaNet, and SSD
- Data augmentation techniques: AugMix, CutMix-Pedestrian, CutOut-Pedestrian, Gaussian Noise, and HorizontalFlip
- Interpretability: using Network Dissection method for quantifying the interpretability
- Datasets: CaltechPedestrian, CityPersons, and EuroCityPersons

Metrics

- Log-Average Miss Rate (LAMR): $\exp\left(\frac{1}{9}\sum_f \log\left(mr\left(\operatorname{argmax}_{f_{ppi(c)} < f}\right)\right)\right)$
- Pedestrian Unit Activation (PUA) - number of units are detecting pedestrian-related concepts (*person, head, hair, ear, eye, arm, hand, torso and leg*)
- Automobile Unit Activation (AUA) - number of units detecting automobile-related concepts (*car, bus, motorbike, train and wheel*)

Results

- Caltech

	LAMR ↓	PUA ↑	AUA ↑
No Aug.	13.45	51	91
H. Flip	13.65	46	91
AugMix	13.85	49	96
CutMix	13.95	52	93
CutOut	14.50	48	101
G. Noise	14.35	50	95

- CityPersons

	LAMR ↓	PUA ↑	AUA ↑
No Aug.	24	35	72
H. Flip	23	29	71
AugMix	25	38	80
CutMix	26	40	72
CutOut	24	34	62
G. Noise	24	40	82

As the results show, there is no significant link between performance (LAMR) and interpretability (PUA, AUA). Neither, the results show a clear improvement in performance for a specific augmentation technique.

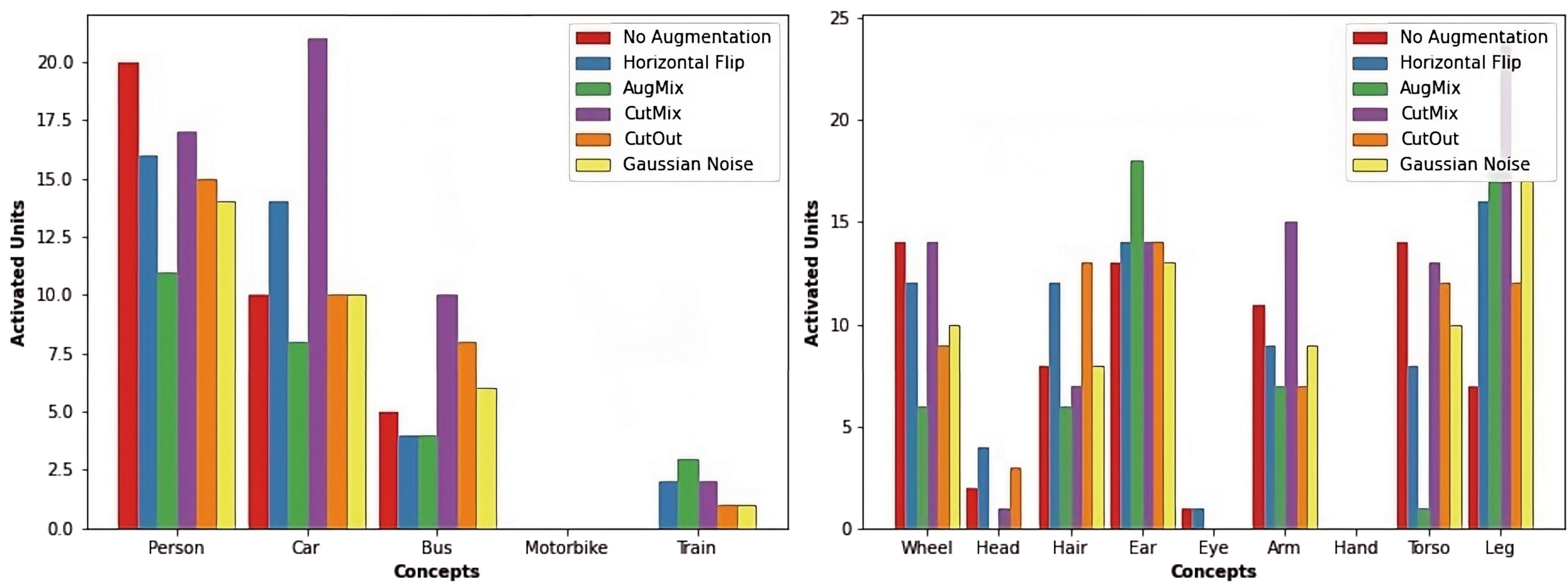


Figure 1: Number of units per concept for different augmentation techniques. (© Fraunhofer IAIS)

Partners



External partners



For more information contact:
kostadin.cvejovski@iais.fraunhofer.de

KI Wissen is a project of the KI Familie. It was initiated and developed by the VDA Leitinitiative autonomous and connected driving and is funded by the Federal Ministry for Economic Affairs and Climate Action.