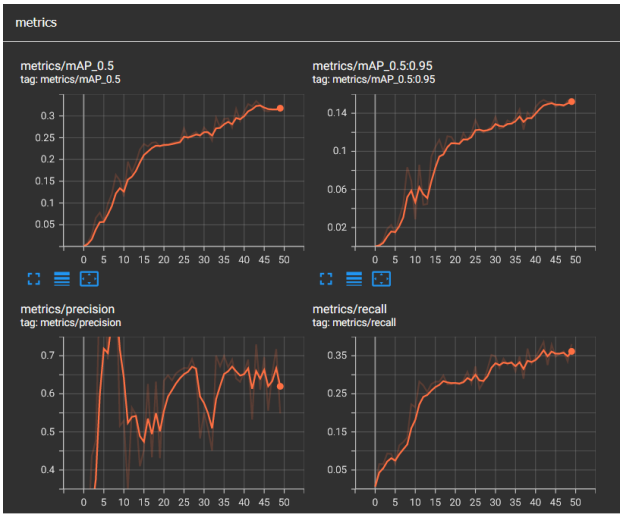
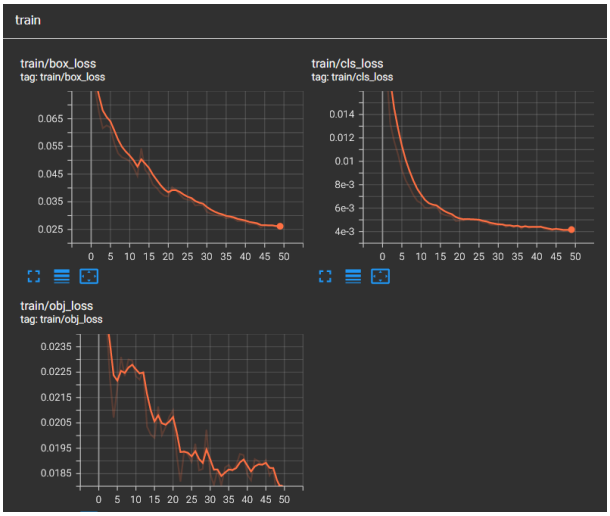
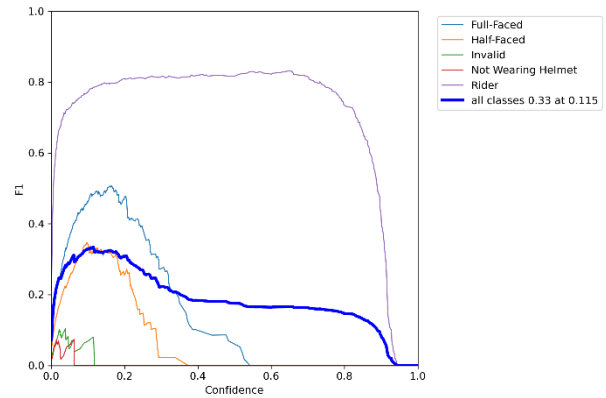
M2 - FA2 YOLOv7 Analysis

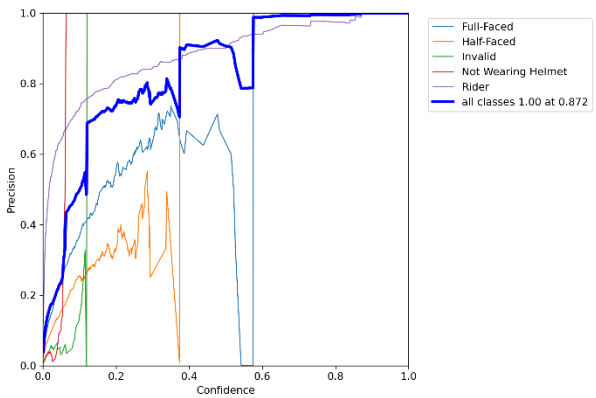
As mentioned in the other document, we were able to gather results from the training of the three-time scenarios (5:00 – 6:00 PM, 6:00 – 7:00 PM, and 7:00 – 8:00 PM). Below are the results of each:

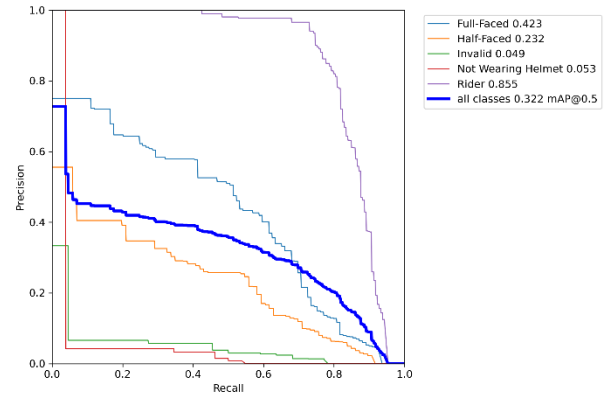
5:00 – 6:00 PM:

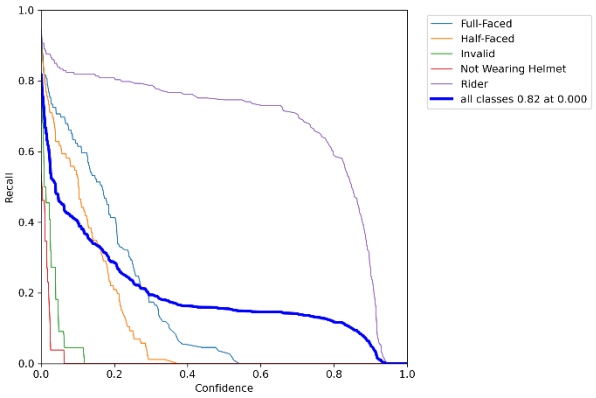


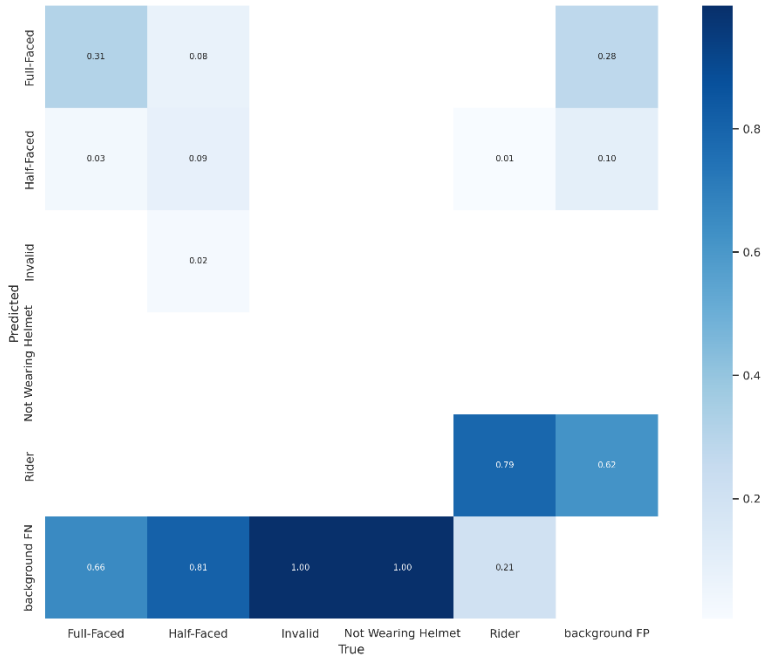




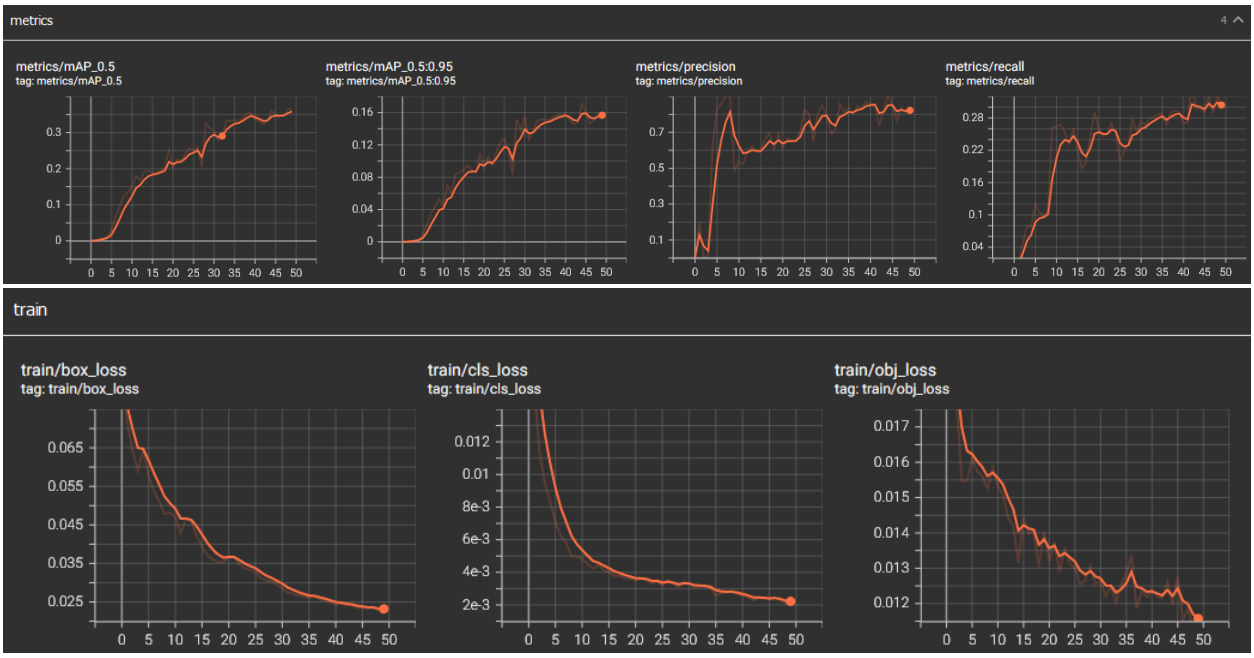


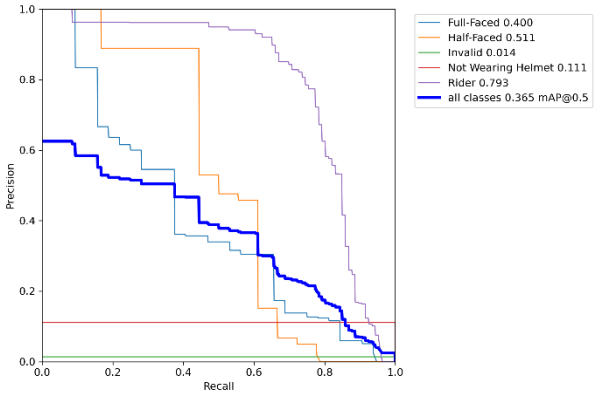


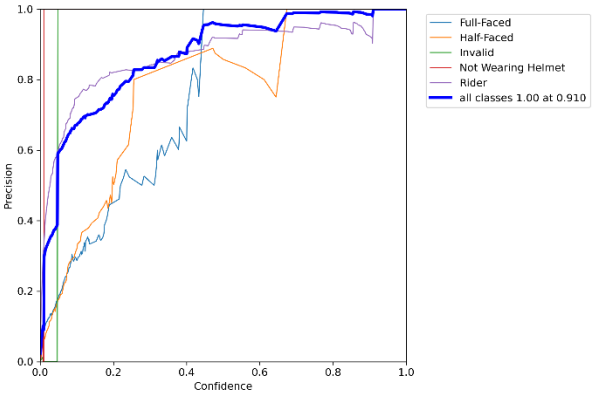


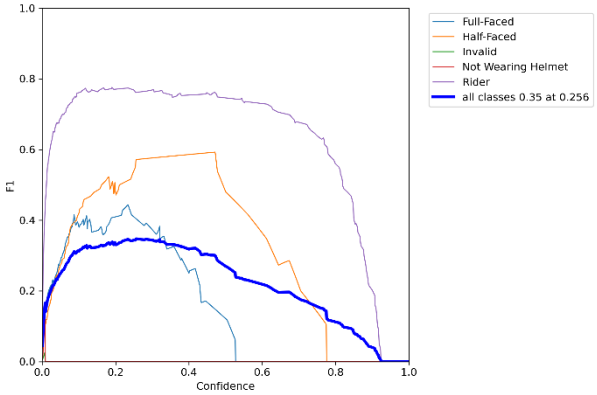

