# Machine Learning Project

## Instance Segmentation using YOLOv8 on Repair Dataset

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# Step 1

- Goal: We want to see how reducing the number of classes in the Repair dataset affects the model's accuracy

# Step 1: Training 14 class model

## Tuning Yolov8 hyper-parameters [1]

- Learning Rate : 0.1
- Momentum : 0.937
- weight_decay : 0.0005
- hsv_h= 0.015
- hsv_s= 0.7
- hsv_v= 0.4

[1] https://docs.ultralytics.com/modes/train/#train-settings

# Step 1: Training 14 class model

## Training

- Pre-trained Model: yolov8l-seg
- Image Size: 800 * 800 pixels
- Batch Size: 16
- Epochs: 250
- Device: L4[2]

[2] GPU : 22.5 GB Memory

# Step 1: Training 14 class model

## Training Results

Table 3. YOLOv8 achieves the best results regarding the motif segmentation ($PA_{motifs}$ includes all classes without background), while UNET wins when including the background in the evaluation ($PA_{avg}$ refer to all classes including background, same for $IoU$).

| Architecture | $IoU_{motifs}$ | $IoU_{avg}$ | $PA_{motifs}$ | $PA_{avg}$ |
|---|---|---|---|---|
| YOLOv8 | **0.582** | 0.538 | **0.634** | **0.797** |
| Original U-NET | 0.416 | **0.606** | 0.452 | 0.630 |
| Modified U-NET | 0.345 | 0.569 | 0.392 | 0.600 |

[3] Semantic Motif Segmentation of Archaeological Fresco Fragments

# Step 1: Training 14 class model

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| Metrics | Bounding Box | | | Segmentation | | |
|---|---|---|---|---|---|---|
| | Precision | Recall | mAP@50 | Precision | Recall | mAP@50 |
| **14 Class** | 0.7866 | 0.8659 | 0.8439 | 0.8961 | 0.8113 | 0.9025 |

