

# EECS6691 Assignment 2 Report

**Contributions:** bk2829: Data preparation and preprocessing, training, writing report  
ss6928: post processing, training, writing report, xj2289: post processing, training, writing report

## Data preparation and preprocessing:

- We started by shuffling the indices to ensure randomness in our dataset.
- Ground truth annotation files were read, and rows corresponding to specified video IDs were selected for training and validation. We used 30 videos for validation and 70 for training.
- For YOLO format conversion:
  - a. Filenames were created based on video IDs and frames. E.g. (<video\_id>\_<frame#>.txt)
  - b. Center coordinates were calculated and normalized.
  - c. Class IDs were merged into fewer classes: RiderHelmet, RiderNoHelmet, and Motorbike.
  - d. Annotations were written to files accordingly.
- A function was developed to extract frames from videos for dataset creation.
- Background images (frames without any corresponding label file) were removed from the dataset to enhance model performance.

## Training and evaluation:

- We used two variants of YOLOv8, namely (YOLOv8n and YOLOv8x) for our training task and compared their performance.
- We used pretrained weights for these models and fine tuned it on our task.
- We used wandb for tracking the training log and comparison between the two models.
- We plotted metrics such as precision, recall, mAP-50, mAP-95 and inference speed for the two models.

## Post Processing:

- Applied confidence thresholding to filter out detections with low confidence scores, aiming to reduce false positives.
- Employed Non-Maximum Suppression (NMS) to eliminate overlapping bounding boxes, retaining only the most confident detection for each object.
- The postprocessing steps did not significantly improve the model's performance metrics (precision, recall, mAP).
- YOLOv8 inherently incorporates advanced post processing techniques during its training and inference stages, which might overlap with our custom post processing steps, leading to minimal incremental gains.

## Results:

A comprehensive overview of the results is provided at the end of the Jupyter notebook. Here, we highlight only the most notable findings to stay within the two-page limit.

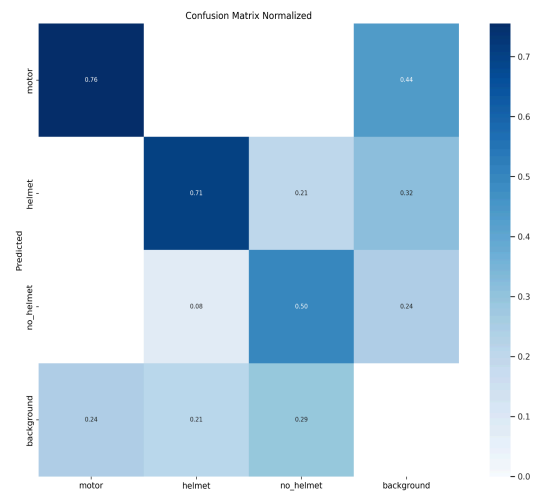
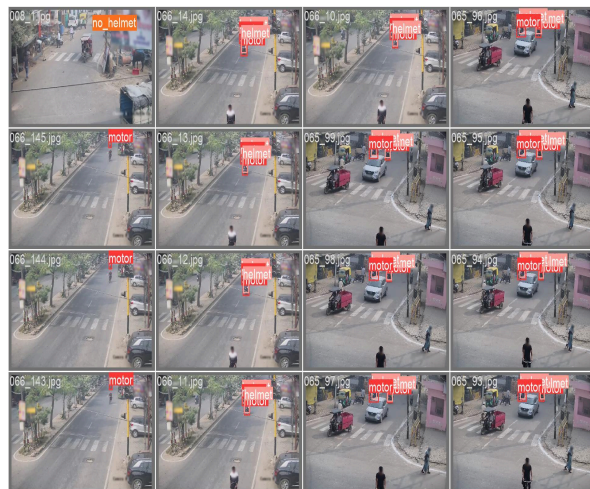
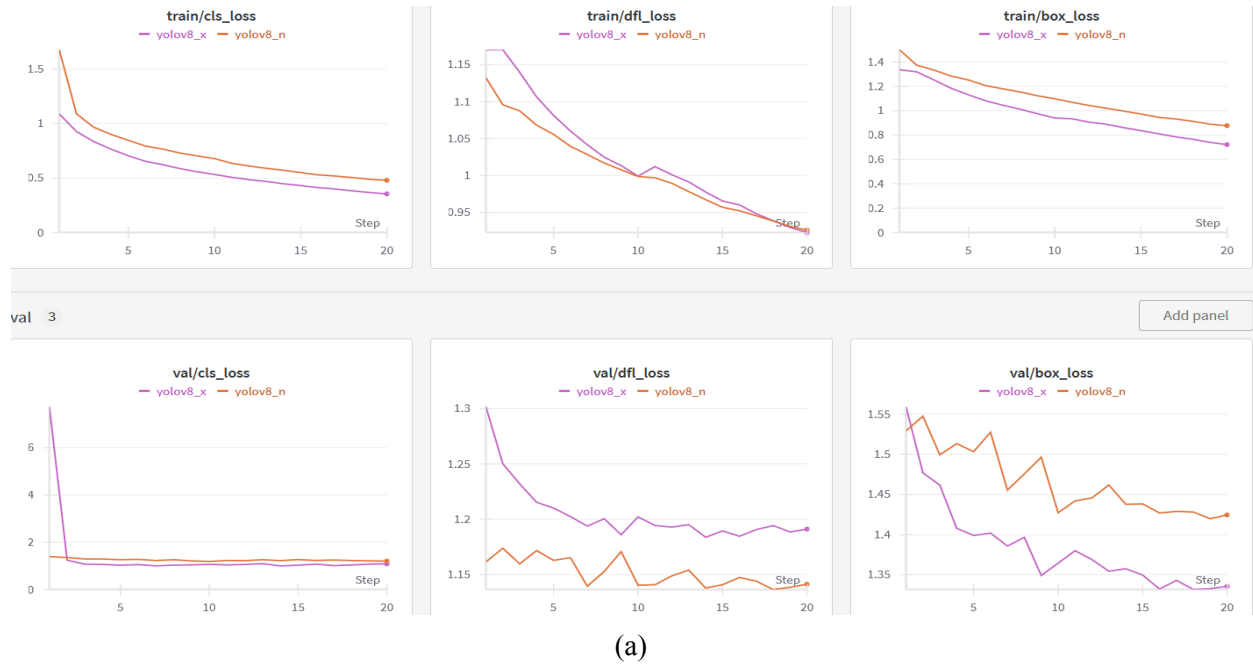


Figure1. (a) Loss plots, (b) model prediction output on validation frames, (c) confusion matrix

## Discussion:

- YOLOv8x achieves a lower loss for classification and boxes compared to YOLOv8n
- The confusion matrix shows the YOLOv8x has reasonable accuracy in detecting the classes
- Augmentation techniques such as rotation, scaling, and flipping could be applied to enrich the dataset and improve model robustness.
- Continuous evaluation and refinement of the dataset and model are essential to address evolving challenges and improve overall effectiveness.