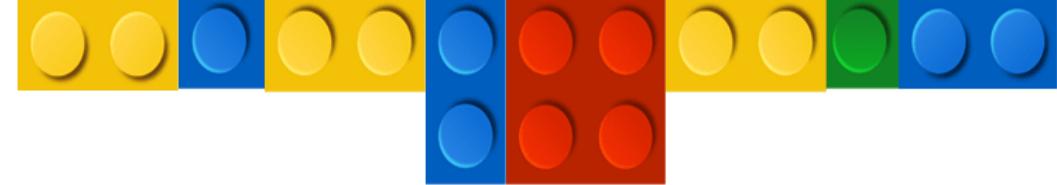


Lego details detection with YOLOv8

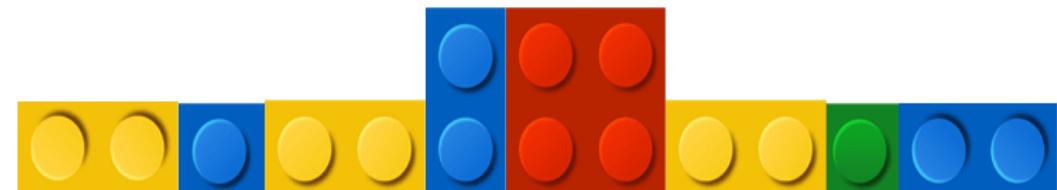
Project for Robotech School



Task

The objective of this project is to develop a Computer Vision-based solution that will help junior robotics students organize their construction kits. Furthermore, this solution is intended to serve as a foundation for expanding its application to other construction kits (such as Lego EV3 Mindstorms).

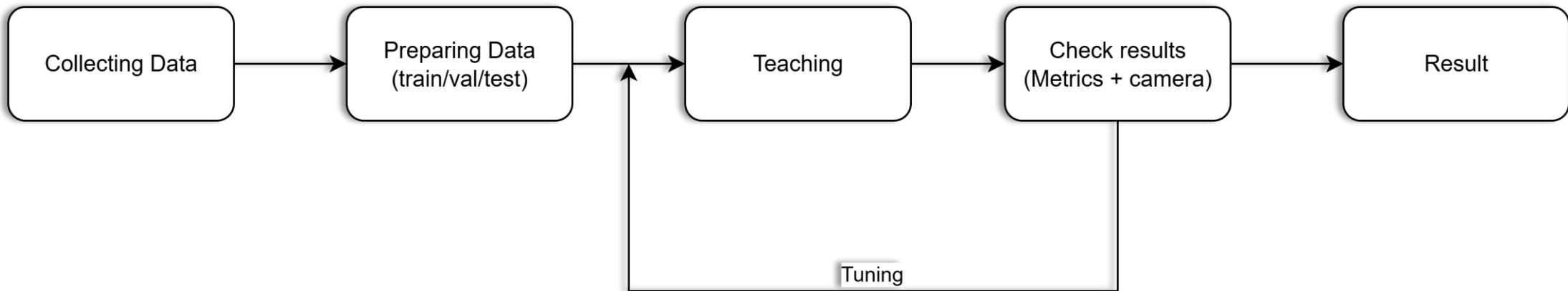
The problem being addressed is the cluttering of kits, as well as the reduction of financial and time costs for teachers who currently sort the kits in their spare time.



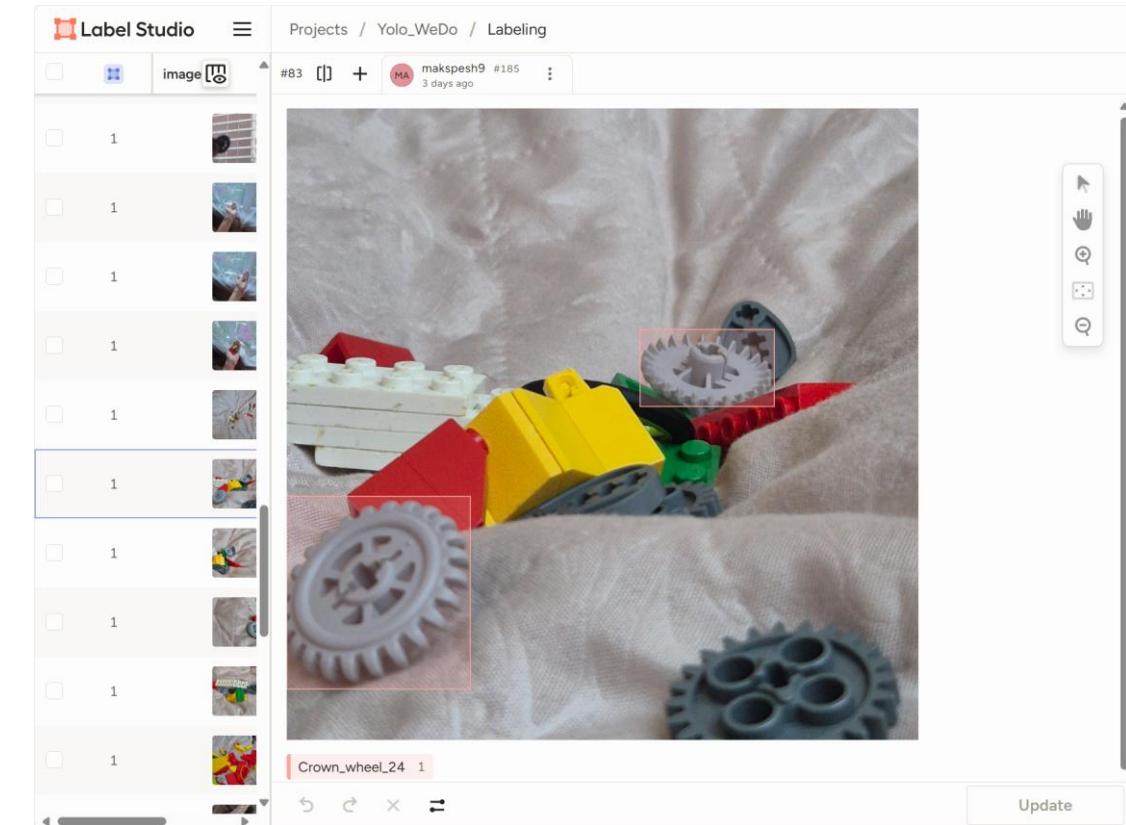
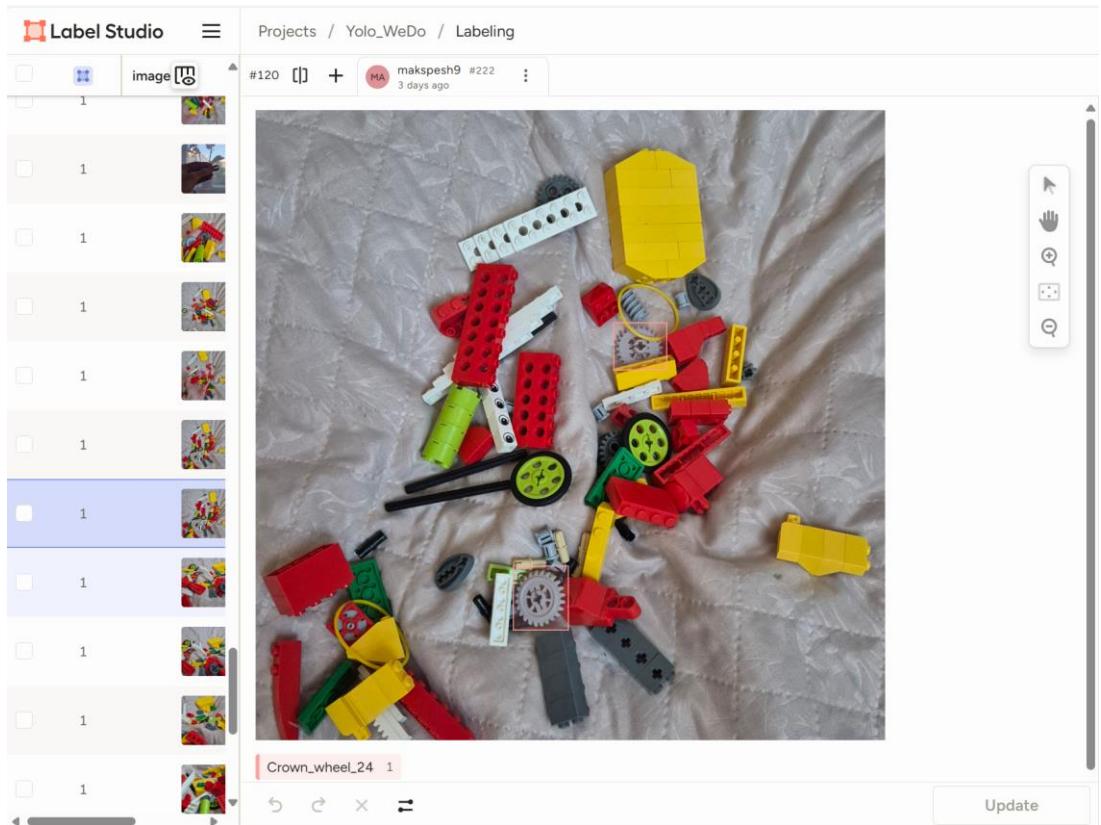
Technology Stack

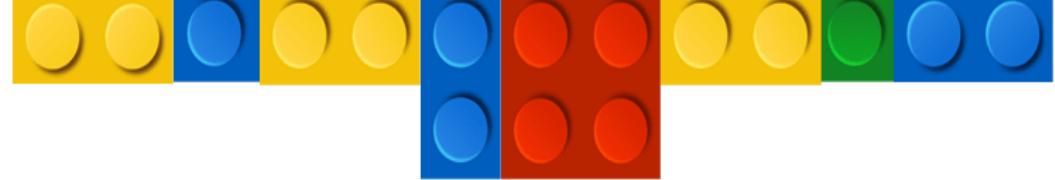
- Python
- Label Studio/CVAT
- YOLOv8
- OpenCV