[3] Semantic Motif Segmentation of Archaeological Fresco Fragments

# Step 1: Training 14 class model

## Training Results

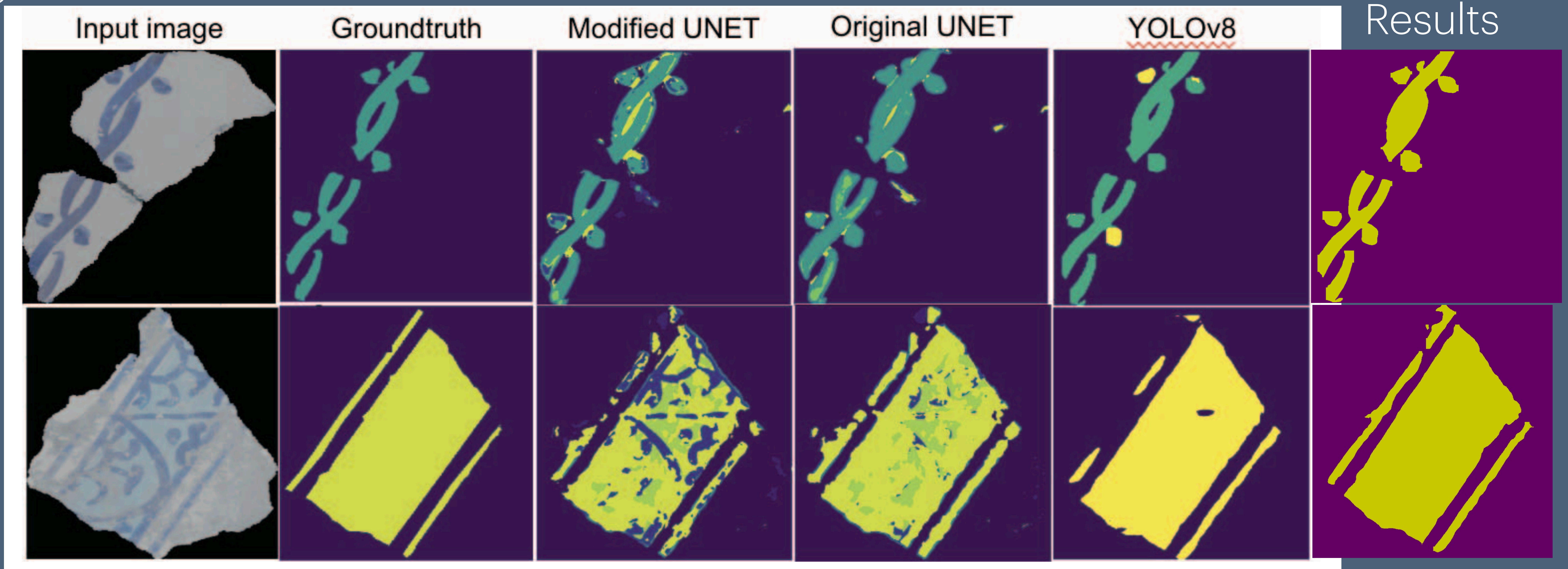
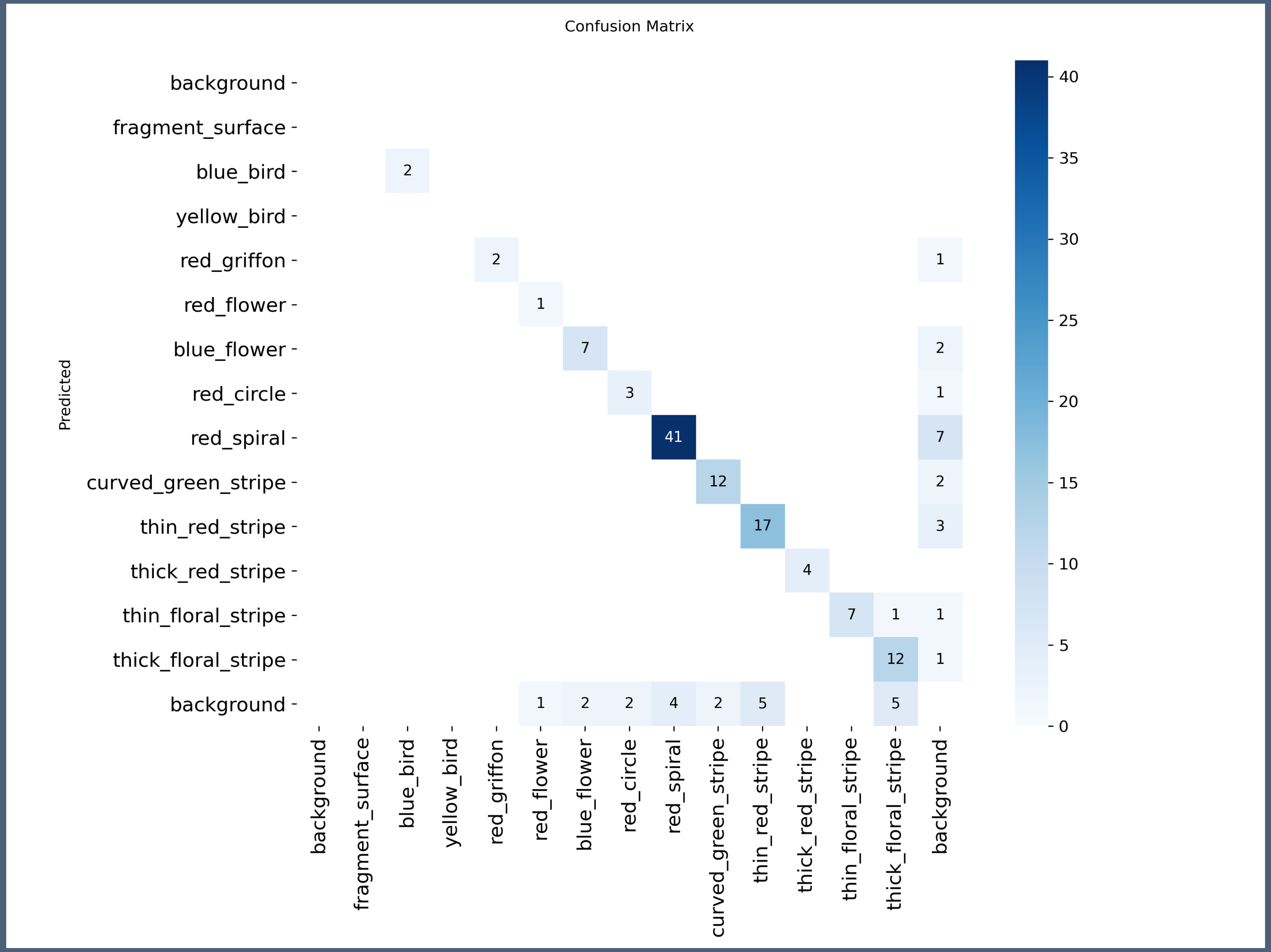


