ML Algorithm Metrics

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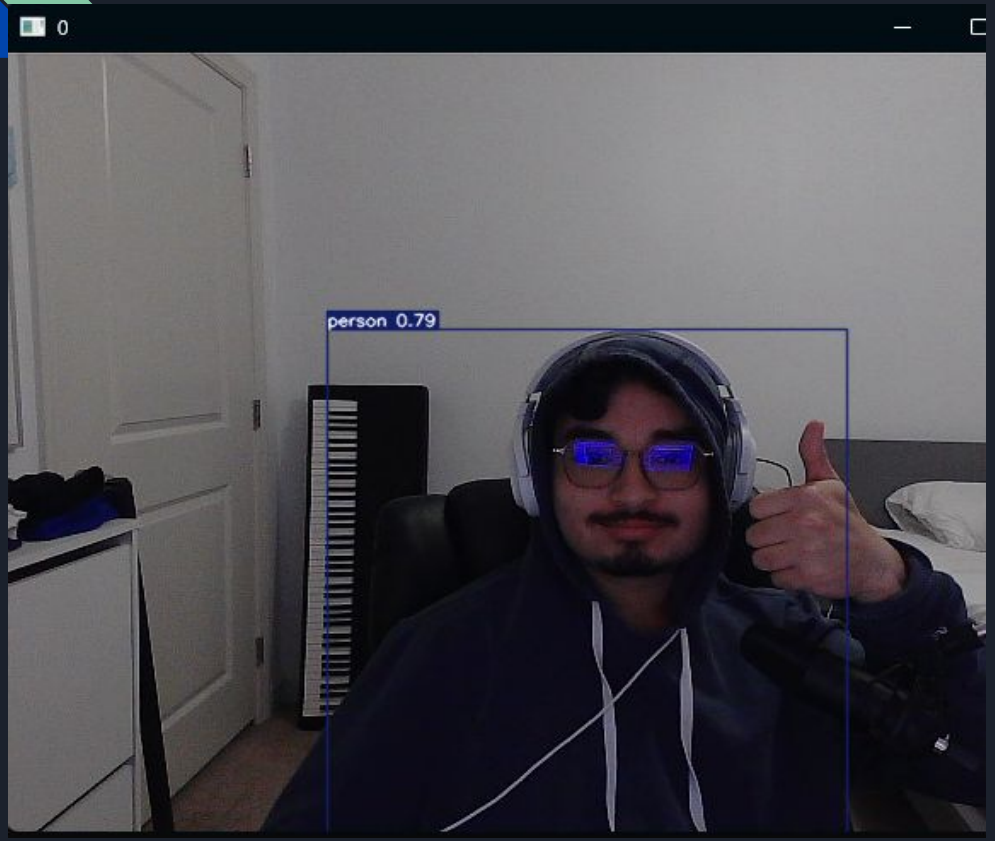
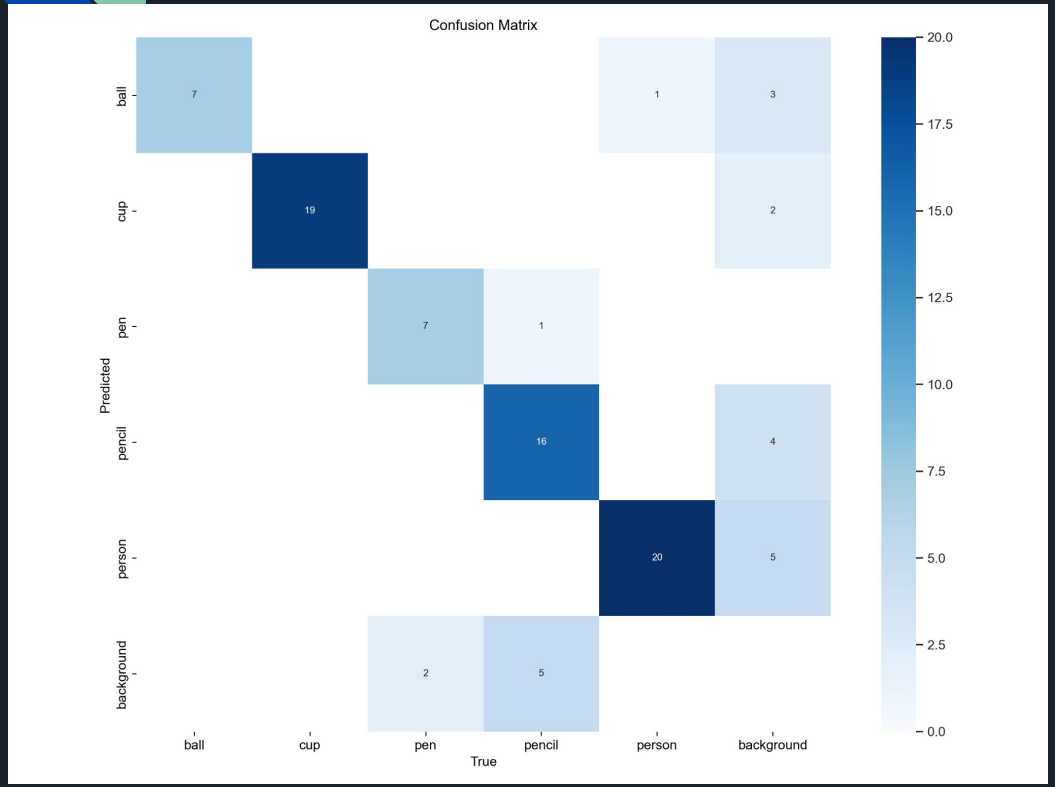
Some Requirements



