Traffic Sign Detection

Duygu Sesver

Overview

- Recap
- Yolo - v4
- Data Flow
- Data Augmentation
- Results
- Conclusion

Recap of Project

Object Detection
Dataset (German Traffic Sign Detection)
Architecture (YOLO)
Framework (Darknet)
Evaluation Metrics

YOLO

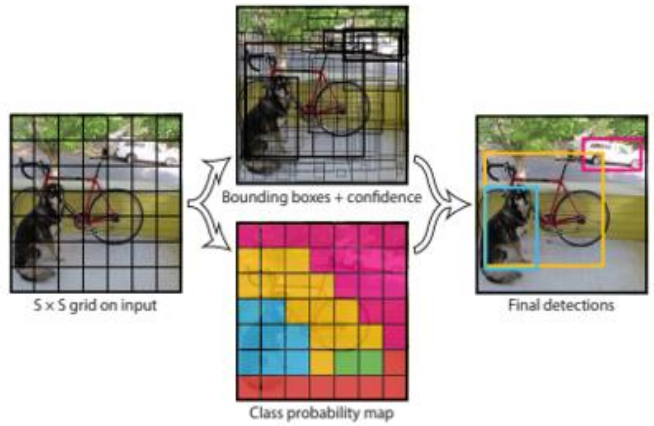
$$\Pr(\text{Class}_i|\text{Object}).$$

$$\Pr(\text{Object}) * \text{IOU}_{\text{pred}}^{\text{truth}}$$

$$\Pr(\text{Class}_i|\text{Object}) * \Pr(\text{Object}) * \text{IOU}_{\text{pred}}^{\text{truth}} = \Pr(\text{Class}_i) * \text{IOU}_{\text{pred}}^{\text{truth}}$$

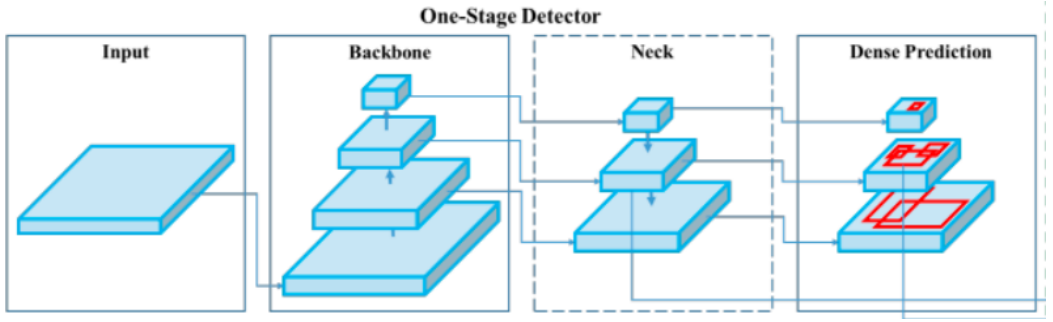
Output Tensor = S ×S ×(B ∗5 + Classes)

- Uses entire image to predict each bounding box.
- Divides the input image into an S × S grid.
- Each grid cell predicts B bounding boxes and confidence scores for those boxes.
- Each bounding box consists of 5 predictions.
- Each grid cell also predicts C conditional class probabilities



For evaluating YOLO on PASCAL VOC, we use $S = 7$, $B = 2$. PASCAL VOC has 20 labelled classes so $C = 20$. Our final prediction is a $7 \times 7 \times 30$ tensor.

What’s new in Yolo



- Yolo v4 : Superior, Faster & More Accurate Object Detection
- Achieves 43.5% AP for MS COCO.
- Bag of Freebies & Bag of Specials
  - CIoU Loss
  - Mish activation function
  - Class label smoothing
  - Data Preprocessing