Development Scheme 1

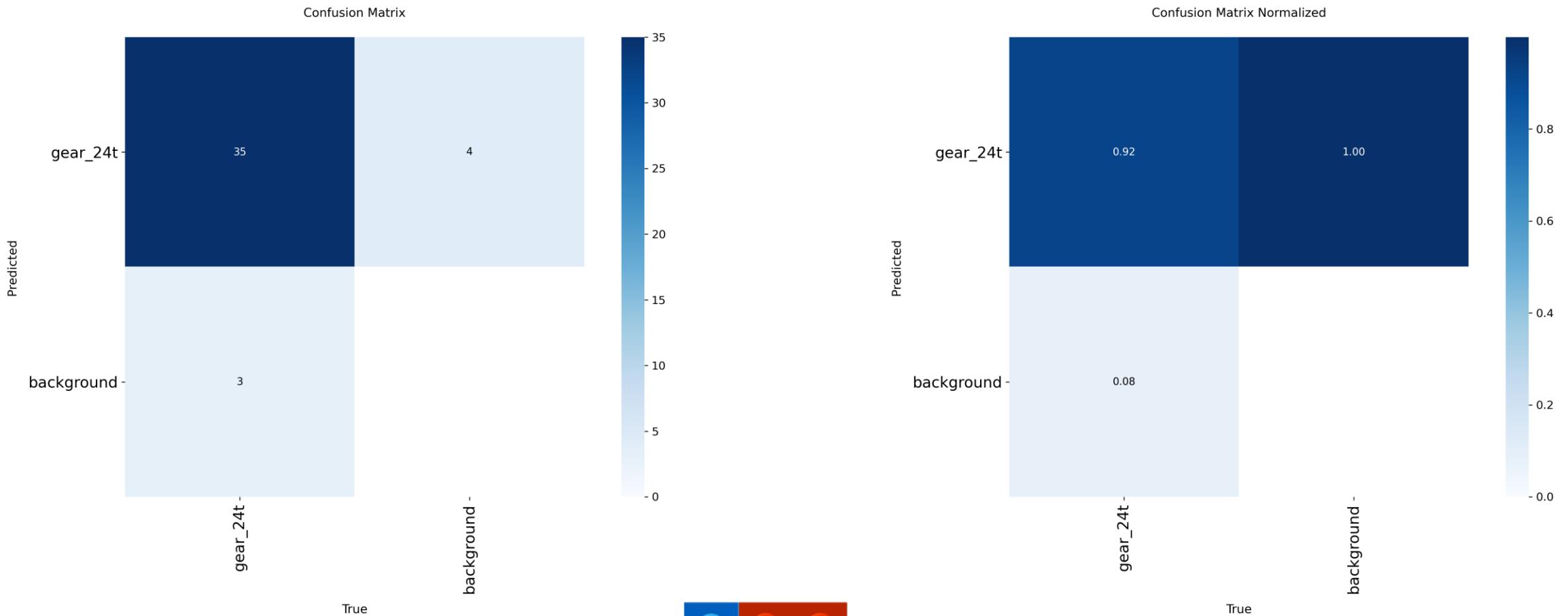


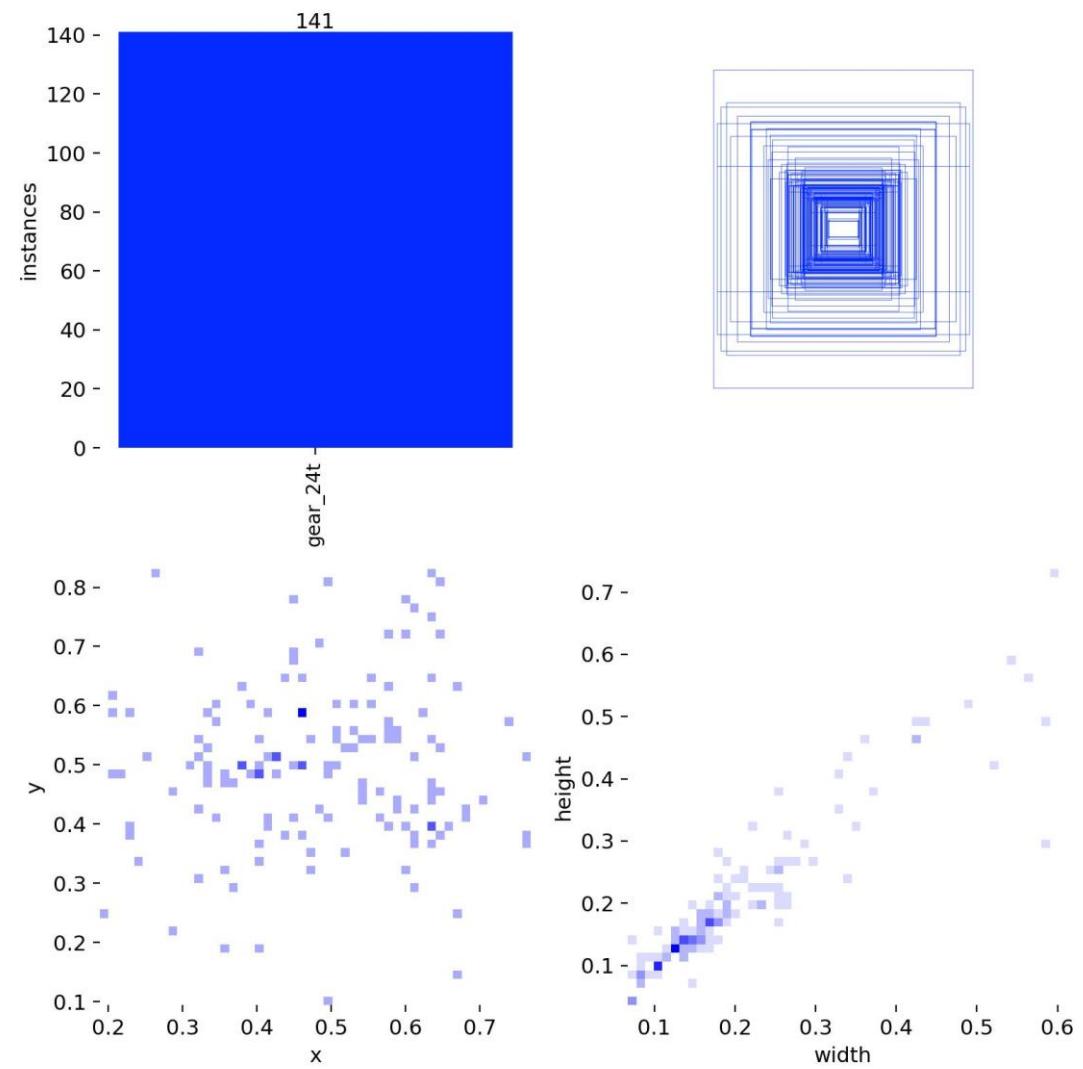
Markup Data

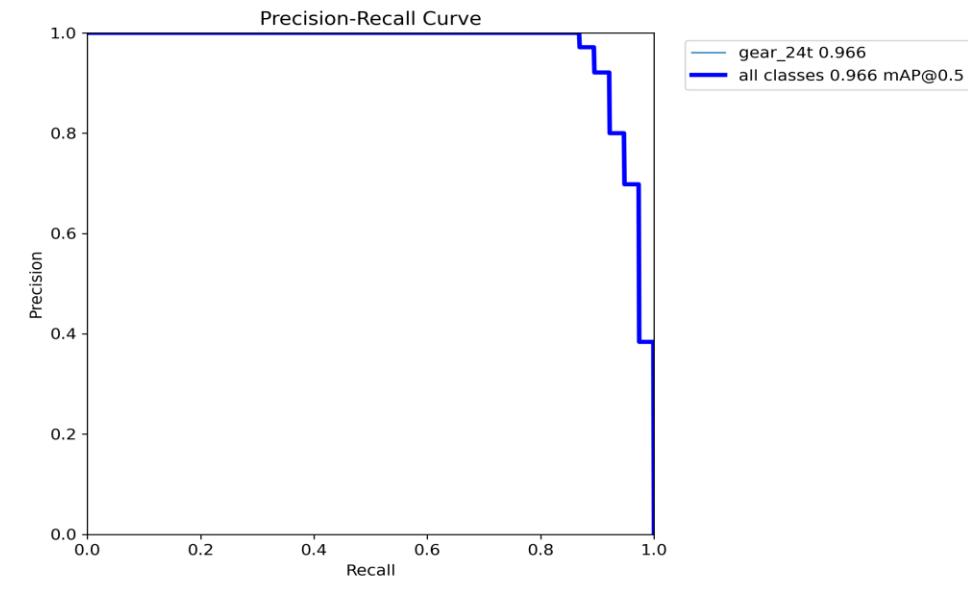
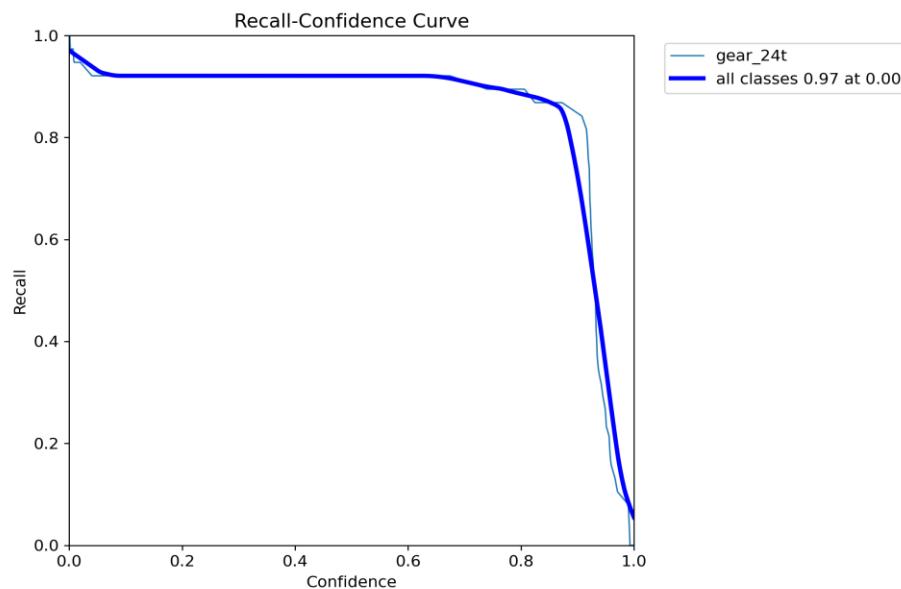
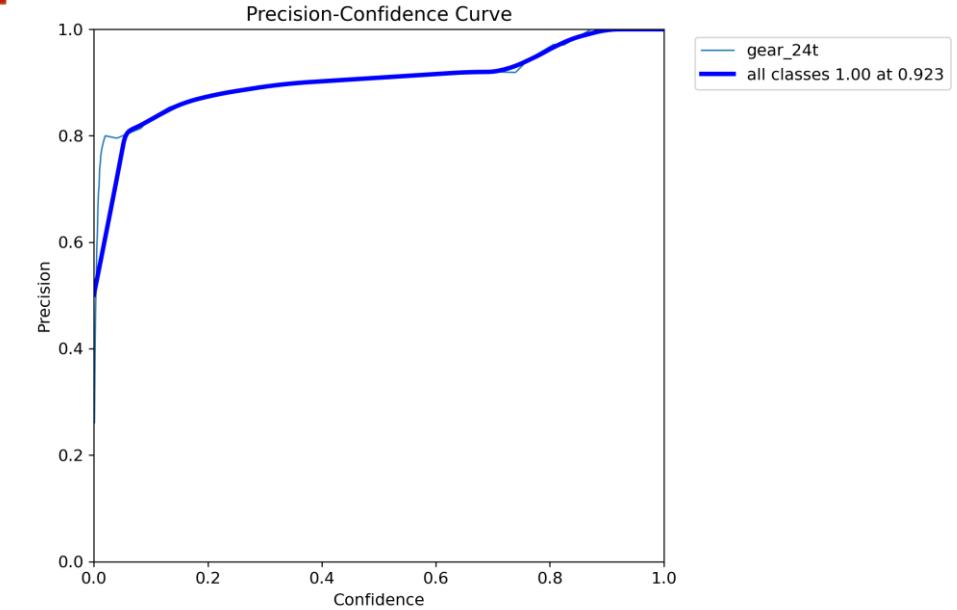
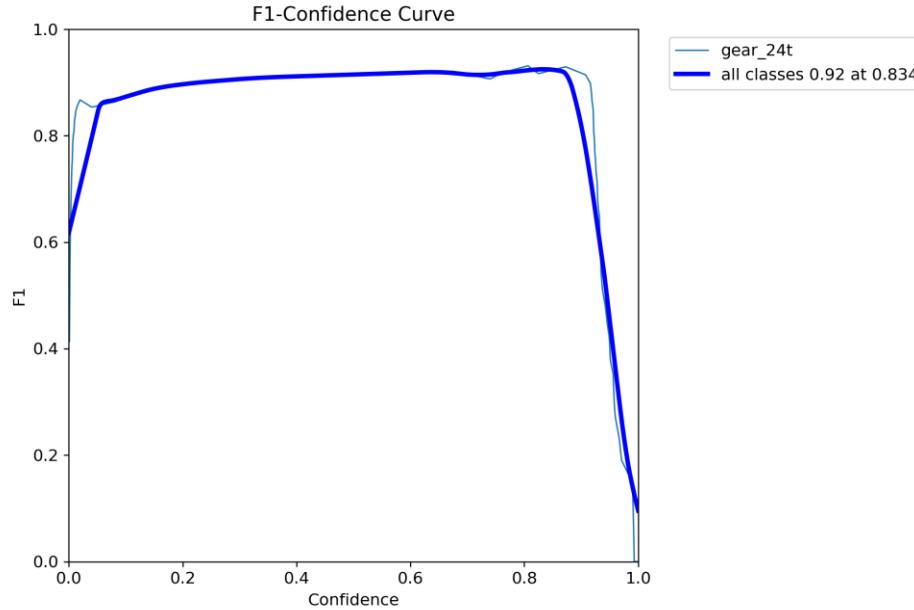