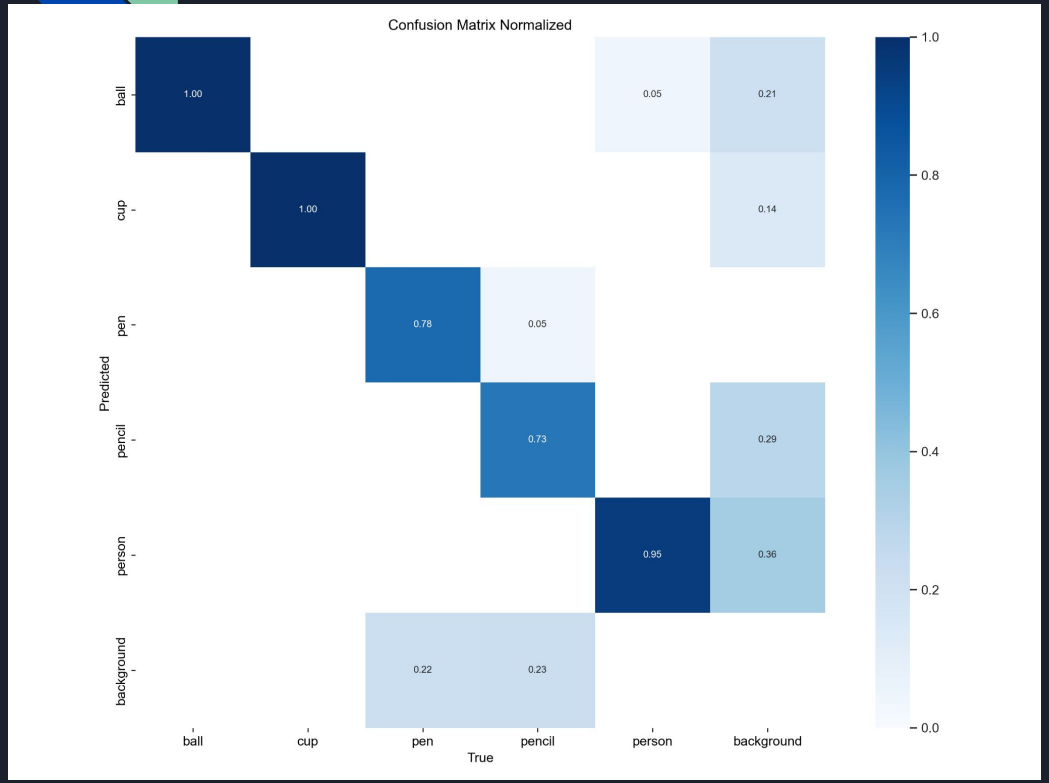
- (SYS_010) The processed image shall have a bounded box of the detected object.
- (SYS_011) The processed image shall display the classification of the object.
- (SYS_012) The system shall contain a screen that shows the processed image.