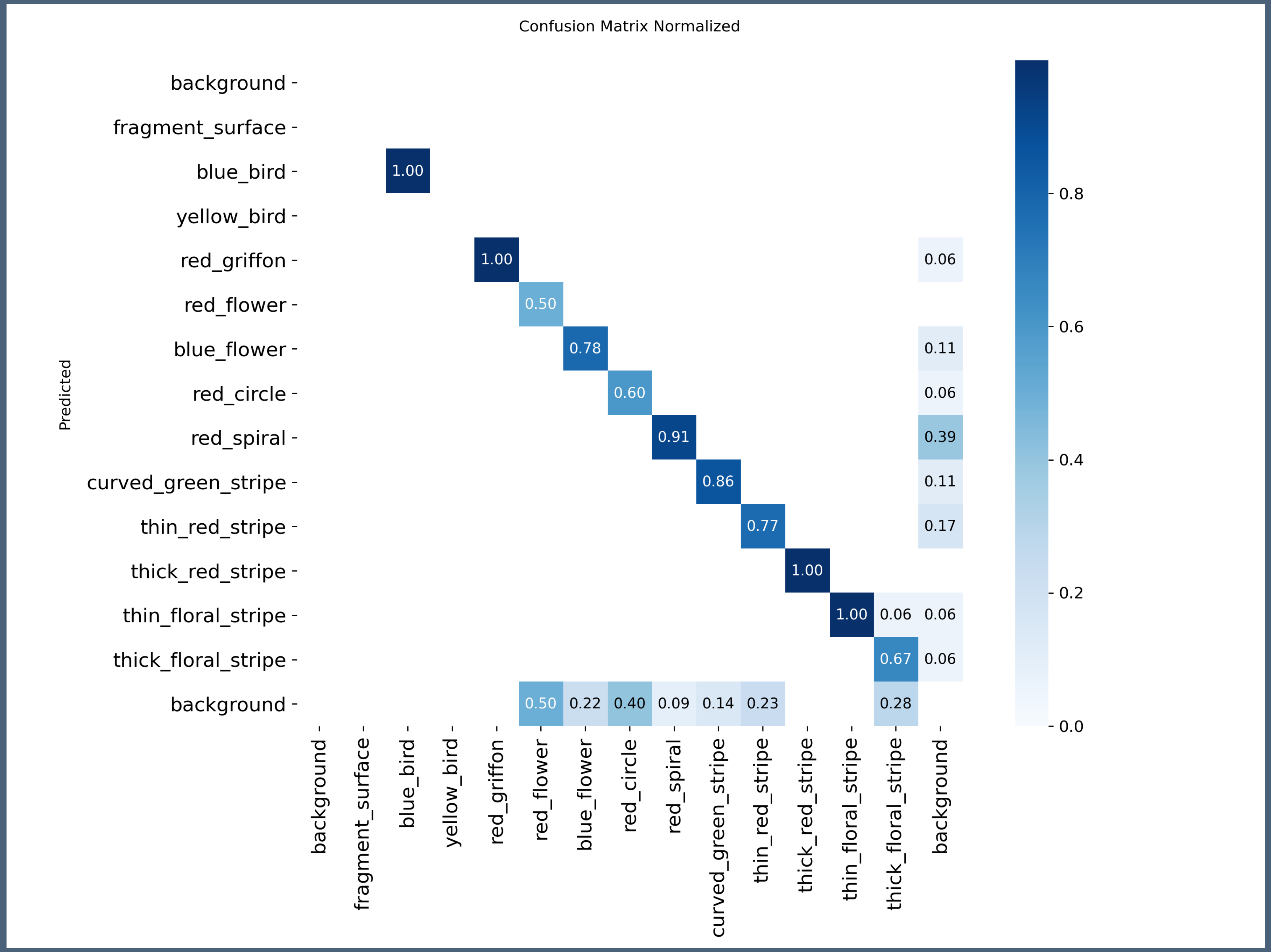

Figure 10. Semantic motif segmentation results of different architectures for Scenario 2.