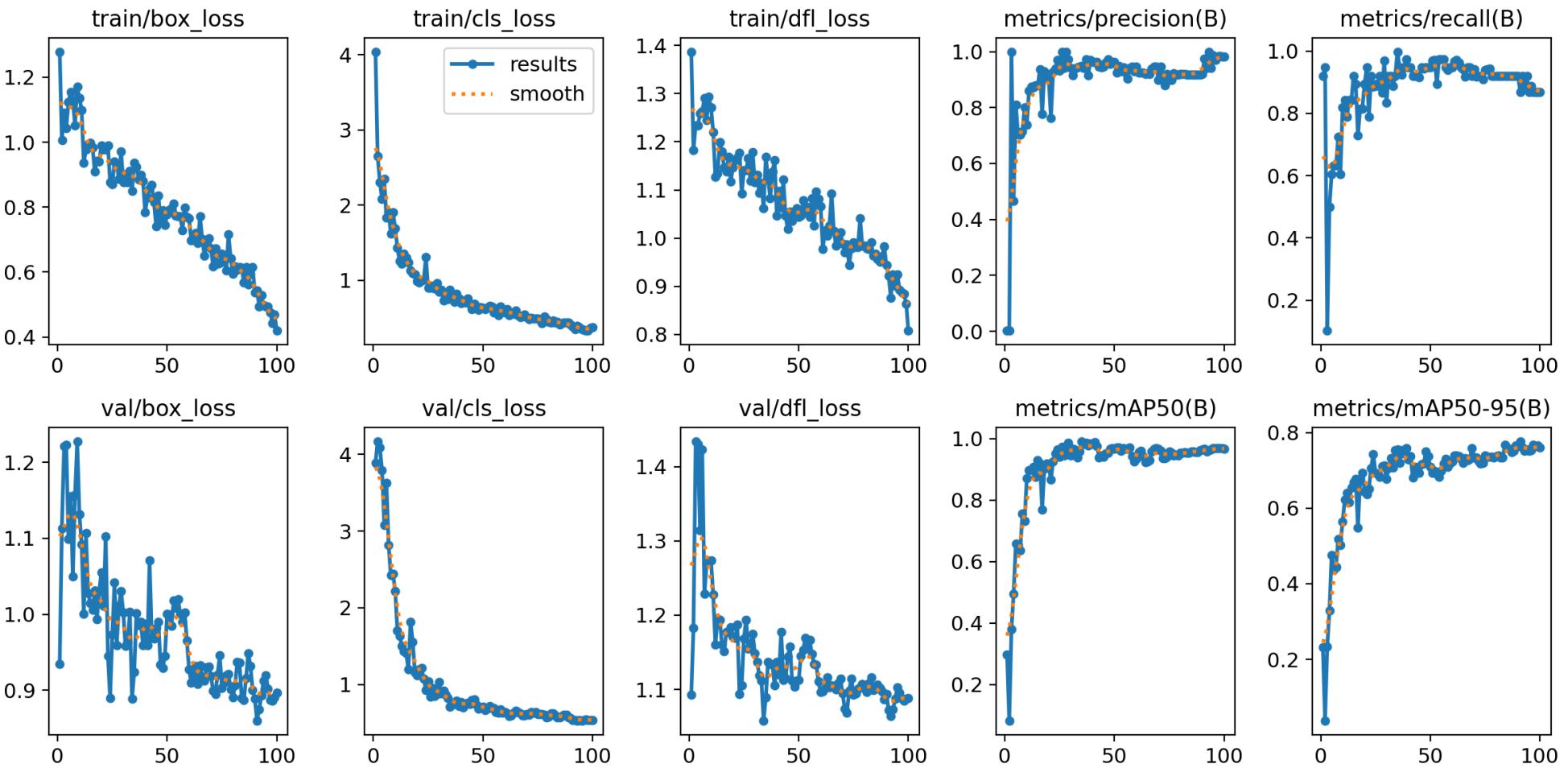
Confusion and Normalized Confusion Matrix

