Key Terms in Simple Words

Instances – How many times a particular can appears in the training set.

Precision – When the model says, "This is a Coca-Cola can," how often is it right?

High precision = Model rarely makes mistakes.

Low precision = Model frequently misidentifies things.

Recall – Out of all the actual Coca-Cola cans in the images, how many did the model correctly detect?

High recall = It finds almost all of them.

Low recall = It misses many.

mAP50 – A basic accuracy score for detection at a 50% overlap threshold.

mAP50-95 – A stricter accuracy score that checks multiple levels of overlap between detected cans and actual cans.

How Well the Model Performed

Best Performing Cans:

Coca-Cola Marvel, Monster LH44, Nescafe Classic Iced Latte, Prime Shitass, Schweppes, Predator, Monster Mango Loco

The model is really good at recognizing these. It identifies them accurately and rarely makes mistakes.

Worst Performing Cans:

Regular Coca-Cola, Coca-Cola Plus, Hell Classic, Red Bull

The model struggles with these. It either mislabels other objects as these cans or completely misses them.

Example:

The model detects **Coca-Cola Marvel cans perfectly (100% recall and 86% precision) but struggles with Coca-Cola Plus (50% recall and only 35% precision).**

For Red Bull, the model finds all of them (100% recall) but also mistakenly labels other things as Red Bull (only 29.7% precision).

What This Means

Some cans are easier for the system to detect because they have unique colours/logos.

Others (like regular Coca-Cola and Red Bull) might be harder because they look similar to other cans.

Class-by-Class YOLO Training Results Analysis

Coca Cola

- **Instances:** 6
- **Precision:** 0.565 (Moderate; model makes false positives)
- **Recall:** 0.333 (Low; model misses some actual Coca Cola cans)
- **mAP50:** 0.584 (Decent)
- **mAP50-95:** 0.368 (Struggles with stricter IoU thresholds)

Coca Cola - Marvel

- **Instances:** 7
- **Precision:** 0.865 (Very high accuracy in identifying)
- **Recall:** 1.0 (Model detects all Coca Cola - Marvel cans)
- **mAP50:** 0.995 (Near perfect detection)
- **mAP50-95:** 0.737 (Still very strong at stricter thresholds)

Coca Cola Plus

- **Instances:** 4
- **Precision:** 0.354 (Low; model misidentifies many times)
- **Recall:** 0.5 (Misses half of the actual cans)
- **mAP50:** 0.509 (Below average detection performance)
- **mAP50-95:** 0.436 (Struggles with strict thresholds)

Coca Cola Zero

- **Instances:** 1
- **Precision:** 0.939 (Very high)
- **Recall:** 1.0 (Perfect recall)
- **mAP50:** 0.995 (Near perfect)
- **mAP50-95:** 0.597 (Drops at higher thresholds)

Hell Apple

- **Instances:** 6
- **Precision:** 0.768 (Good)
- **Recall:** 0.5 (Misses half of actual detections)
- **mAP50:** 0.692 (Decent)
- **mAP50-95:** 0.554 (Not as strong at stricter thresholds)

Hell Classic

- **Instances:** 4
- **Precision:** 0.557 (Moderate)
- **Recall:** 0.25 (Very poor recall)
- **mAP50:** 0.682 (Average)
- **mAP50-95:** 0.489 (Struggles at stricter thresholds)

Monster Aussie Lemonade

- **Instances:** 3
- **Precision:** 0.819 (Very high)
- **Recall:** 1.0 (Perfect recall)
- **mAP50:** 0.995 (Near perfect detection)
- **mAP50-95:** 0.808 (Very strong)

Monster LH44

- **Instances:** 2
- **Precision:** 0.828 (Very high)
- **Recall:** 1.0 (Perfect recall)
- **mAP50:** 0.995 (Near perfect detection)
- **mAP50-95:** 0.895 (Exceptional performance)

Monster Mango Loco

- **Instances:** 12
- **Precision:** 0.788 (Very strong)
- **Recall:** 1.0 (Perfect recall)
- **mAP50:** 0.995 (Near perfect detection)
- **mAP50-95:** 0.704 (Strong at stricter thresholds)

Nescafe Classic Iced Latte

- **Instances:** 3
- **Precision:** 0.851 (Very high)
- **Recall:** 1.0 (Perfect recall)
- **mAP50:** 0.995 (Near perfect detection)
- **mAP50-95:** 0.841 (Very strong)

Pepsi Retro

- **Instances:** 3
- **Precision:** 0.787 (Good)
- **Recall:** 0.667 (Misses some detections)
- **mAP50:** 0.913 (High accuracy)
- **mAP50-95:** 0.698 (Decent at stricter thresholds)

Predator

- **Instances:** 3
- **Precision:** 0.86 (Very high)
- **Recall:** 1.0 (Perfect recall)
- **mAP50:** 0.995 (Near perfect detection)
- **mAP50-95:** 0.841 (Very strong)

Prime - Shitass

- **Instances:** 6
- **Precision:** 1.0 (Perfect precision)
- **Recall:** 0.819 (Misses some detections)
- **mAP50:** 0.995 (Near perfect detection)
- **mAP50-95:** 0.825 (Strong at stricter thresholds)

