Parameterized Defogging Network

Nathan Nussbaumer, Rishie Raj,
Lucas Leitao, Sahaj Singh,
Uthappa Suresh Madettira

NEURAL INFORMATION PROCESSING SYSTEMS

Motivation

We are interested in object detection in adverse weather conditions as they have a lot of applications in autonomous driving and underwater navigation.

Previous Approaches

- Vanilla YOLO
- AOD-Net: All-in-One Dehazing Network
- Image-Adaptive YOLO

Our Implementation: IA YOLO

We have implemented the IA-YOLO paper based on our understanding of the approach and trained it on a wide range of datasets

We designed 2 modules for the image pre-processing:
- CNN-PP: This is a parameter predictor module that takes low-res images and outputs processing parameters
- DIP: Image processing module that uses the parameter from the CNN-PP module and defogs the original images.

The entire network (CNN-PP + DIP + YOLOv5) is trained together to enable connected learning of parameters. We have also taken a mixture of foggy and non-foggy images to reduce bias in the data.
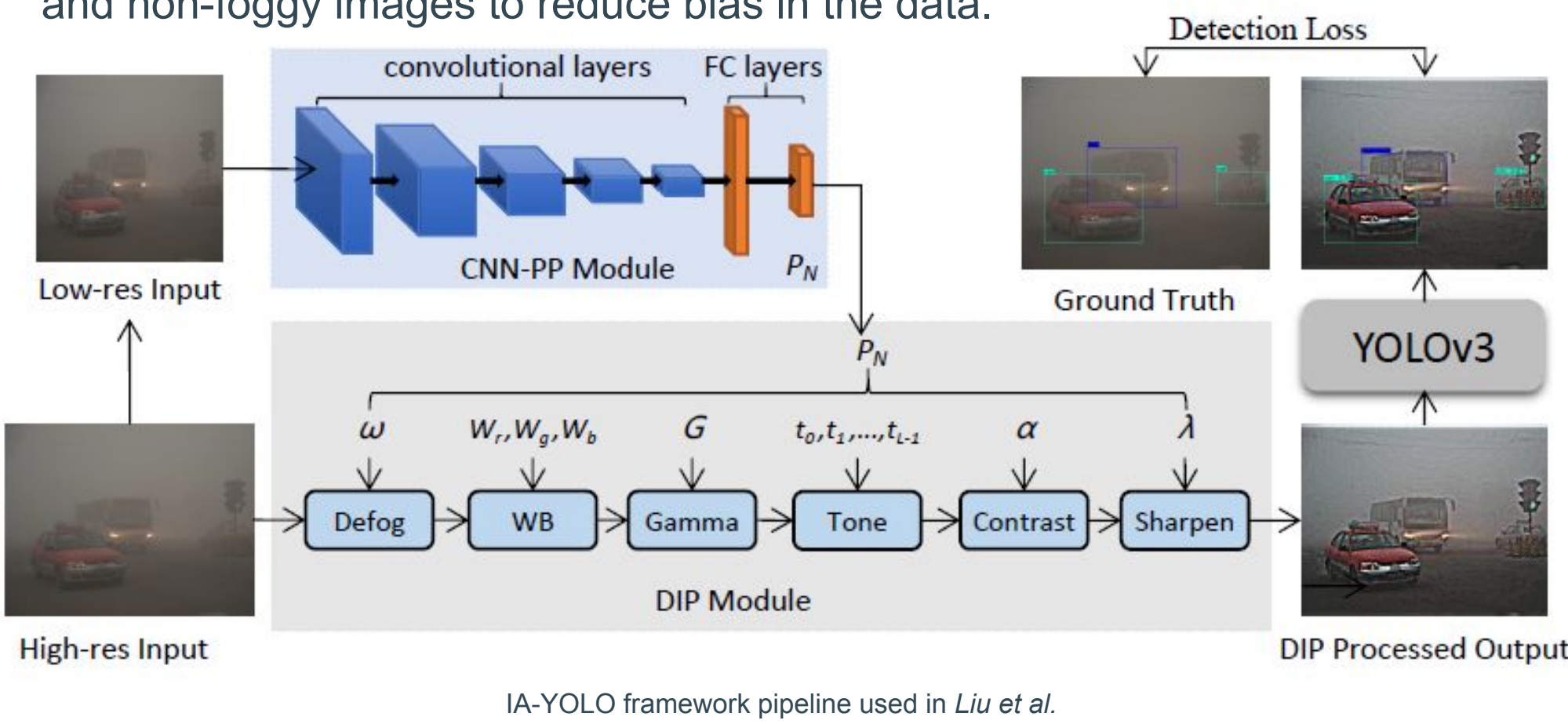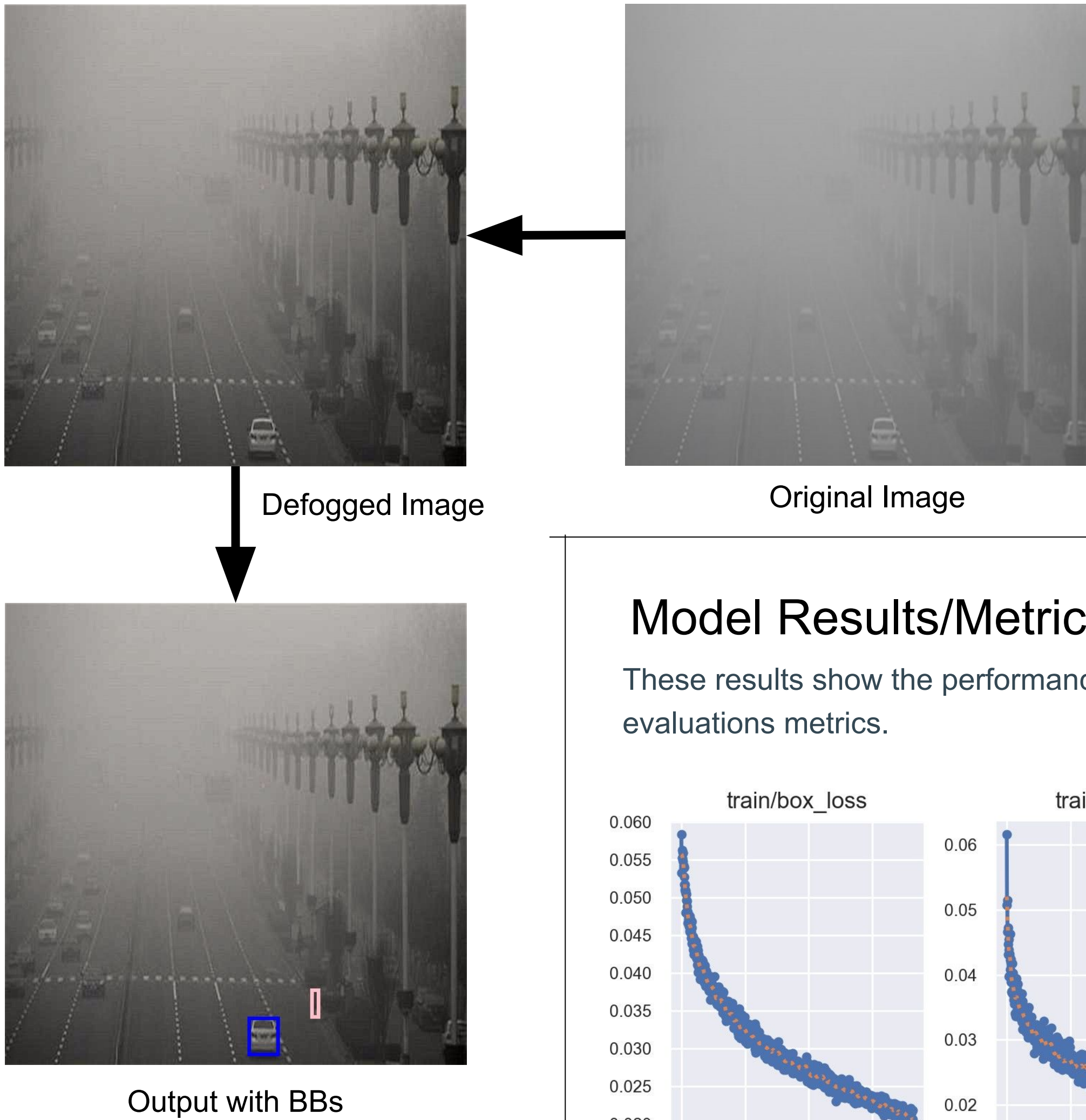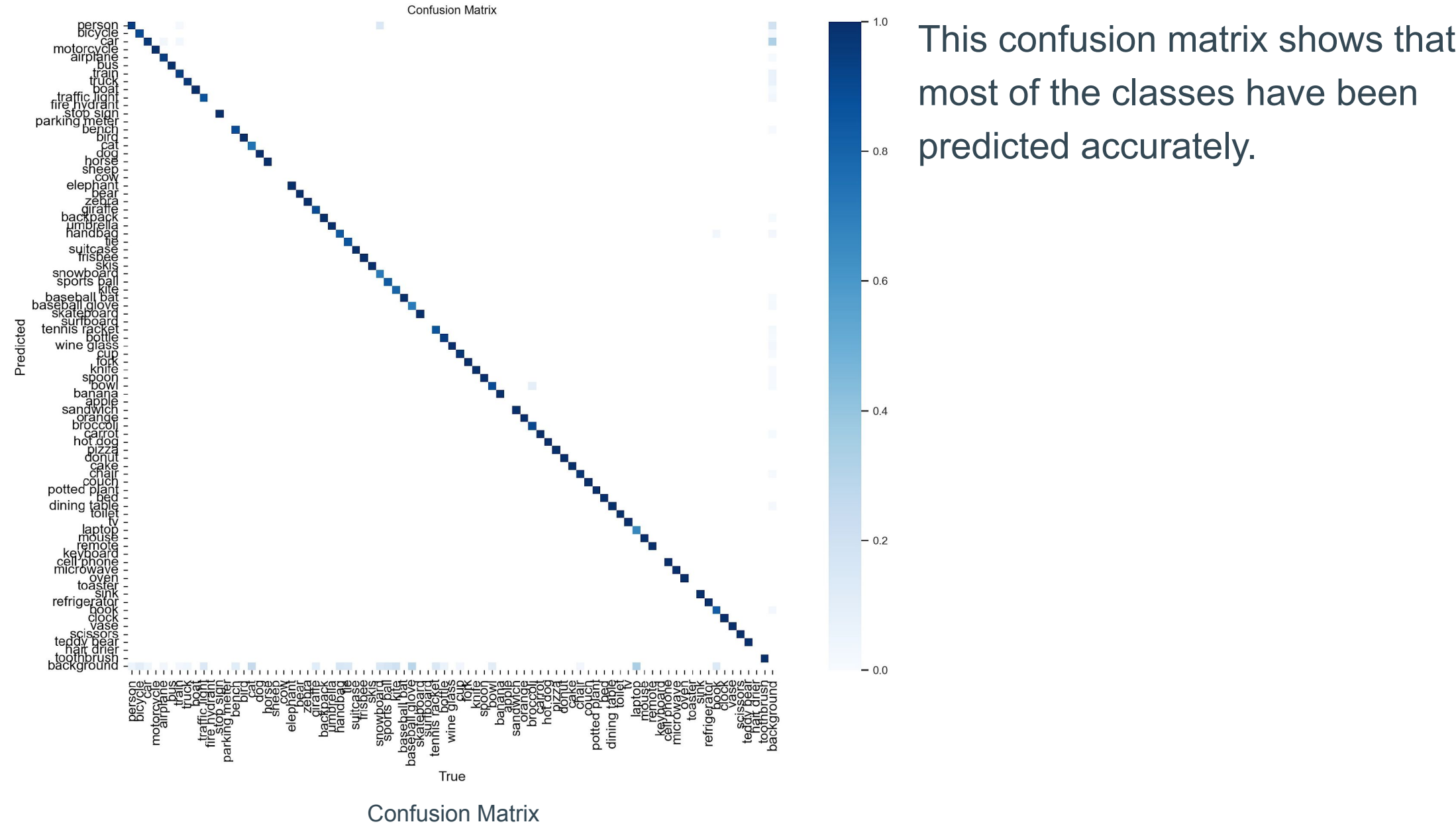