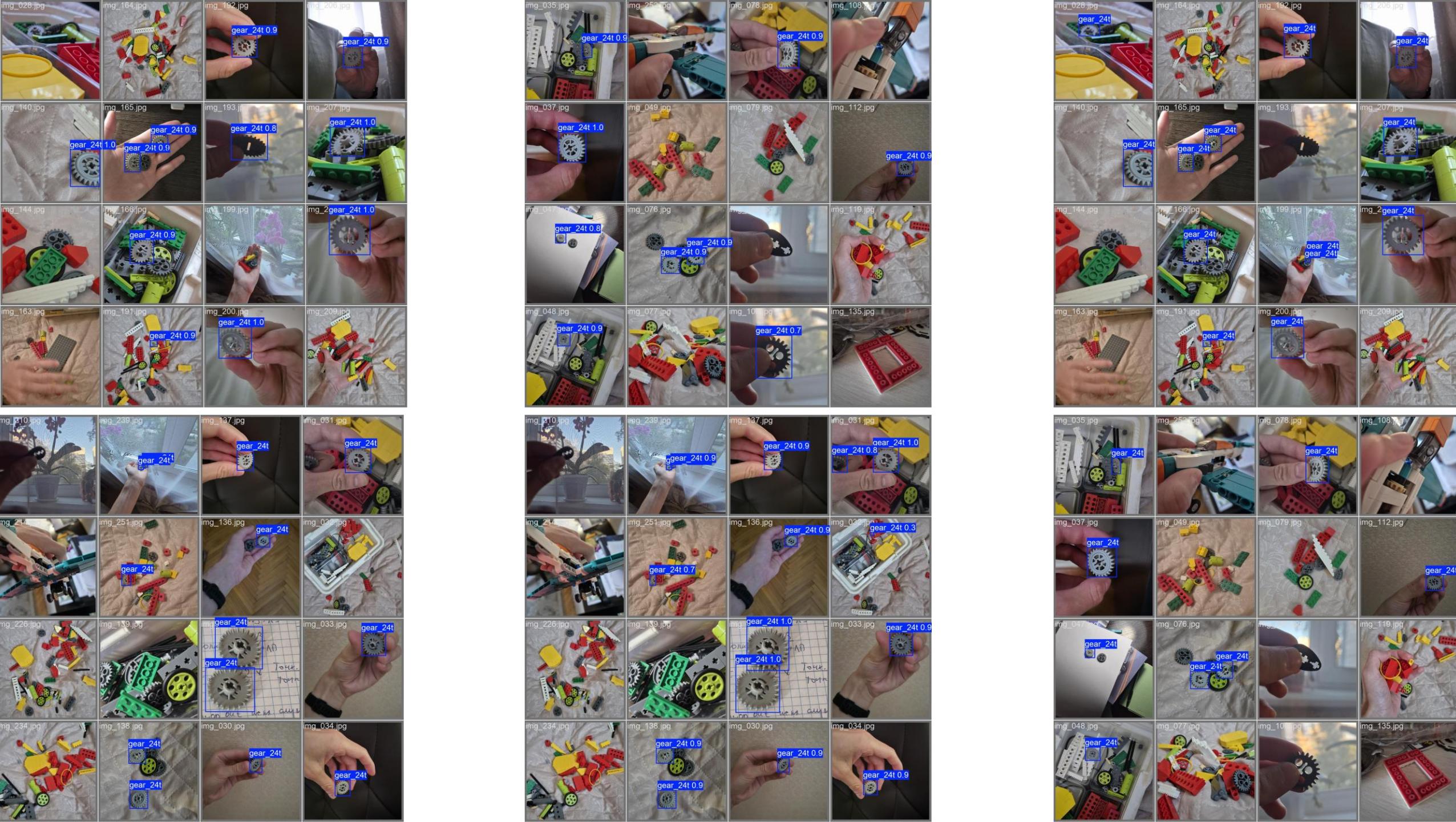




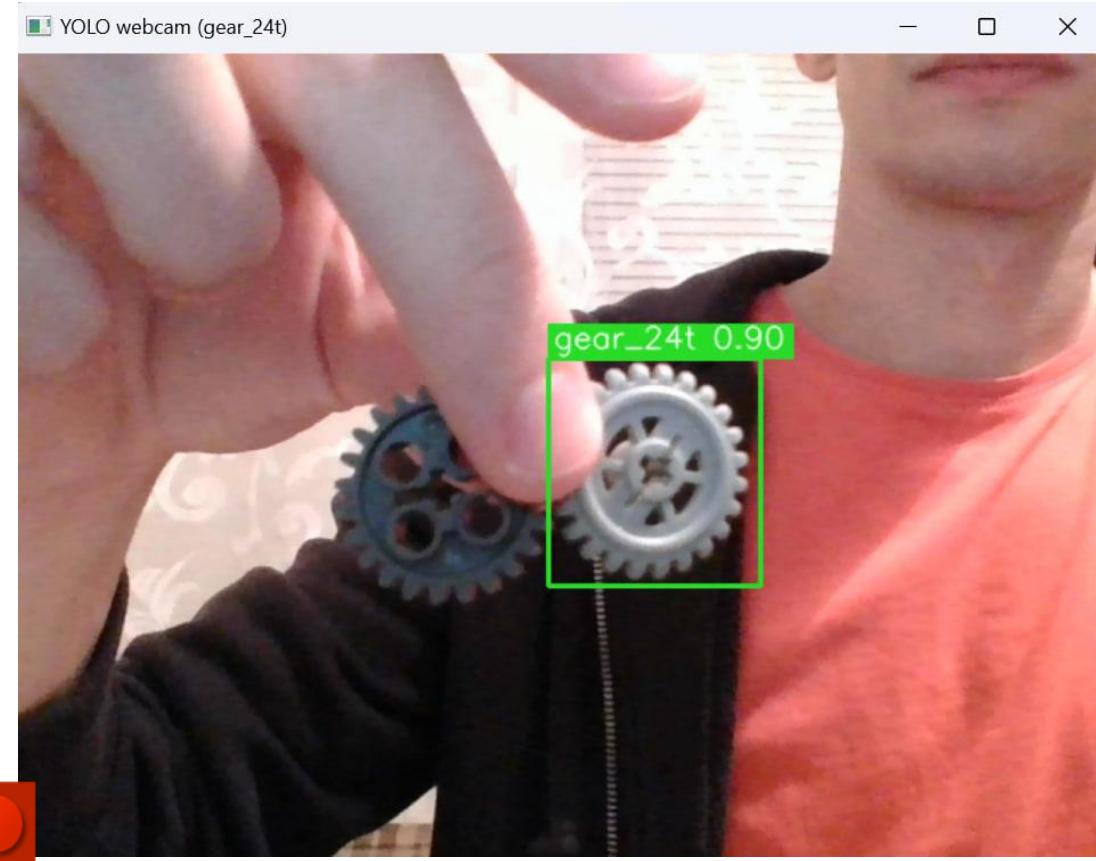


Metrics

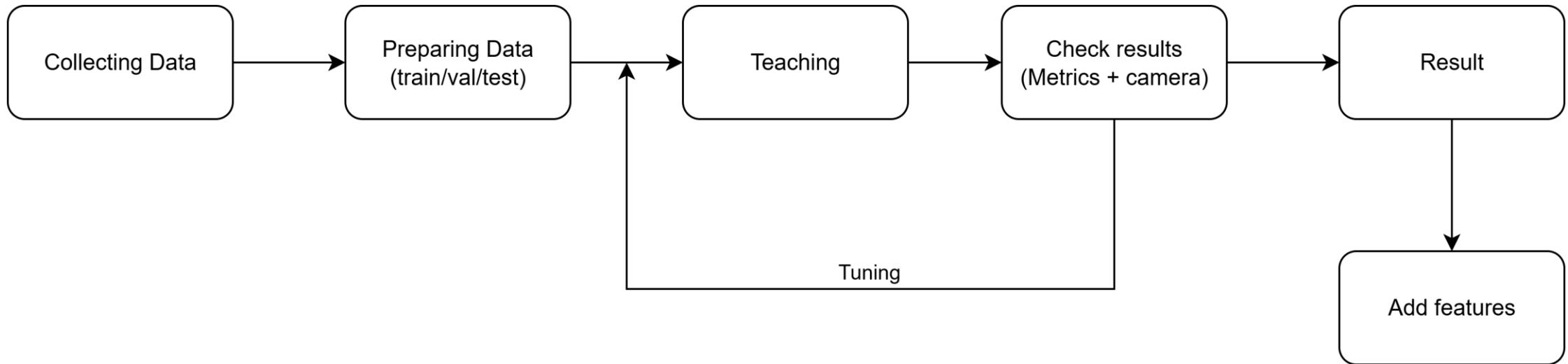




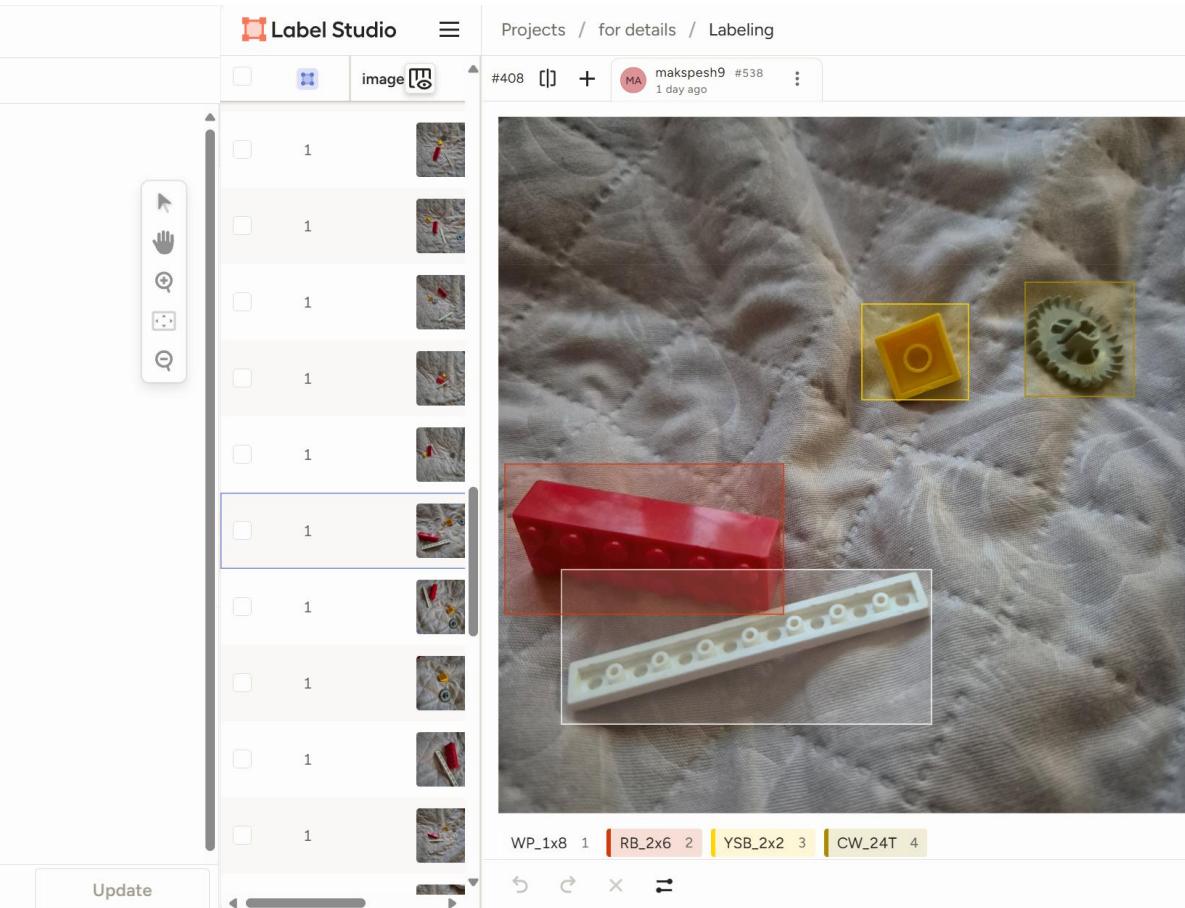
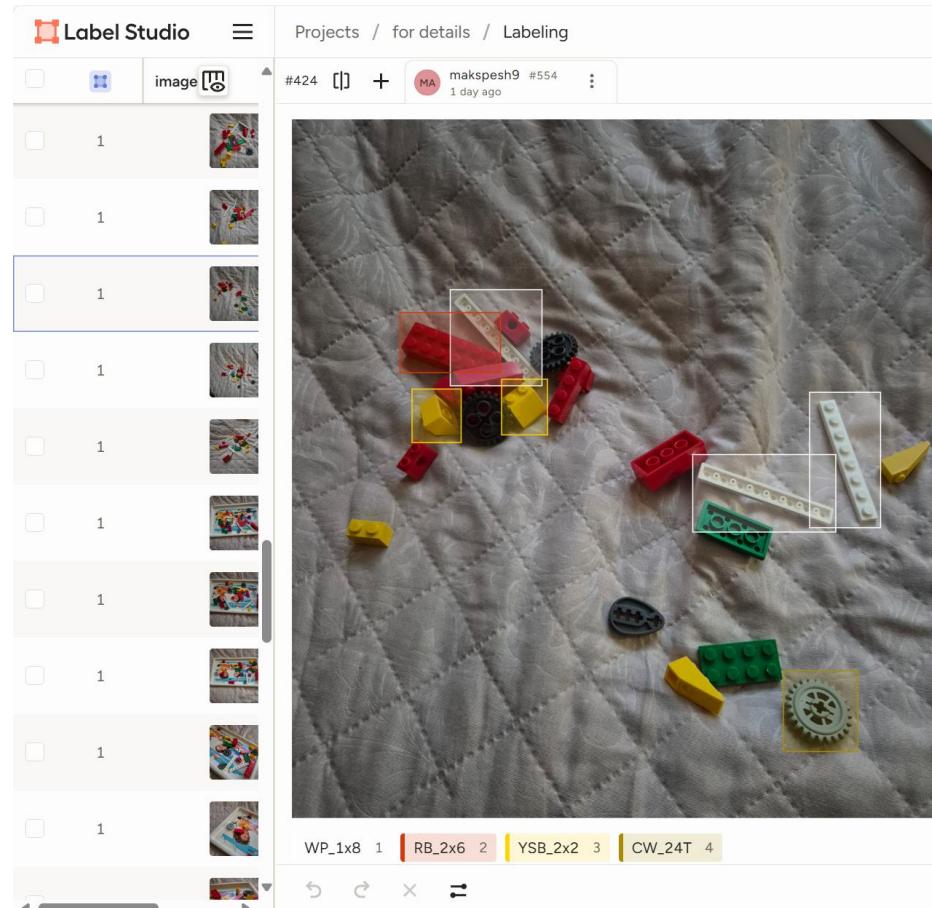
Result