Redbull

- **Instances:** 4
- **Precision:** 0.297 (Very low; model misidentifies often)
- **Recall:** 1.0 (Detects all Redbull cans but with false positives)
- **mAP50:** 0.845 (Surprisingly good at IoU 50%)
- **mAP50-95:** 0.651 (Struggles at stricter thresholds)

Redbull DanceYourStyle

- **Instances:** 7
- **Precision:** 1.0 (Perfect precision)
- **Recall:** 0.674 (Misses some actual detections)
- **mAP50:** 0.814 (High accuracy)
- **mAP50-95:** 0.609 (Lower at stricter thresholds)

Redbull Summer Edition

- **Instances:** 3

- **Precision:** 0.707 (Good)
- **Recall:** 1.0 (Perfect recall)
- **mAP50:** 0.995 (Near perfect detection)
- **mAP50-95:** 0.638 (Struggles at stricter thresholds)

Redbull Yellow Edition

- **Instances:** 3
- **Precision:** 0.641 (Decent)
- **Recall:** 1.0 (Perfect recall)
- **mAP50:** 0.995 (Near perfect detection)
- **mAP50-95:** 0.808 (Strong at stricter thresholds)

Schweppes

- **Instances:** 7
- **Precision:** 0.963 (Exceptional)
- **Recall:** 1.0 (Perfect recall)
- **mAP50:** 0.995 (Near perfect detection)
- **mAP50-95:** 0.696 (Drops slightly at stricter thresholds)

White Monster

- **Instances:** 7
- **Precision:** 0.82 (High)
- **Recall:** 0.714 (Misses some detections)
- **mAP50:** 0.836 (Good accuracy)
- **mAP50-95:** 0.639 (Weaker at stricter thresholds)

Summary & Recommendations

- **Best Performing Classes**:
    - **Coca Cola - Marvel, Monster LH44, Monster Mango Loco, Nescafe Classic Iced Latte, Predator, Prime - Shitass, Schweppes**
    - These classes have **high precision and recall**, meaning the model detects them correctly with minimal false positives.
- **Worst Performing Classes**:
    - **Coca Cola, Coca Cola Plus, Hell Classic, Redbull**

    - These have **low precision or recall**, meaning the model either misidentifies them or misses detections.

- **Redbull has very low precision (0.297),** meaning it is frequently misclassified.

Future Game Plan

The Model is Confused by Similar Cans

Some cans, like **Regular Coca-Cola, Coca-Cola Plus, and Red Bull**, are performing poorly. This happens because:

- **They look very similar to other cans** in your dataset (e.g., Coca-Cola Marvel vs. Regular Coca-Cola).
- **Their colours and logos don't have enough unique features** for the AI to easily tell them apart.

Solution:

- **Add more training images** where these cans appear in different lighting, angles, and backgrounds.
- **Make sure the cans aren't cropped badly**—the AI needs to see the whole object clearly.
- **Use data augmentation** (flipping, rotating, slightly changing brightness) to help the model learn better.

Some Classes Have Too Few Examples

Your dataset might have an **imbalance**, where some cans have many images, while others have very few.
For example:

- **Coca-Cola Zero only has 1 instance!** The model can't learn properly with just one image.
- **More training data = better learning.**

Solution:

- **Find or generate more images** for the underrepresented cans.
- **Ensure an even number of images for each type of can** to prevent bias.

Precision vs. Recall Problem

- **Red Bull has 100% recall but only 29.7% precision.**
    - This means the model **finds all Red Bull cans** but **also wrongly calls other cans "Red Bull"**.

- **Coca-Cola Plus has 50% recall and 35% precision.**
    - It **misses** many real Coca-Cola Plus cans and **sometimes labels other cans incorrectly** as Coca-Cola Plus.

Solution:

- **Make the model more selective.** Right now, it's too eager to label things as Red Bull. You can tweak the confidence threshold so that it only predicts a can when it's more sure.
- **Improve the quality of labels.** Check if the wrong labels were assigned during training.

Check Labelling Quality

- If the training data has **incorrect or inconsistent labels**, the AI will learn incorrectly.
- Example: If a **Pepsi can was accidentally labelled as a Red Bull**, the AI will start thinking that Pepsi cans look like Red Bull.

Solution:

- **Manually review** some of the training images to make sure they are labeled correctly.

Adjust Training Settings

- If you trained the model **for too few epochs**, it might not have learned enough.
- If the **IoU threshold** was too high, the model might struggle to detect objects that don't perfectly overlap with its predictions.

Solution:

- **Retrain the model with a slightly longer training time.**
- **Try lowering the IoU threshold slightly** (if it's too strict, the model might reject correct detections).

Final Recommendation:

📌 **Step 1** – Collect more diverse images for the low-performing cans.
📌 **Step 2** – Use data augmentation to improve the model's ability to recognize variations.
📌 **Step 3** – Double-check labels for accuracy.
📌 **Step 4** – Adjust training settings (confidence threshold, IoU, epochs).