Confusion Matrix



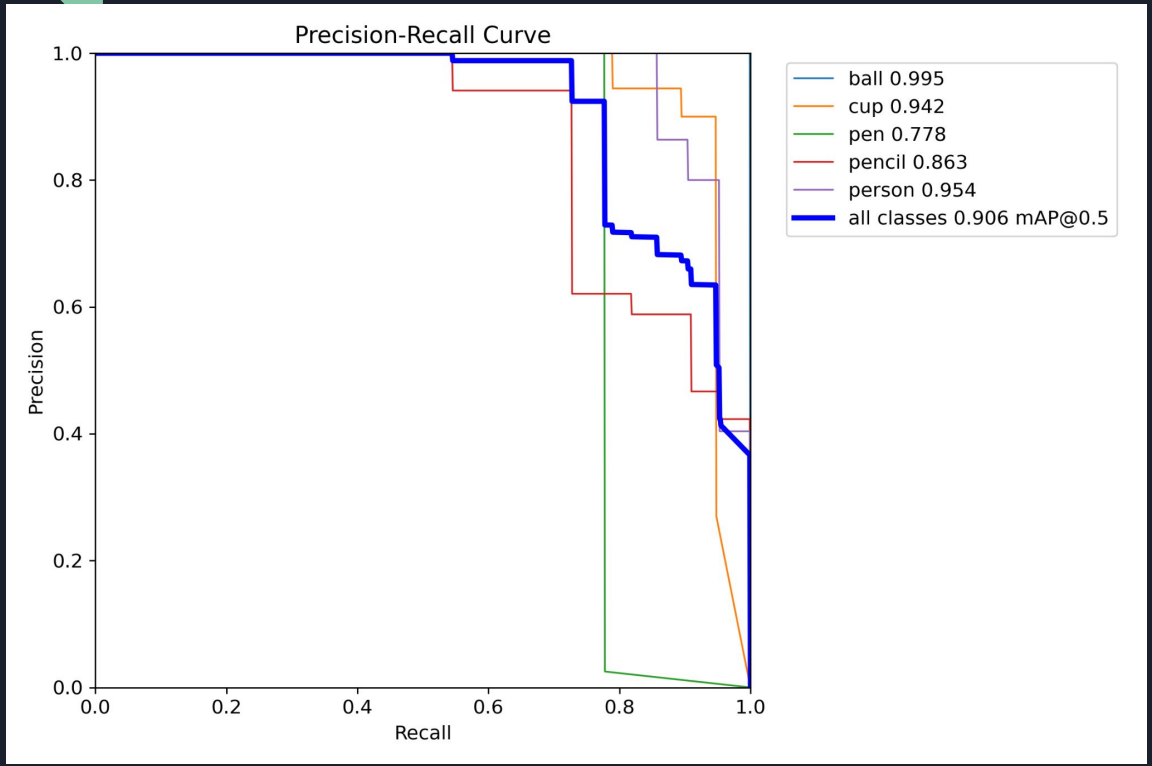
- Provides a detailed view of the outcomes
- For each class:
  - True positives
  - True negatives
  - False positives
  - False negatives
- (SYS_013) At minimum, the system shall have the capability to detect a (1) “person”, (2) “cup”, (3) “ball”, and (4)“pen/pencil”.