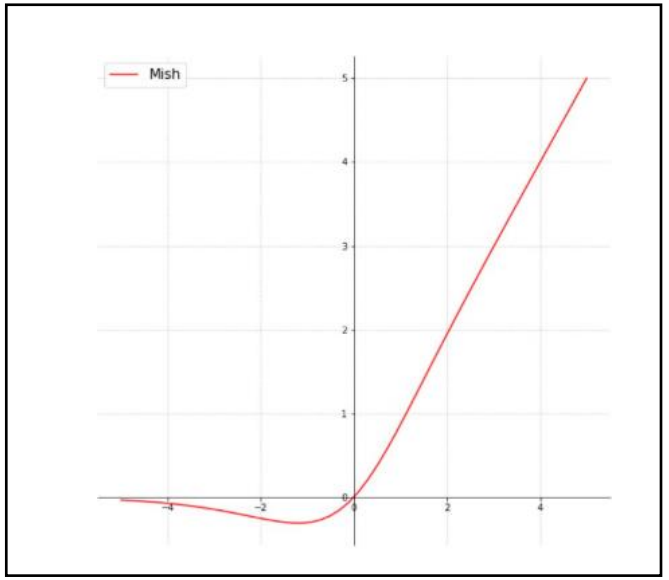
Class label smoothing
[[0, 0, 0, 0.9, 0, 0, 0, 0, 0, 0]] # Image with label "3"

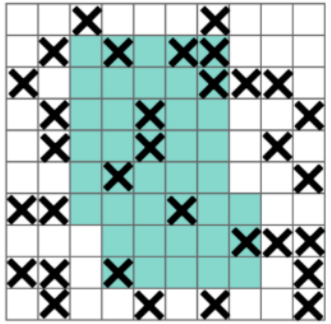
$$IoU = \frac{|B \cap B^{gt}|}{|B \cup B^{gt}|}$$

$$\mathcal{R}_{DIoU} = \frac{\rho^2(\mathbf{b}, \mathbf{b}^{gt})}{c^2}$$

$$\mathcal{R}_{CIoU} = \frac{\rho^2(\mathbf{b}, \mathbf{b}^{gt})}{c^2} + \alpha v,$$

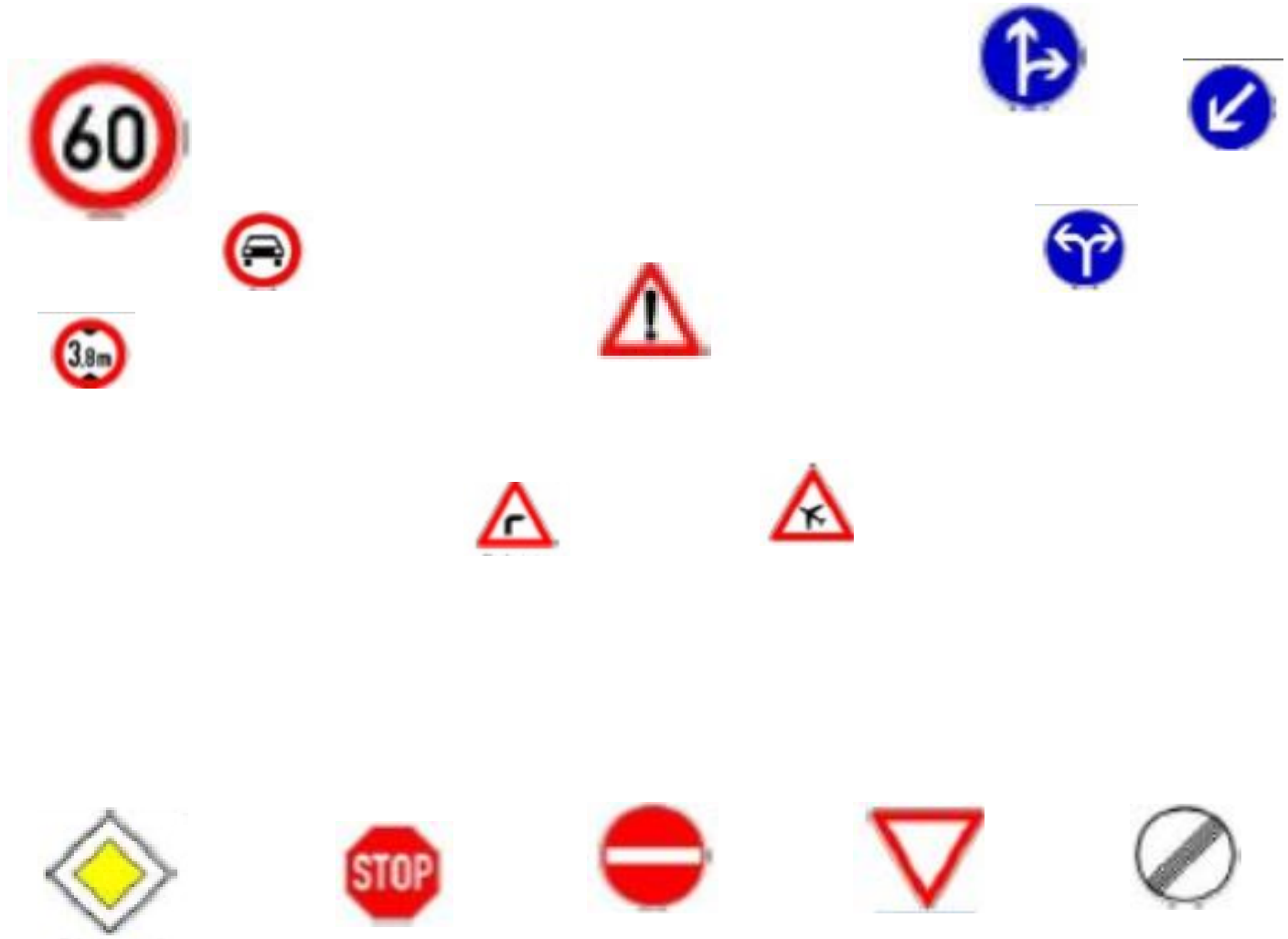
$$\mathcal{L}_{CIoU} = 1 - IoU + \frac{\rho^2(\mathbf{b}, \mathbf{b}^{gt})}{c^2} + \alpha v.$$