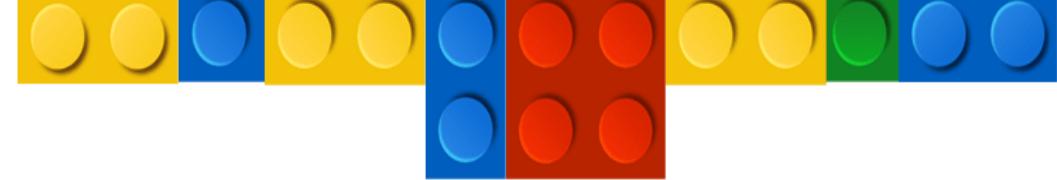


Development Scheme 2

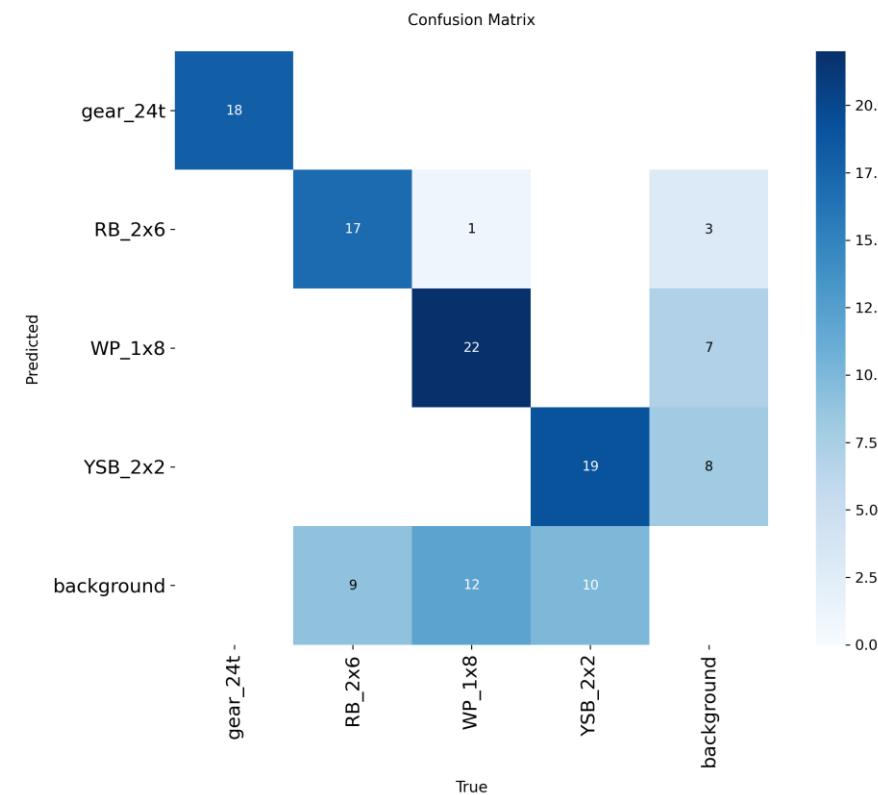
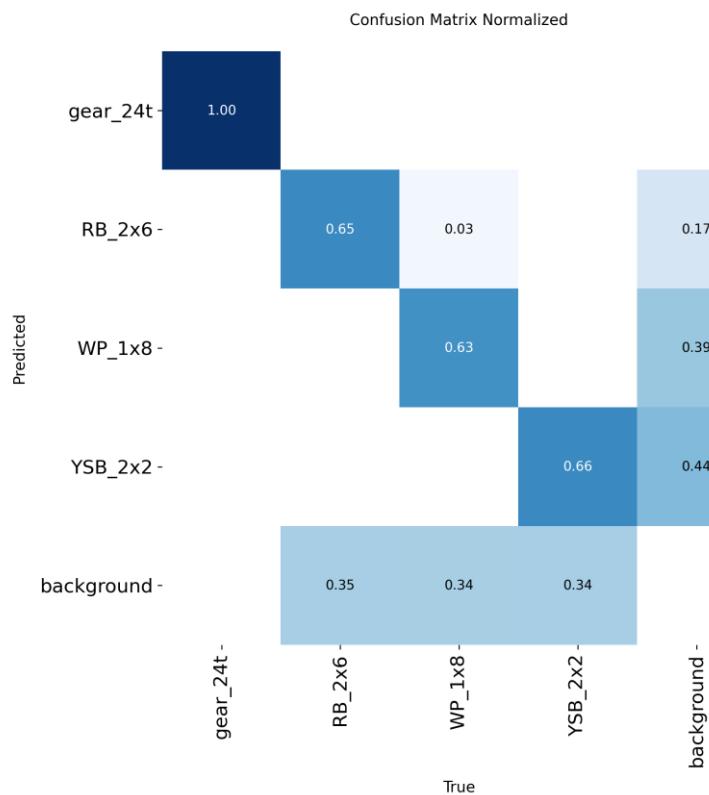


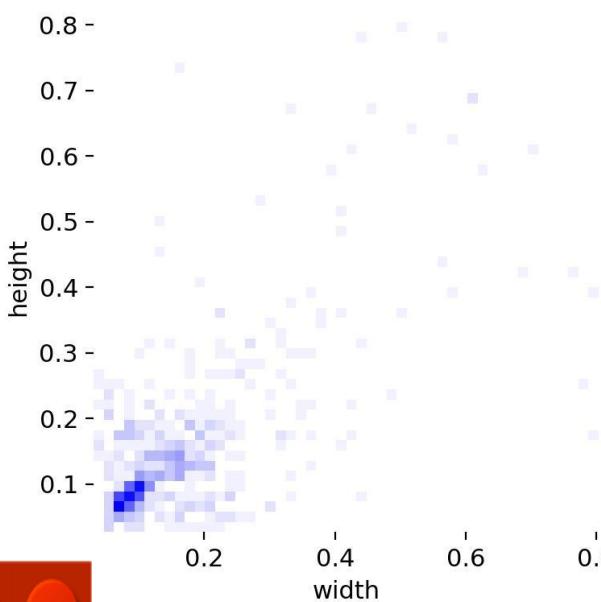
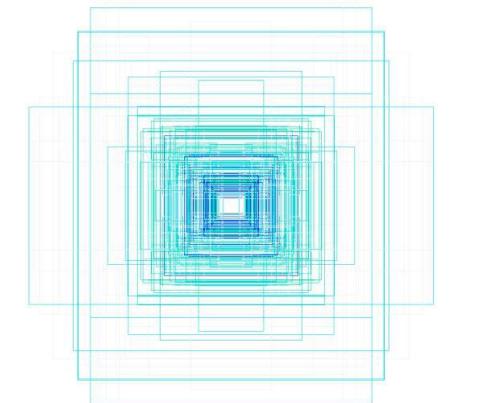
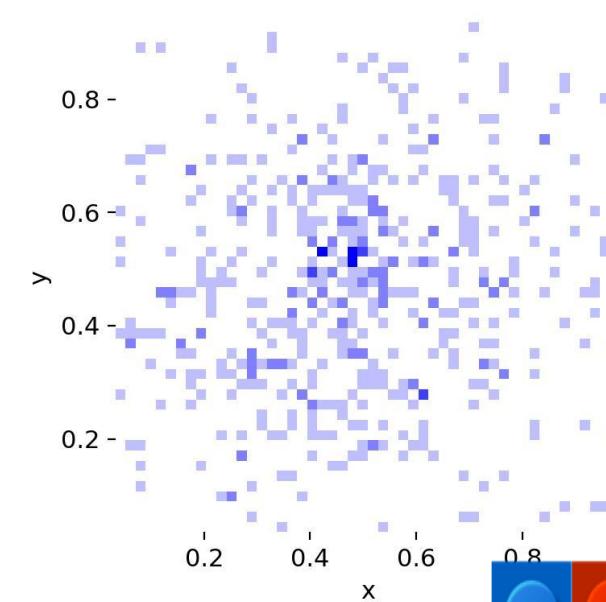
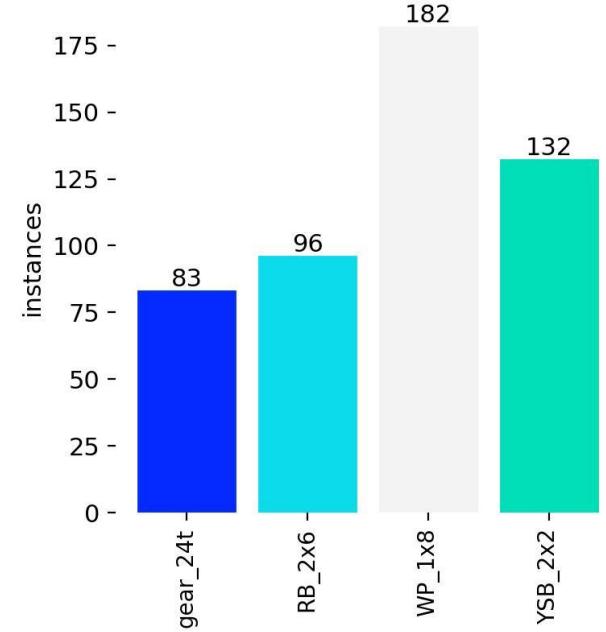
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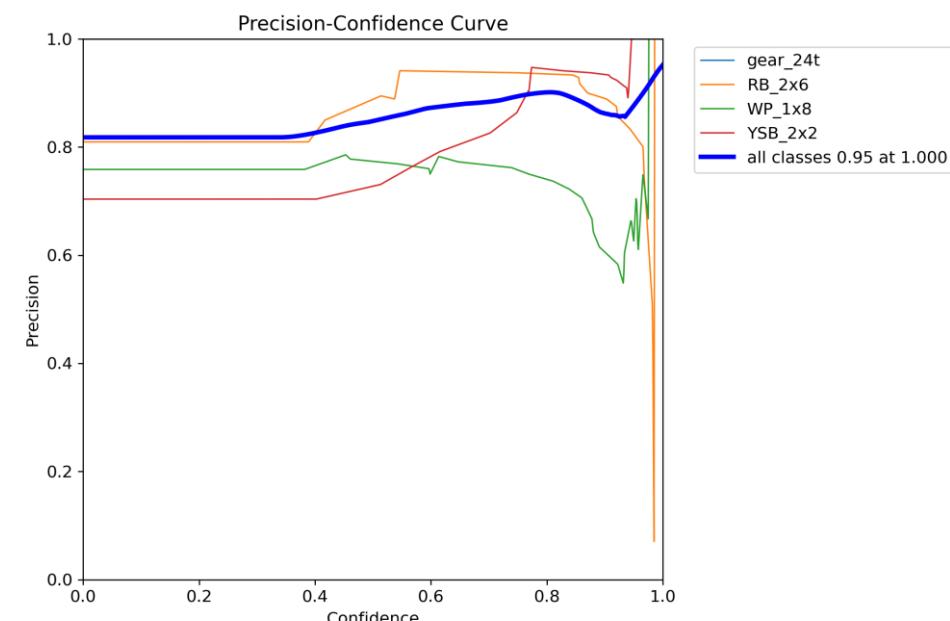
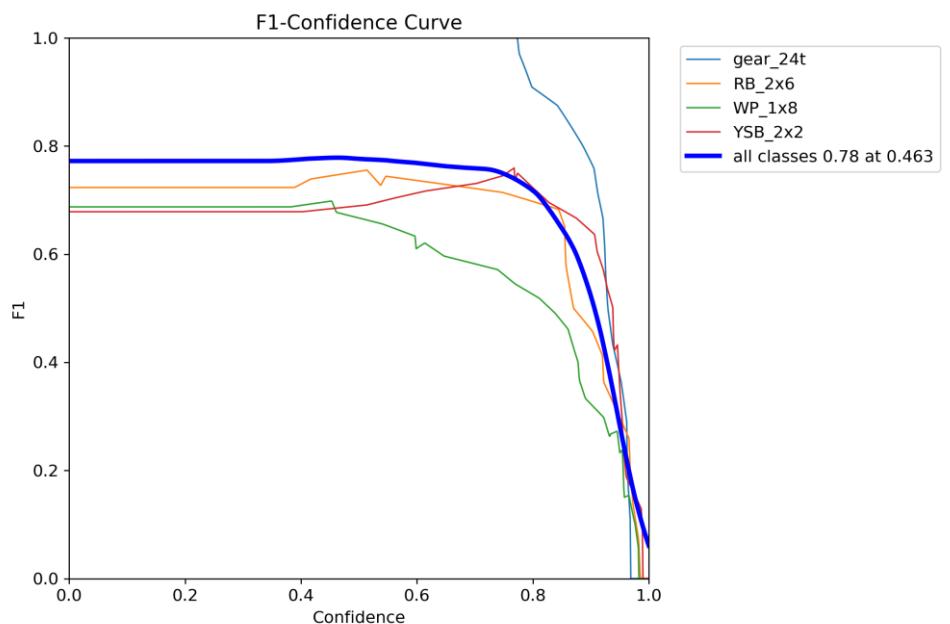
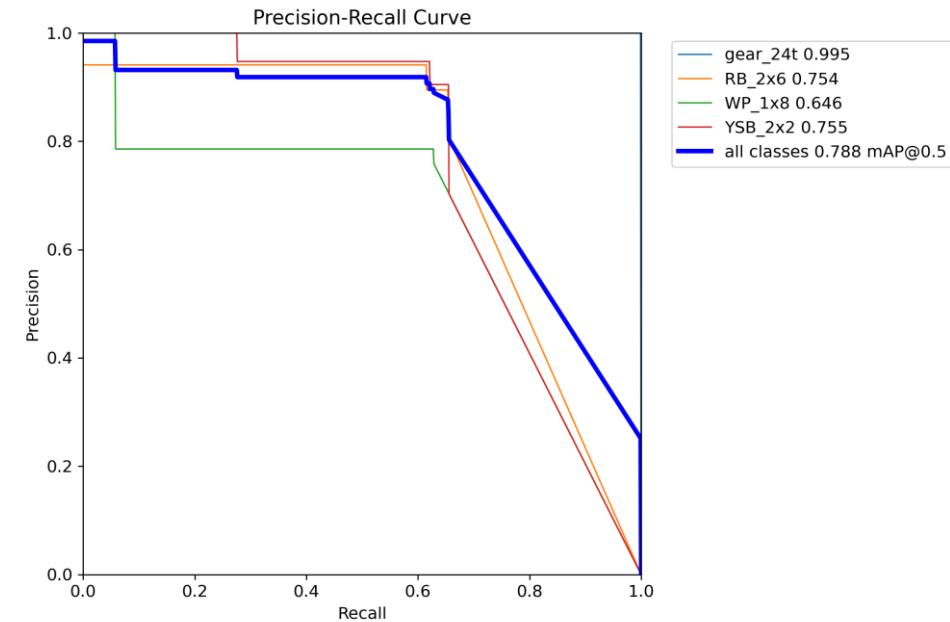
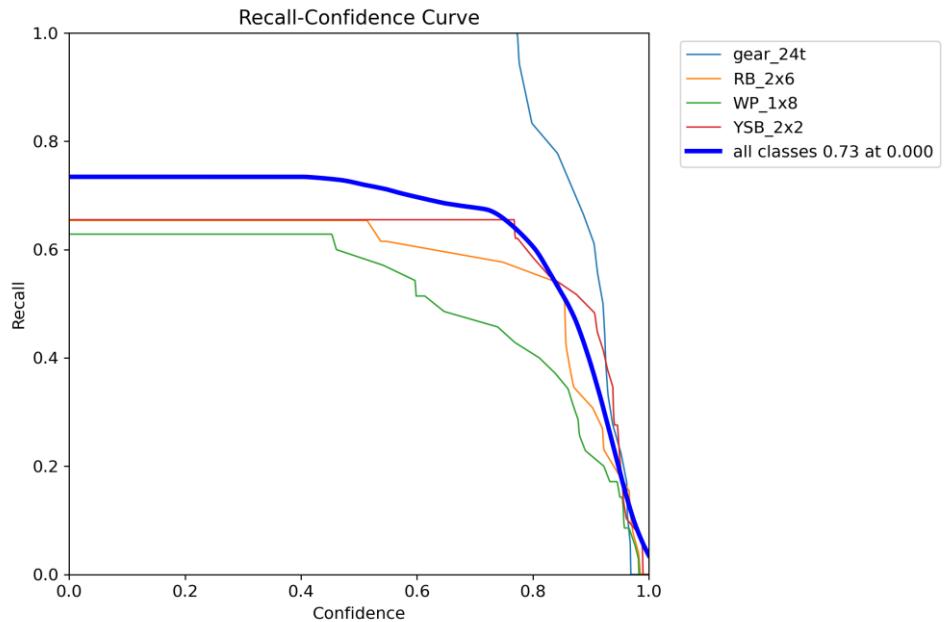