Normalized Confusion Matrix



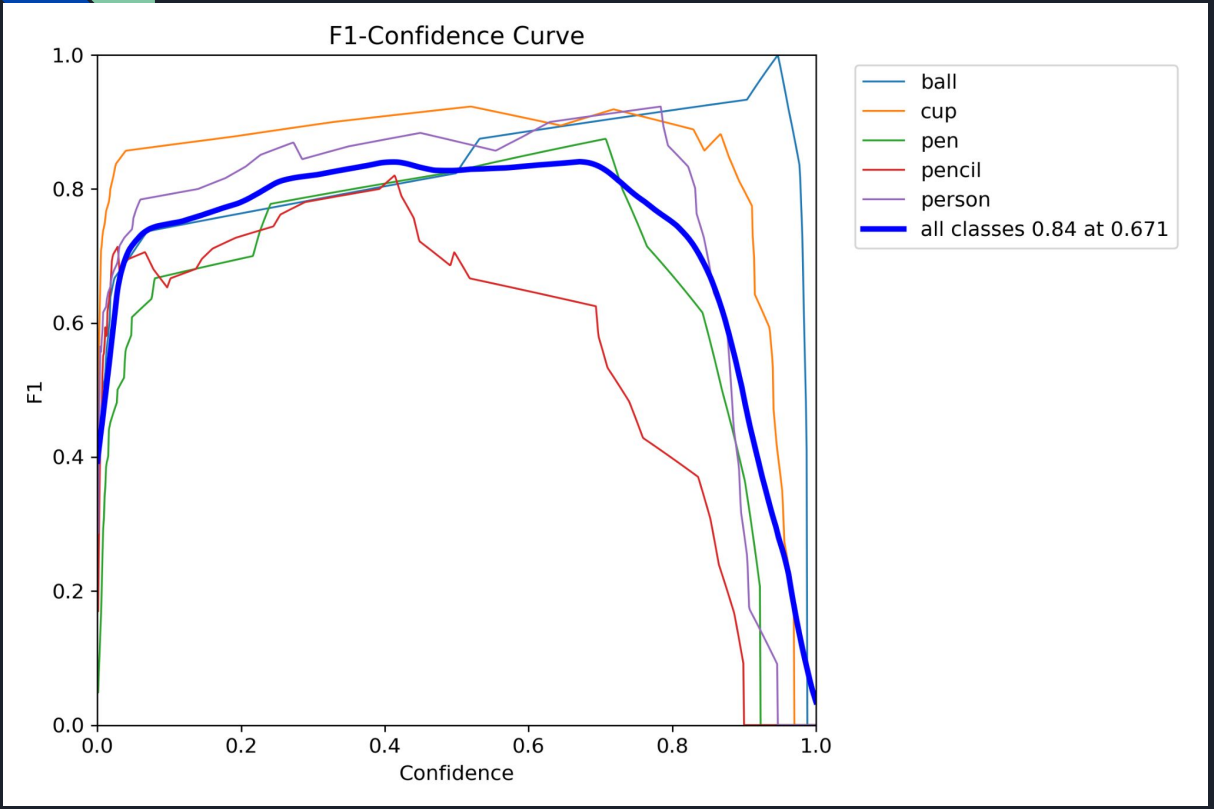
- Represents the data in proportions rather than raw counts
- Makes it simpler to compare the performance across classes