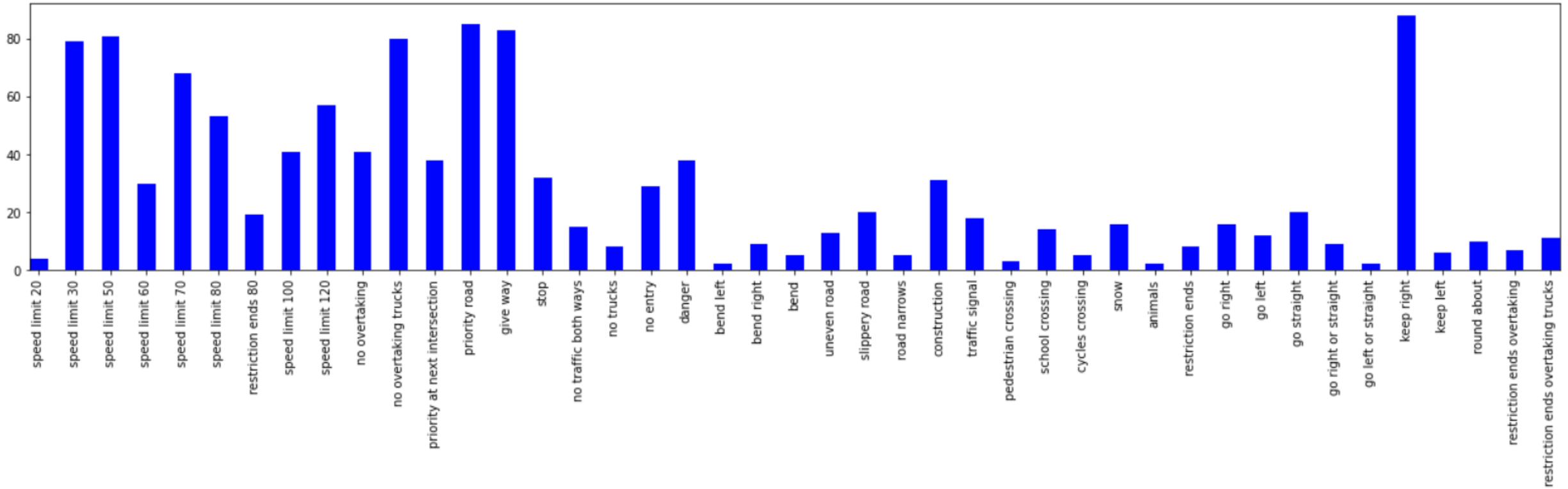




Bag of Freebies

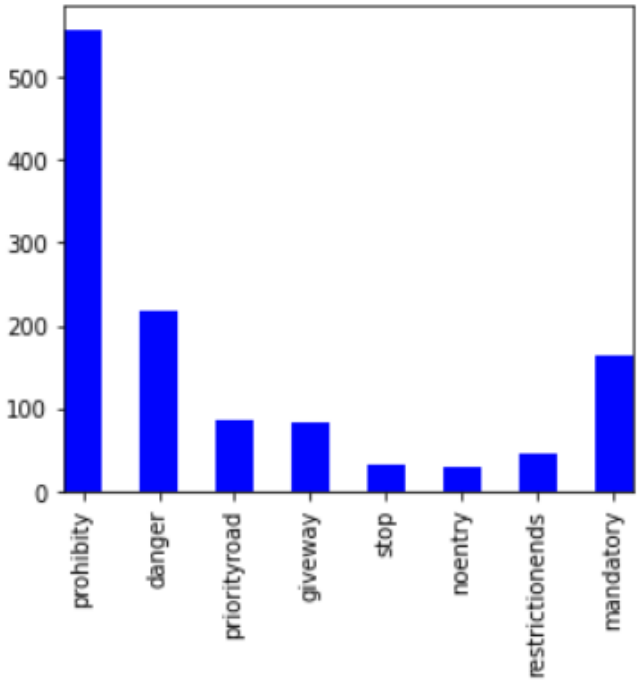
Dataset

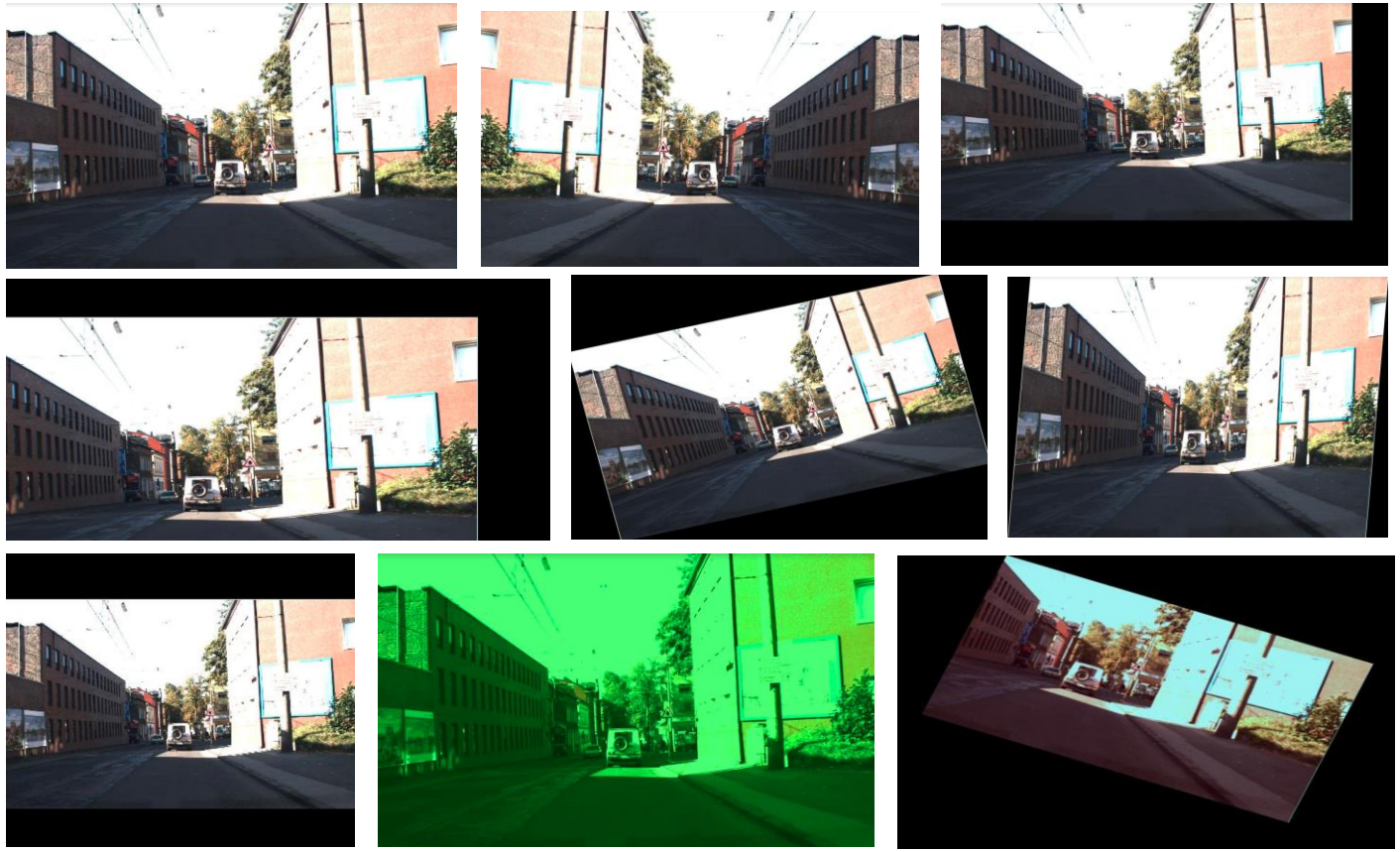