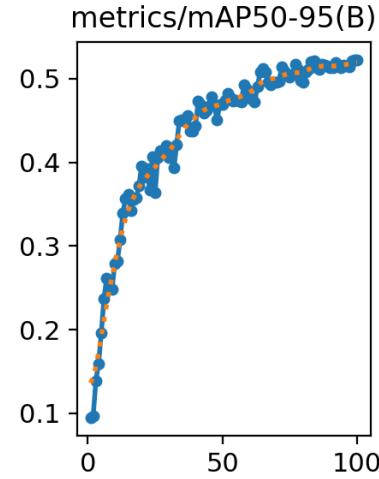
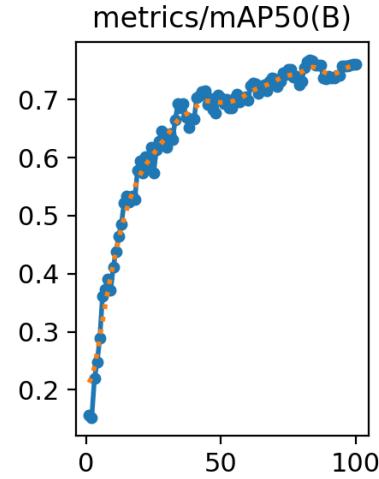
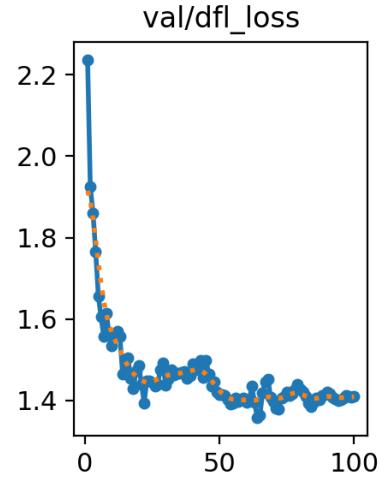
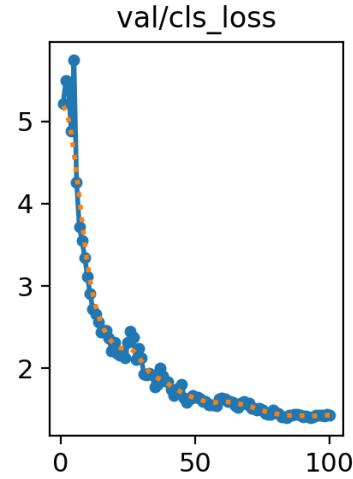
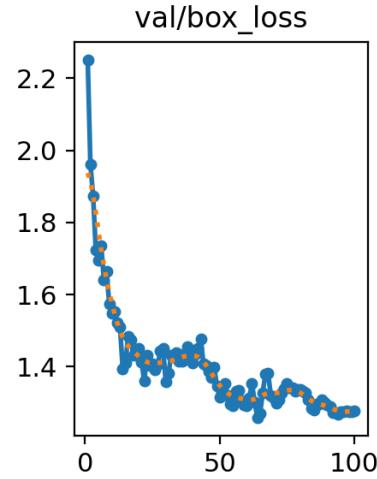
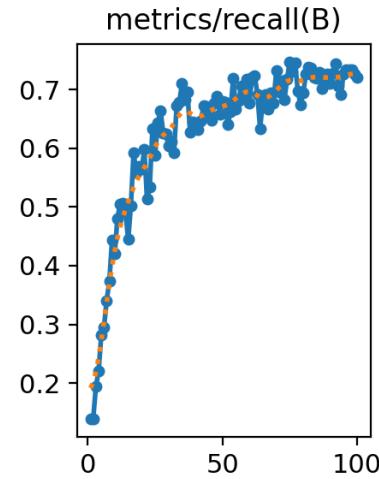
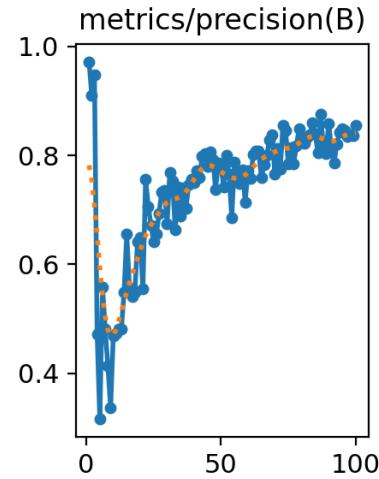
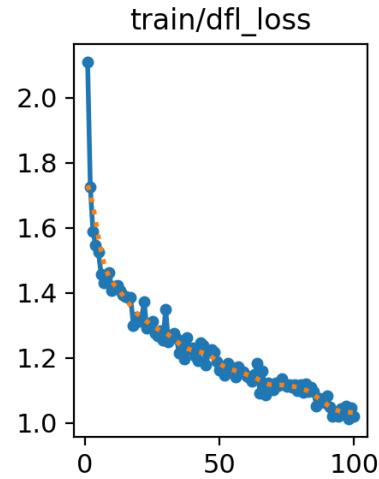
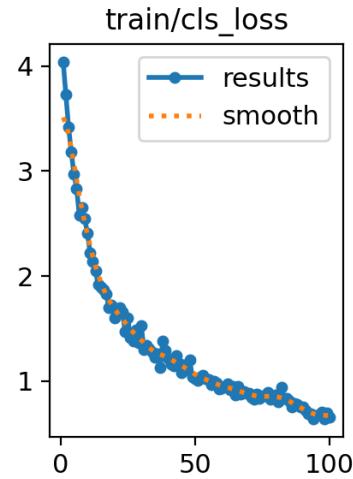
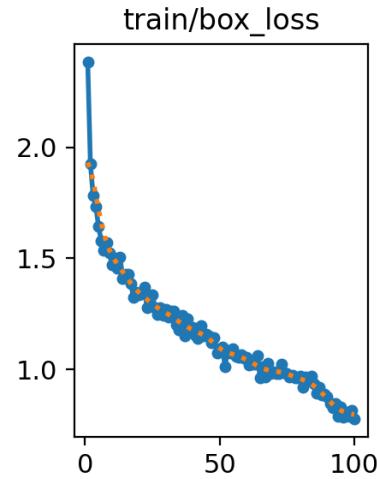
Confusion and Normalized Confusion Matrix

