YOLOv8 Multiclass Training Report

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Introduction

In this work, we trained a YOLOv8 model capable of detecting four hazard object categories: **cables**, **fire**, **knives**, and **tools**. Instead of training separate models for each class (which we did before), we merged multiple datasets into a single multiclass dataset so the model can learn all four categories together. Our report summarizes the dataset preparation, labeling standardization, merging procedure, and training steps.

Dataset Preparation and Relabeling

We imported four datasets from Roboflow. Each dataset originally used its own internal class numbering, so we created a unified labeling system to ensure that all annotations followed the same structure. The final class mapping was:

- cables $\rightarrow$ 0
- fire $\rightarrow$ 1
- knife $\rightarrow$ 2
- tool $\rightarrow$ 3

All label files were rewritten to match this mapping so that YOLO could correctly distinguish between the four categories during training.

Dataset Merging

Every dataset included its own train, validation, and test splits. We combined all splits into one unified directory structure:

- `dataset/train/images` and `dataset/train/labels`
- `dataset/valid/images` and `dataset/valid/labels`
- `dataset/test/images` and `dataset/test/labels`

We then created a `data.yaml` file specifying the dataset paths, the total number of classes, and the class names.

Training Process

We trained the model using the `ultralytics` YOLOv8s architecture on Google Colab. The main training parameters were:

- epochs: 60
- image size: 640
- batch size: 16
- pretrained checkpoint: `yolov8s.pt`

Evaluation and Conclusion

We evaluated the trained model on the test split using the built-in `model.val` function, which produced precision, recall, and mAP scores for each class. These metrics allowed us to assess how well the model recognized each of the four categories.

Overall, the process resulted in a clean multiclass YOLOv8 model trained on merged and standardized datasets, providing consistent detection performance across the four hazard classes.