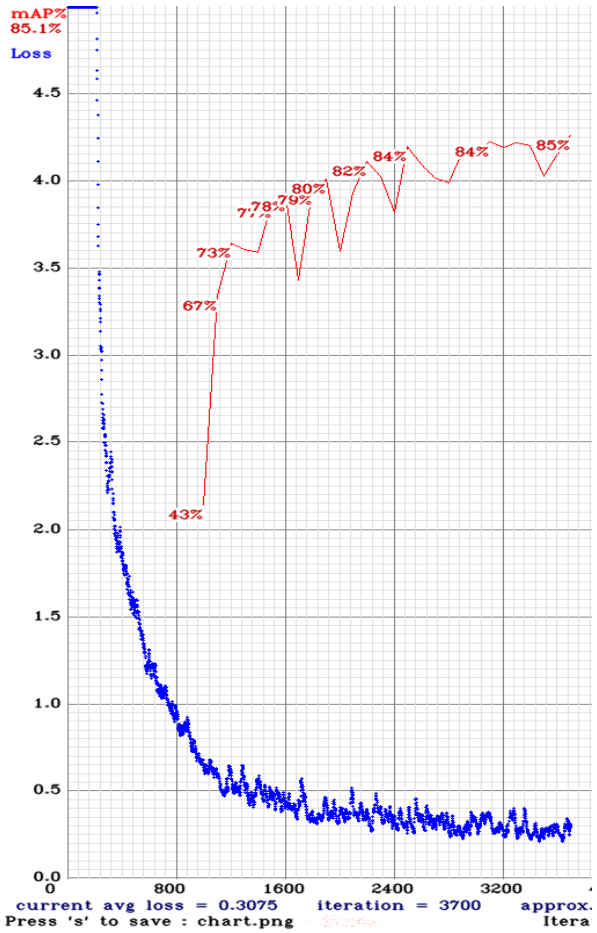
Data and Class Distribution

Data Augmentation



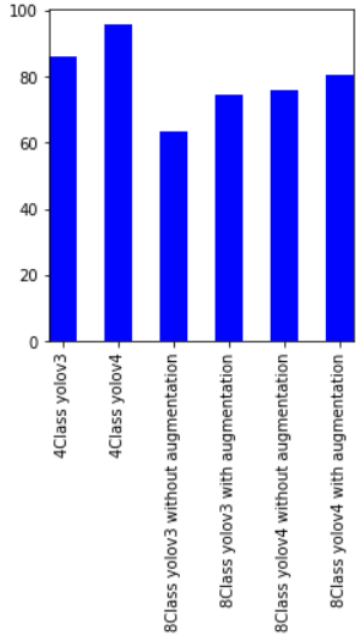


Results



Yolov3 – 4 Class | Loss accuracy curve

mAP@0.5	4 Class	8 Class without aug	8 Class with aug
Yolo V3	85.86	63.36	74,40
Yolo V4	95.60	75.75	80.57