Full-Faced
Half-Faced
Invalid
Not Wearing Helmet
Rider
background FN
Predicted
0.31
0.08
0.28
0.03
0.09
0.01
0.10
0.02
0.79
0.62
0.66
0.81
1.00
1.00
0.21
0.8
0.6
0.4
0.2
Full-Faced
Half-Faced
Invalid
Not Wearing Helmet
Rider
background FP
True

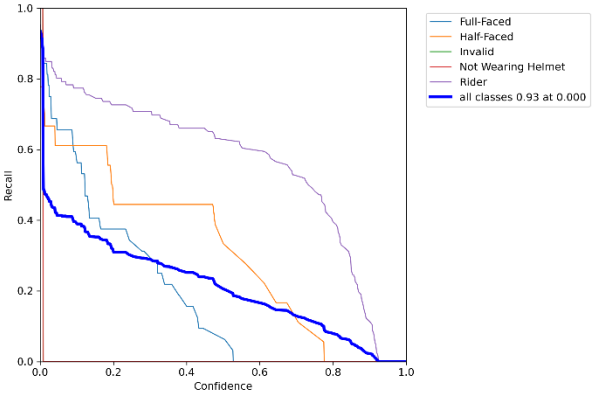
6:00 – 7:00 PM:

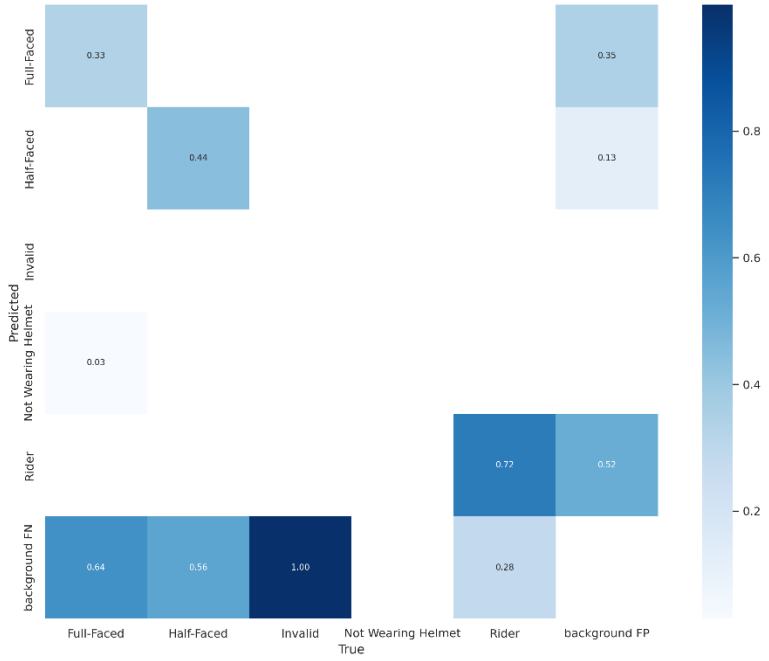

metrics
metrics/mAP_0.5
tag: metrics/mAP_0.5
metrics/mAP_0.5:0.95
tag: metrics/mAP_0.5:0.95
metrics/precision
tag: metrics/precision
metrics/recall
tag: metrics/recall
train
train/box_loss
tag: train/box_loss
train/cls_loss
tag: train/cls_loss
train/obj_loss
tag: train/obj_loss