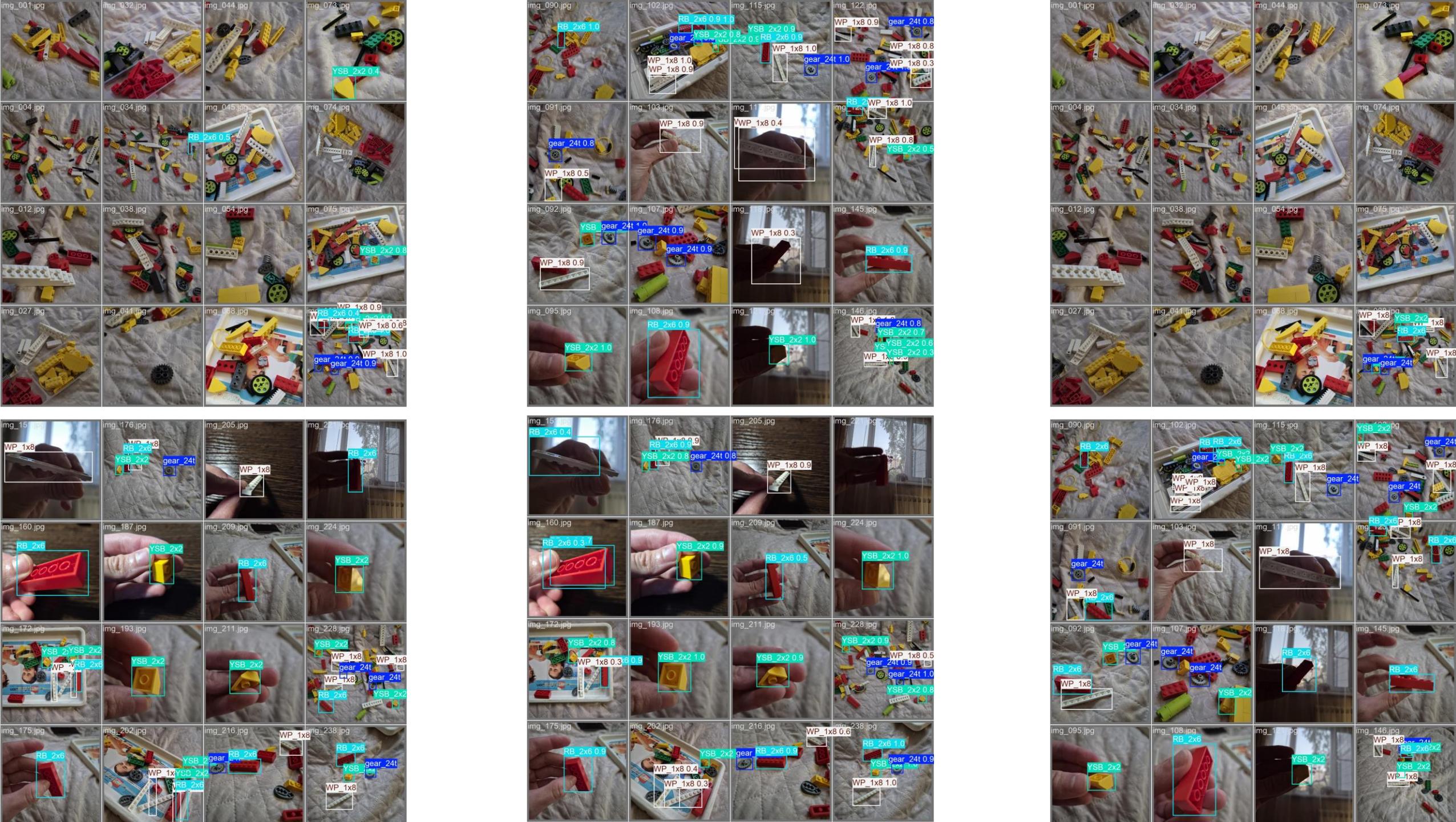


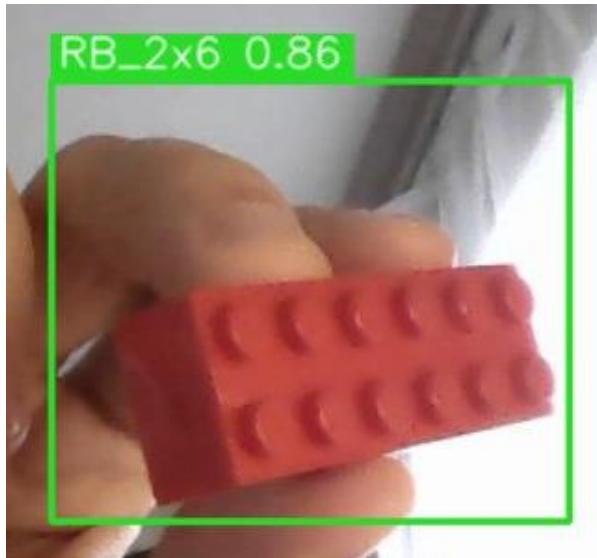




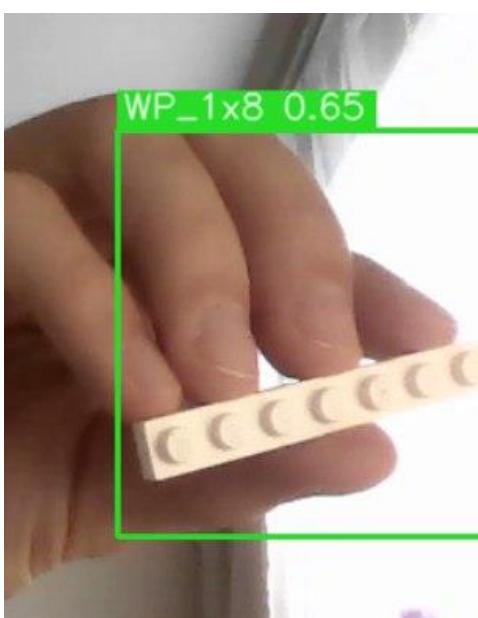
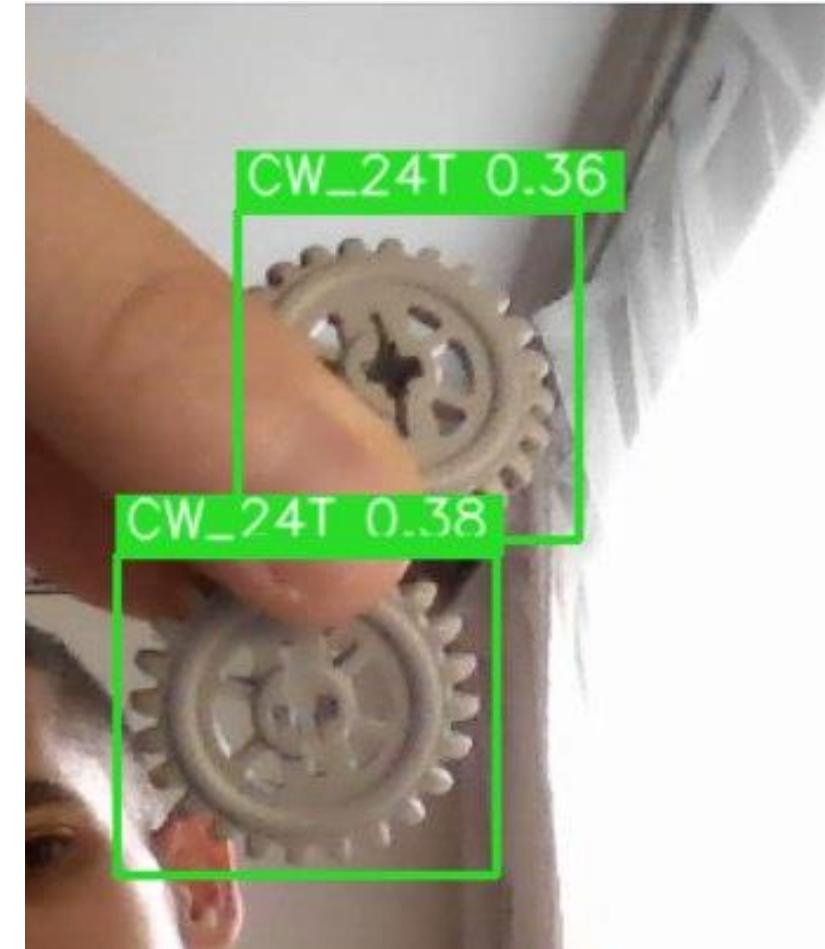
Metrics