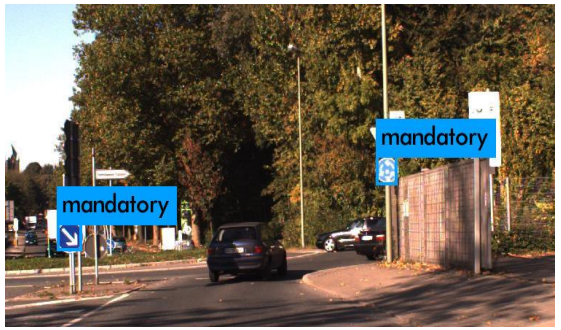


Accuracy graphic

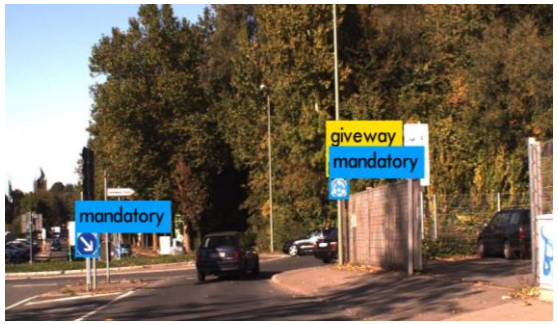
Results on different models

Input image

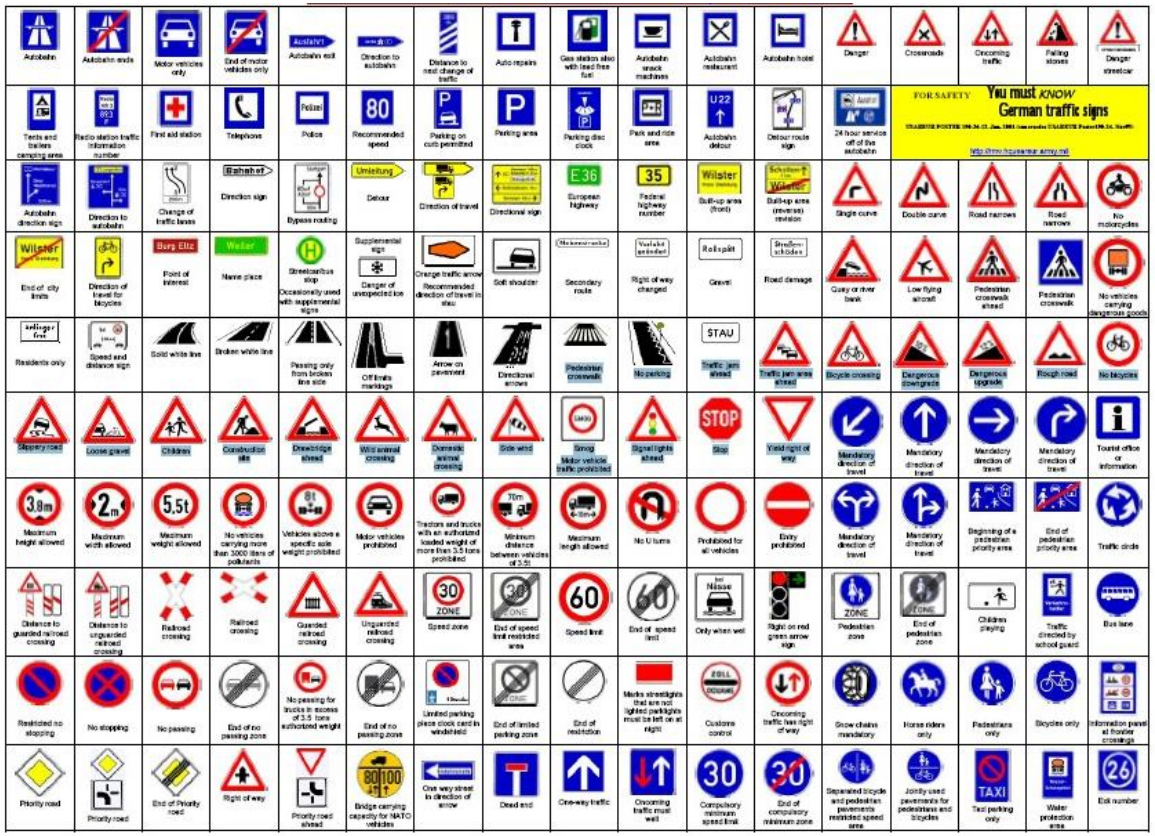
Prediction on Yolo v3 without aug

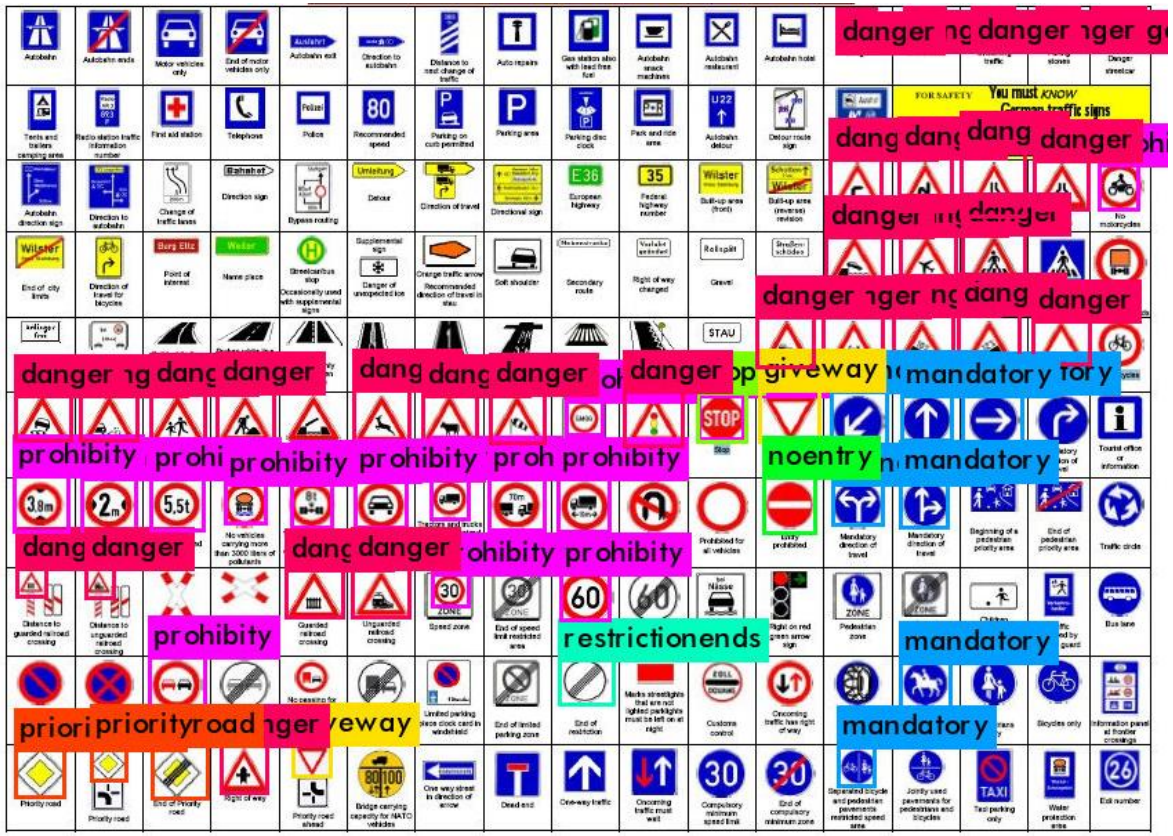


Prediction on Yolo v3 with aug



Results on Traffic Sign Table





Conclusion

Data augmentation

Yolo v3 – yolo v4

Darknet Framework

Thank you

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Traffic Sign Detection with YOLO