Full-Faced 0.400
Half-Faced 0.511
Invalid 0.014
Not Wearing Helmet 0.111
Rider 0.793
all classes 0.365 mAP@0.5
Precision
Recall

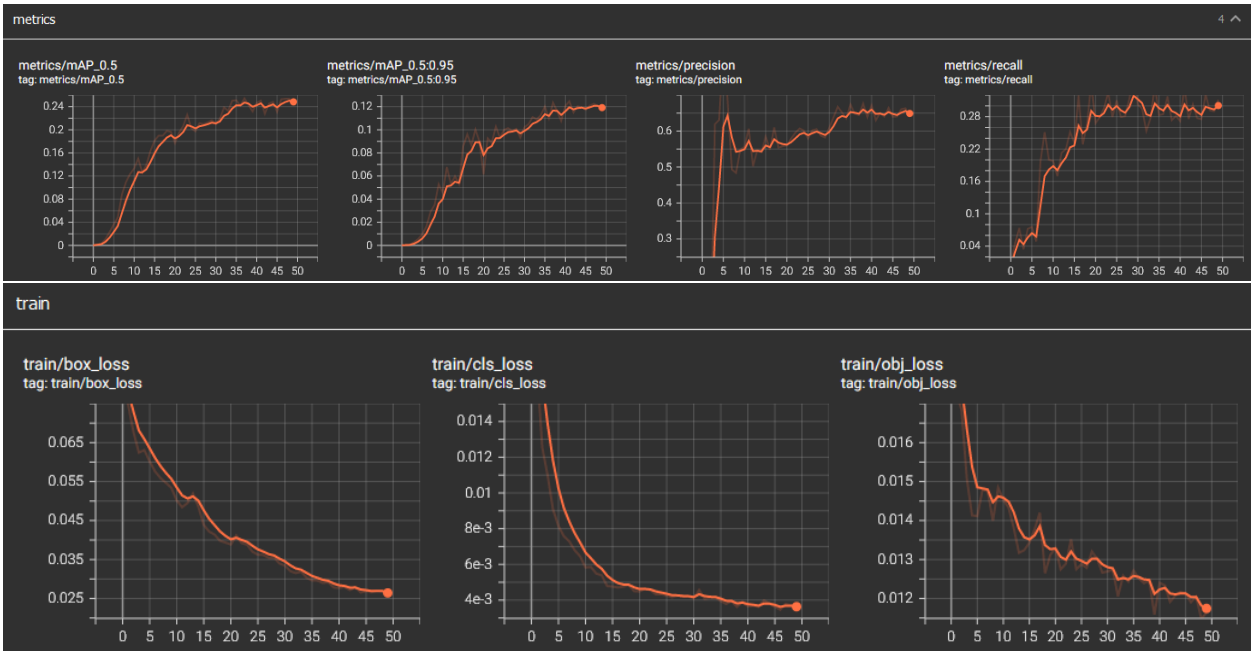

Full-Faced
Half-Faced
Invalid
Not Wearing Helmet
Rider
all classes 1.00 at 0.910
Precision
Confidence

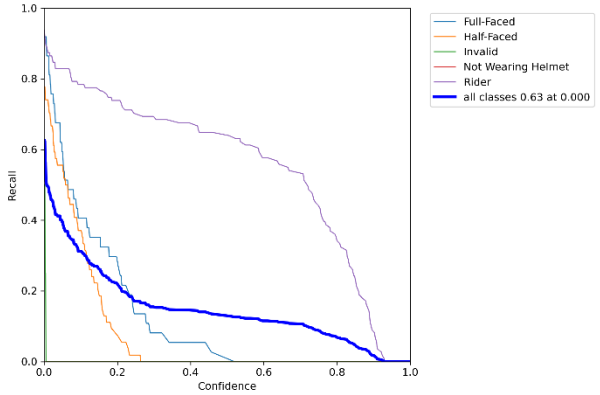

Full-Faced
Half-Faced
Invalid
Not Wearing Helmet
Rider
all classes 0.35 at 0.256
F1
Confidence