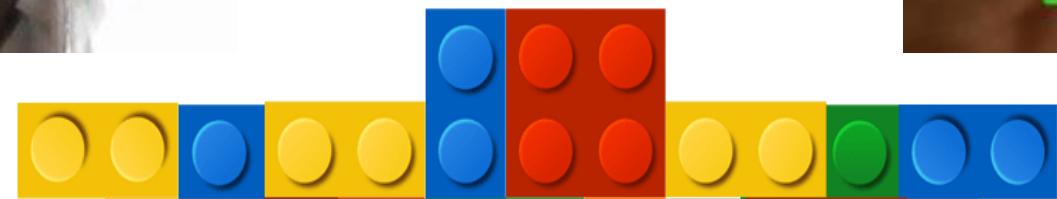
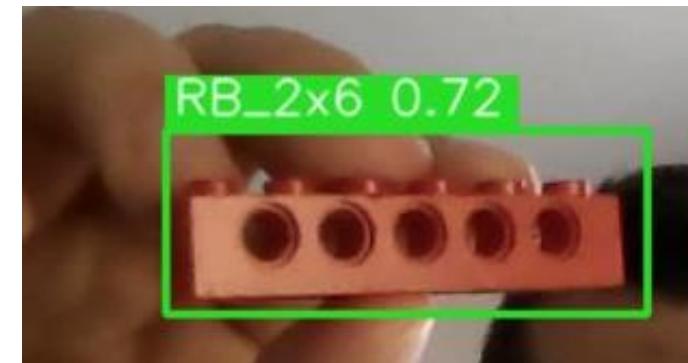
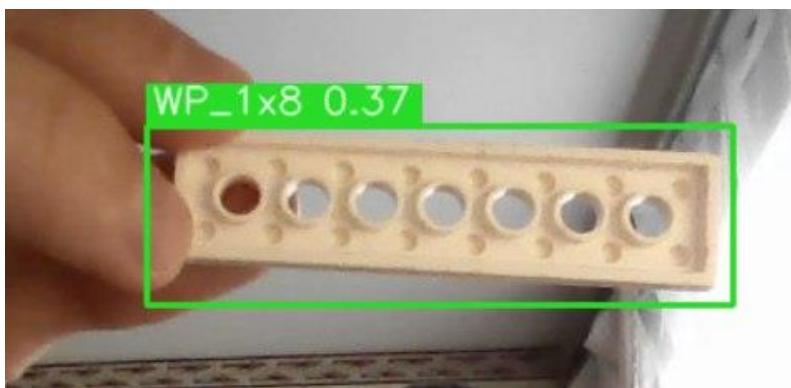
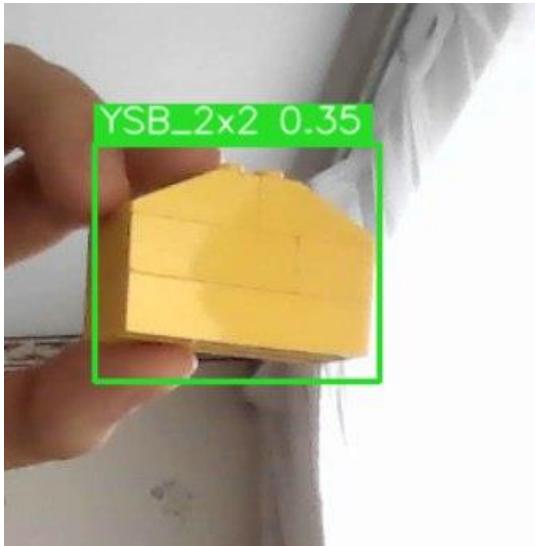


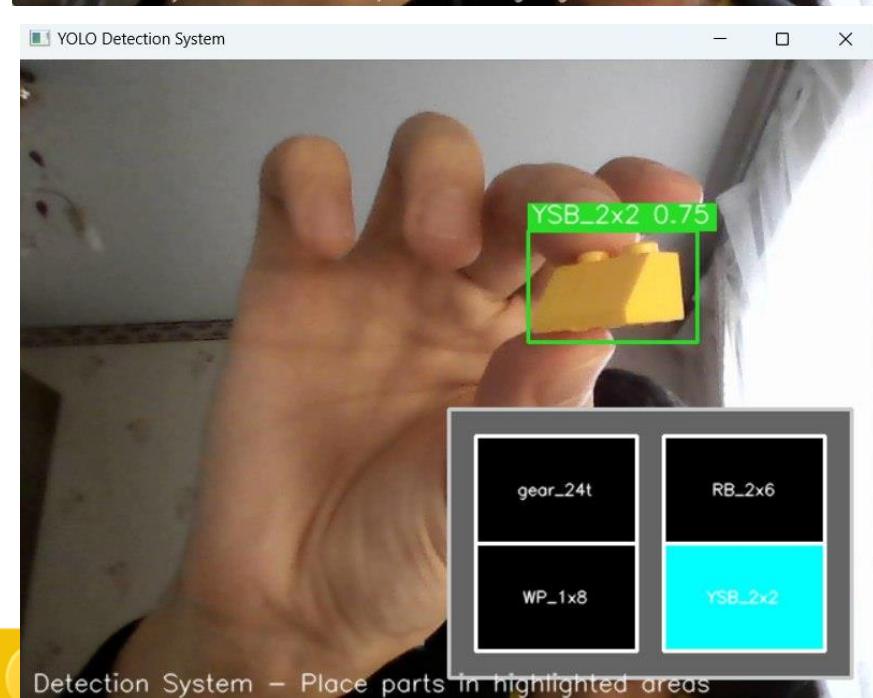
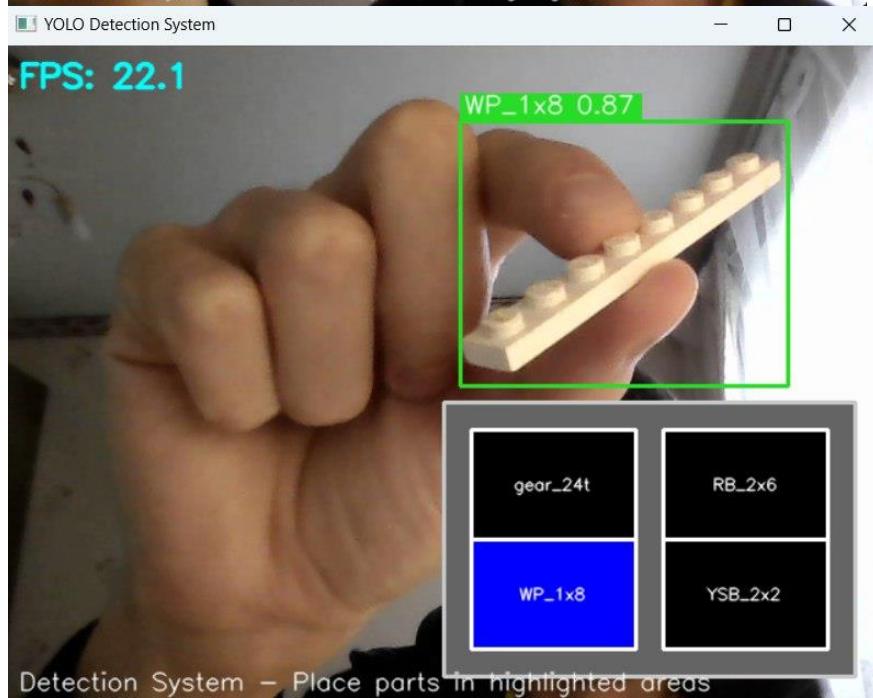
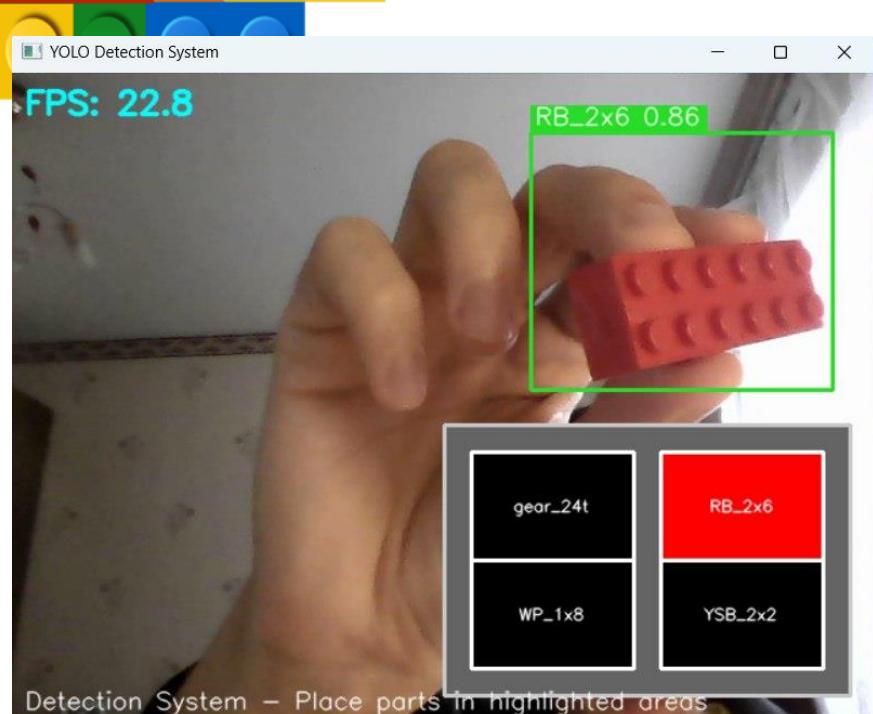
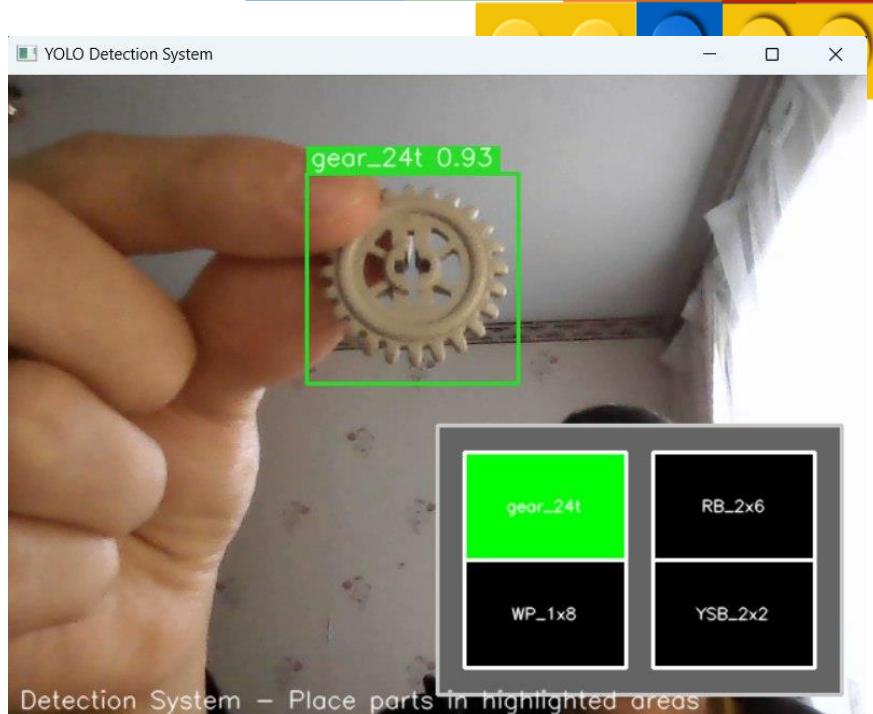
Right Detection





Wrong Detection





Results

As a result, weights for the YOLOv8 model were obtained for recognizing parts for four sections.

When a part is detected, the algorithm visually indicates which section the part should be placed into.

According to the metrics, the gear wheel is identified with the highest accuracy. The white plate (size 1x8) is recognized with the lowest accuracy (in some cases, YOLO interprets a hand as a part).

To improve the precision of part recognition, it is necessary to further train the model with an expanded dataset for each part, as well as apply data augmentation to increase detection accuracy. Special attention should also be paid to the quality of data labeling.

Thank you for attention!