**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).