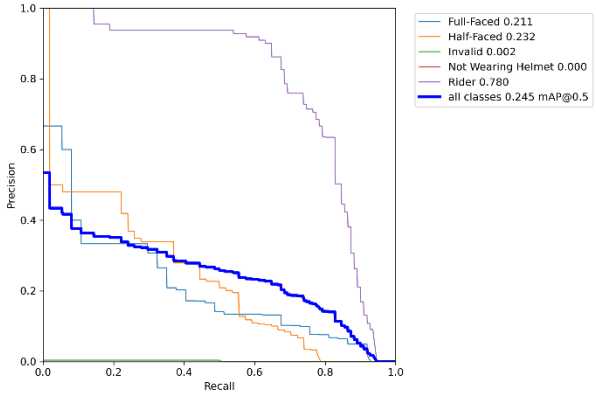

Full-Faced
Half-Faced
Invalid
Not Wearing Helmet
Rider
all classes 0.93 at 0.000
Recall
Confidence

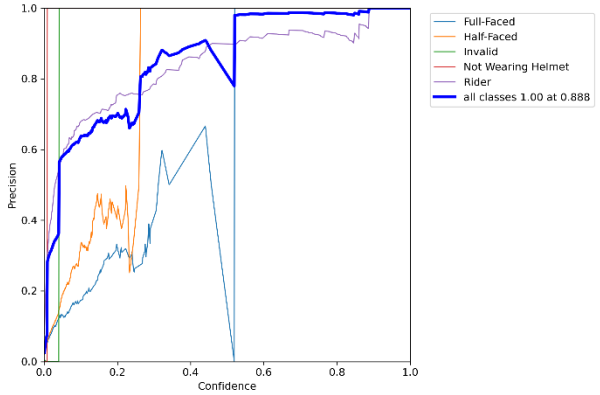

Full-Faced
Half-Faced
Invalid
Not Wearing Helmet
Rider
background FN
0.33
0.35
0.44
0.13
0.03
0.72
0.52
0.64
0.56
1.00
0.28
Predicted
Full-Faced
Half-Faced
Invalid
Not Wearing Helmet
Rider
background FP
True

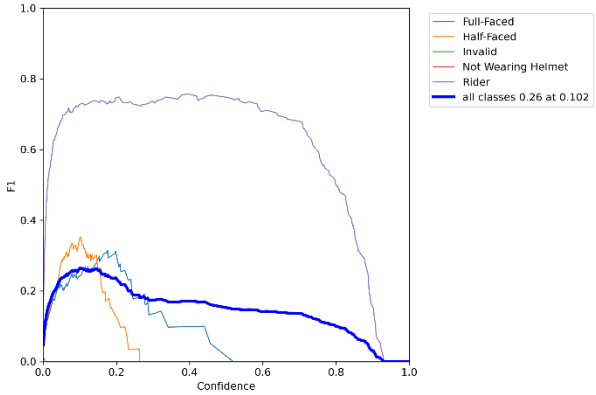
7:00 – 8:00 PM:

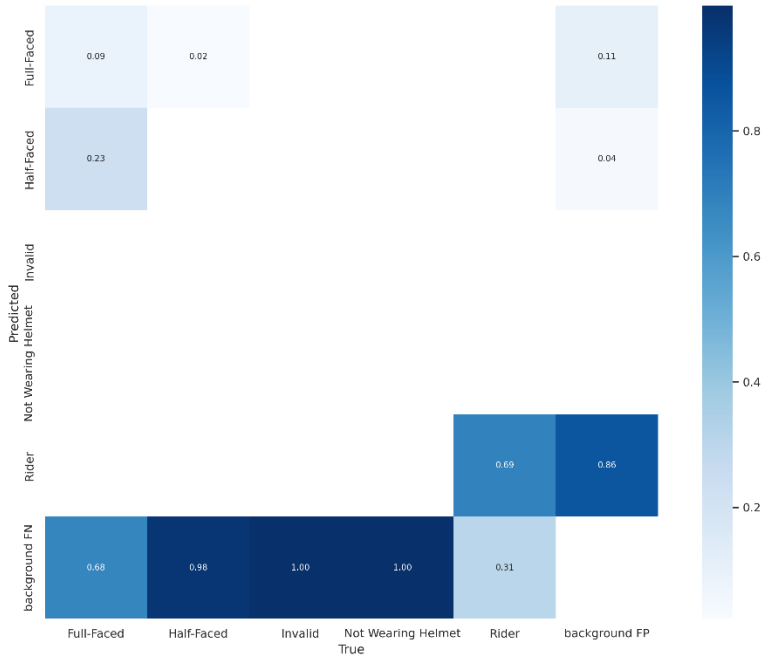

metrics
metrics/mAP_0.5
tag: metrics/mAP_0.5
metrics/mAP_0.5:0.95
tag: metrics/mAP_0.5:0.95
metrics/precision
tag: metrics/precision
metrics/recall
tag: metrics/recall
train
train/box_loss
tag: train/box_loss
train/cls_loss
tag: train/cls_loss
train/obj_loss
tag: train/obj_loss


Full-Faced
Half-Faced
Invalid
Not Wearing Helmet
Rider
all classes 0.63 at 0.000
Recall
Confidence


Full-Faced 0.211
Half-Faced 0.232
Invalid 0.002
Not Wearing Helmet 0.000
Rider 0.780
all classes 0.245 mAP@0.5
Precision
Recall


Full-Faced
Half-Faced
Invalid
Not Wearing Helmet
Rider
all classes 1.00 at 0.888
Precision
Confidence


Full-Faced
Half-Faced
Invalid
Not Wearing Helmet
Rider
all classes 0.26 at 0.102
F1
Confidence



Using the test dataset, detect.py and val.py were used to test and validate each model. The 5:00 - 6:00 PM scenario has resulted in 53.7% precision rate, 38.2% recall rate, 31.7% mean average precision at 0.5, and a 15.3% mean average precision at 0.5-0.95. The 6:00 - 7:00 PM scenario had an 89.7% precision rate, 29.8% recall rate, and a 35.6% mean average precision at 0.5, and a 16.8% mean average precision at 0.5-0.95. Lastly, the 7:00 - 8:00 PM scenario had a 64.9% precision rate, 27.4% recall rate, and a 24.4% mean average precision at 0.5, and a 12.3% mean average precision at 0.5-0.95.

Metric	*5:00 – 6:00 PM*	*6:00 – 7:00 PM*	*7:00 – 8:00 PM*
Precision	0.537	0.897	0.649
Recall	0.382	0.298	0.274
mAP@.5	0.317	0.356	0.244
mAP@.5:.95	0.153	0.168	0.123

As we can see, the 6:00 - 7:00 PM scenario had the highest precision rate amongst the three. However, the 5:00 - 6:00 PM scenario has the highest recall rate despite having the lowest precision rate. Finally, we can see that the 6:00 - 7:00 PM scenario had the highest mean average precision at 0.5 and at 0.5-0.95.

Unlike the previous assessment in creating a YOLOv5 model, this YOLOv7 model did not perform terribly well that we had expected. It performed averagely in detecting if it is a proper helmet or not. But it performed greatly when detecting riders. We suspect that these results came to be due to the many augmentations we did for the dataset as last time, our dataset only had few augmentations. It could also be plausible that the YOLOv7 model is much better than a YOLOv5 model as it achieved a better accuracy.

For future purposes, we would recommend increasing the amount of pictures in the dataset and enhance these pictures. But we conclude that the YOLOv7 is a much better model to use if one wants higher precision/accuracy.

References

Boesch, G. (2023, January 1). *YOLOv7: The Most Powerful Object Detection Algorithm (2023 Guide)*. viso.ai. https://viso.ai/deep-learning/yolov7-guide/

Dwyer, B. (2022, December 29). *How to Train YOLOv7 on a Custom Dataset*. Roboflow Blog. https://blog.roboflow.com/yolov7-custom-dataset-training-tutorial/

Skelton, J. (2022, August 17). *How to train and use a custom YOLOv7 model*. Paperspace Blog. https://blog.paperspace.com/yolov7/