Precision-Recall Curve



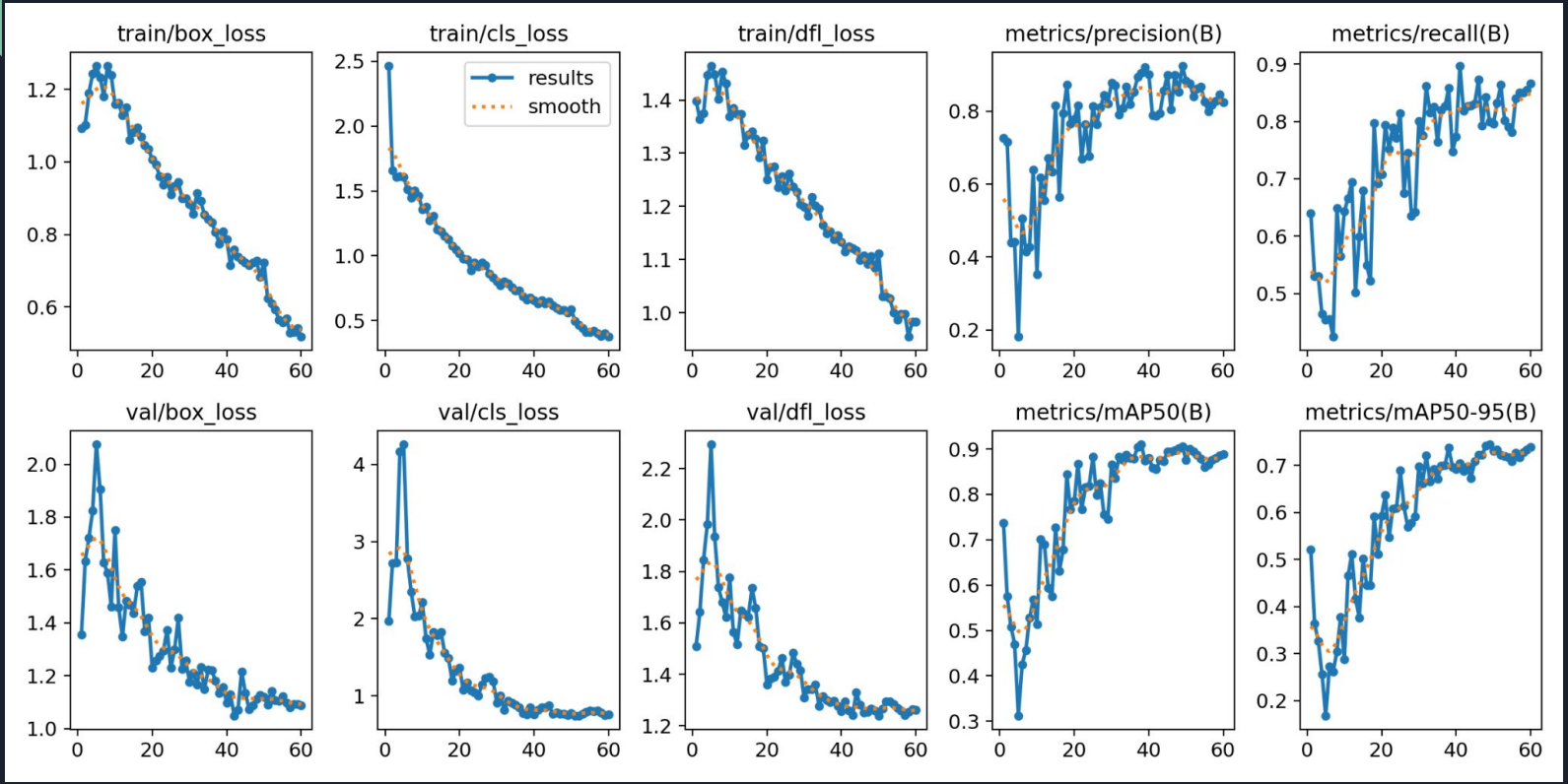
- (SYS_016) The object detection algorithm shall have an Area Under Precision-Recall Curve (AU-PR) of 0.75 or more.
- P (Precision): How many detections were correct
- R (Recall): Precision/ Total of the class in image
- Shows average precision for all classes
- Area under Precision-Recall curve

F1-Curve



- (SYS_017) The object detection algorithm shall have a F1 Score of 0.75.
- Harmonic mean of precision and recall
- Important for seeing overall performance, when P and R are of equal importance

Other Metrics - Change Over Epochs



Next Steps

- (SYS_015) The object detection algorithm shall have an Area Under Receiver Operating Characteristics Curve (AU-ROC) of 0.75 or more.
    - Calculate True Positive Rate (TPR) and False Positive Rate (FPR) at various threshold values
- (SYS_018) The object detection algorithm will output a text file for each frame, with each row having the format: **object class**, x center, y center, x width, y width **(Partial)**
- Optimizing the ML model for the PYNQ Z2 board
- Integration into the board
    - Deep Learning Processing Unit to speed up the model using FPGA + Processor