IA-YOLO framework pipeline used in *Liu et al.*

Image Pipeline

For a single image, the stages of processing in the model are shown:

Defogged Image

Original Image

Output with BBs

Prediction Comparisons

Original YOLOv5

Original YOLOv5 + DIP

Trained YOLOv5 + DIP

The predictions from the different types of model show that the highest number of accurate predictions occur in our implementation of the model

Evaluations

Confusion Matrix

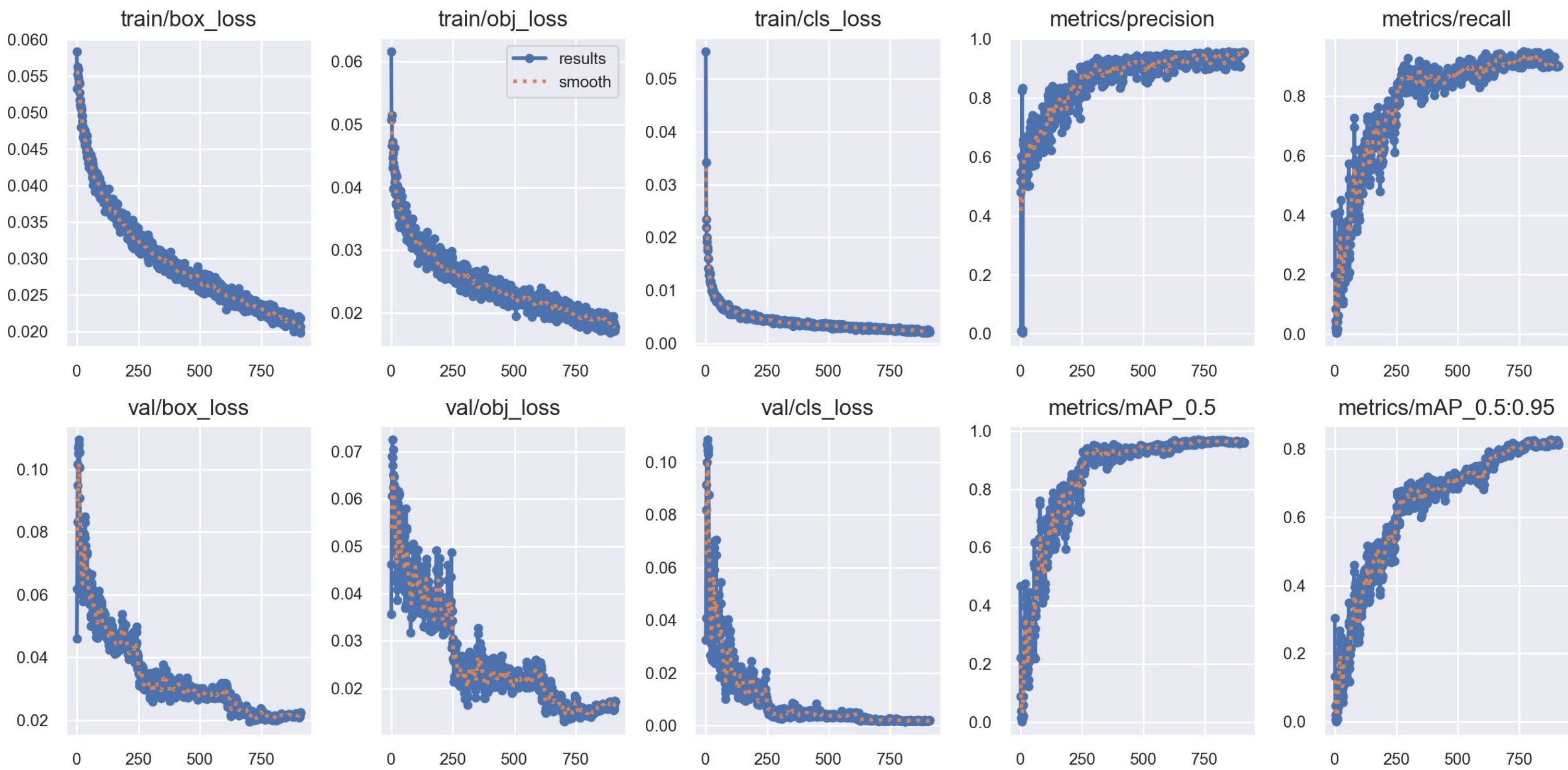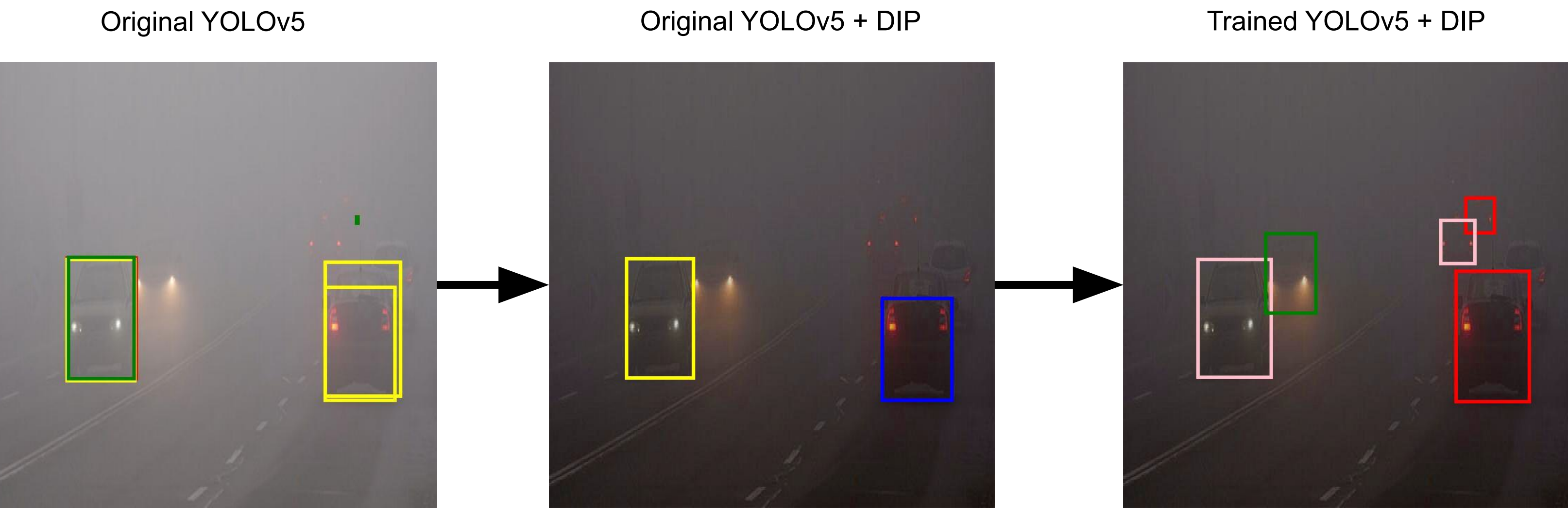This confusion matrix shows that most of the classes have been predicted accurately.

Model Results/Metrics

These results show the performance of the model during training and validation along with the evaluations metrics.

References

Wenyu Liu (2022). "Image-Adaptive YOLO for Object Detection in Adverse Weather Conditions" In: arXiv:2112.08088

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Hang, D (2009) "Single image haze removal using dark channel prior.". In: Proceedings of IEEE/CVF Conference Computer Vision Pattern Recognition (CVPR).