[3] [Semantic Motif Segmentation of Archaeological Fresco Fragments]

# Step 1: Training 14 class model

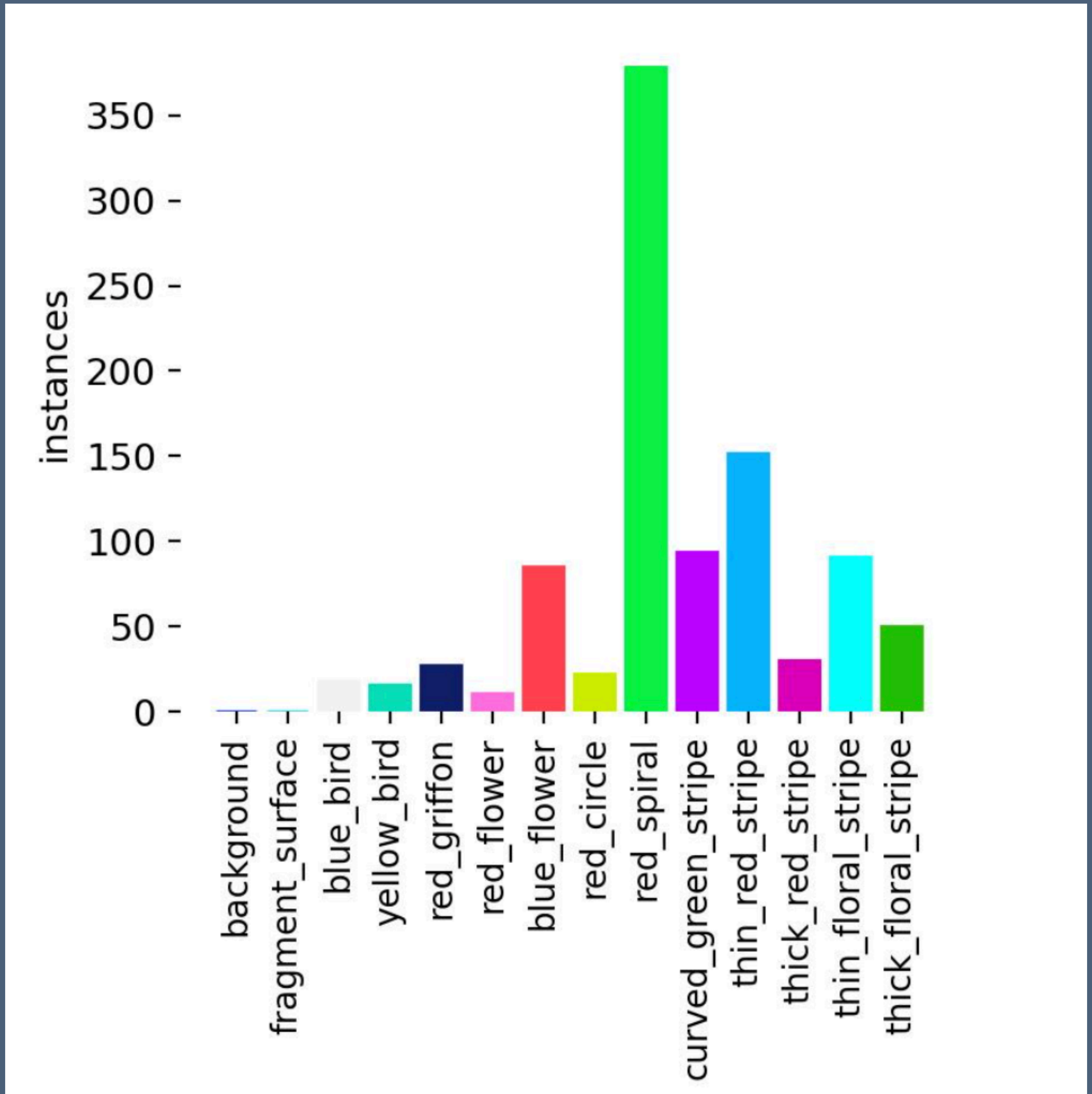
## Training More Results



# Step 1: Training 7 class model

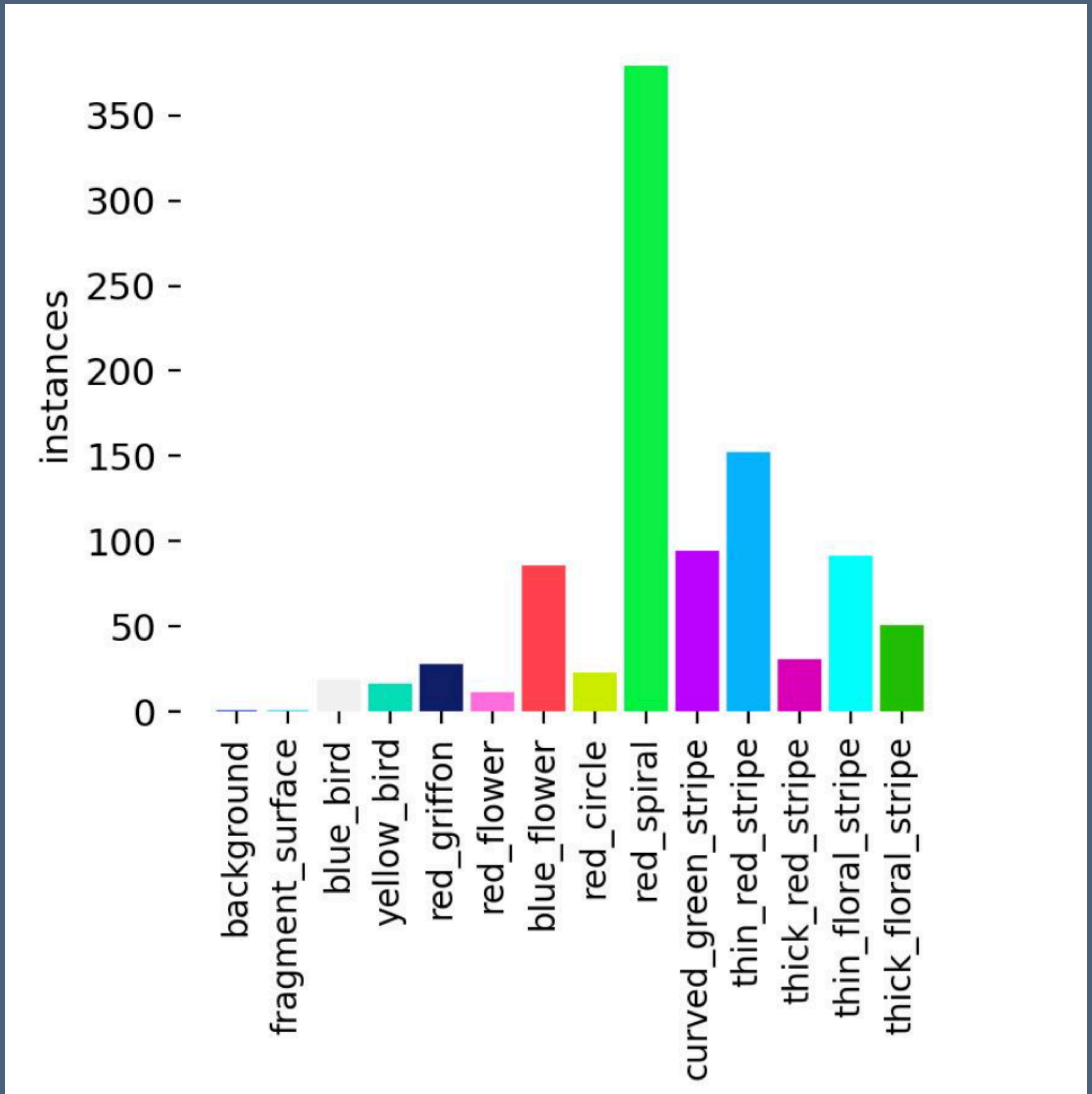
Training



# Step 1: Training 7 class model

## Training

- Step 1 : I think a good first step would be to train a model which accurately recognizes these.



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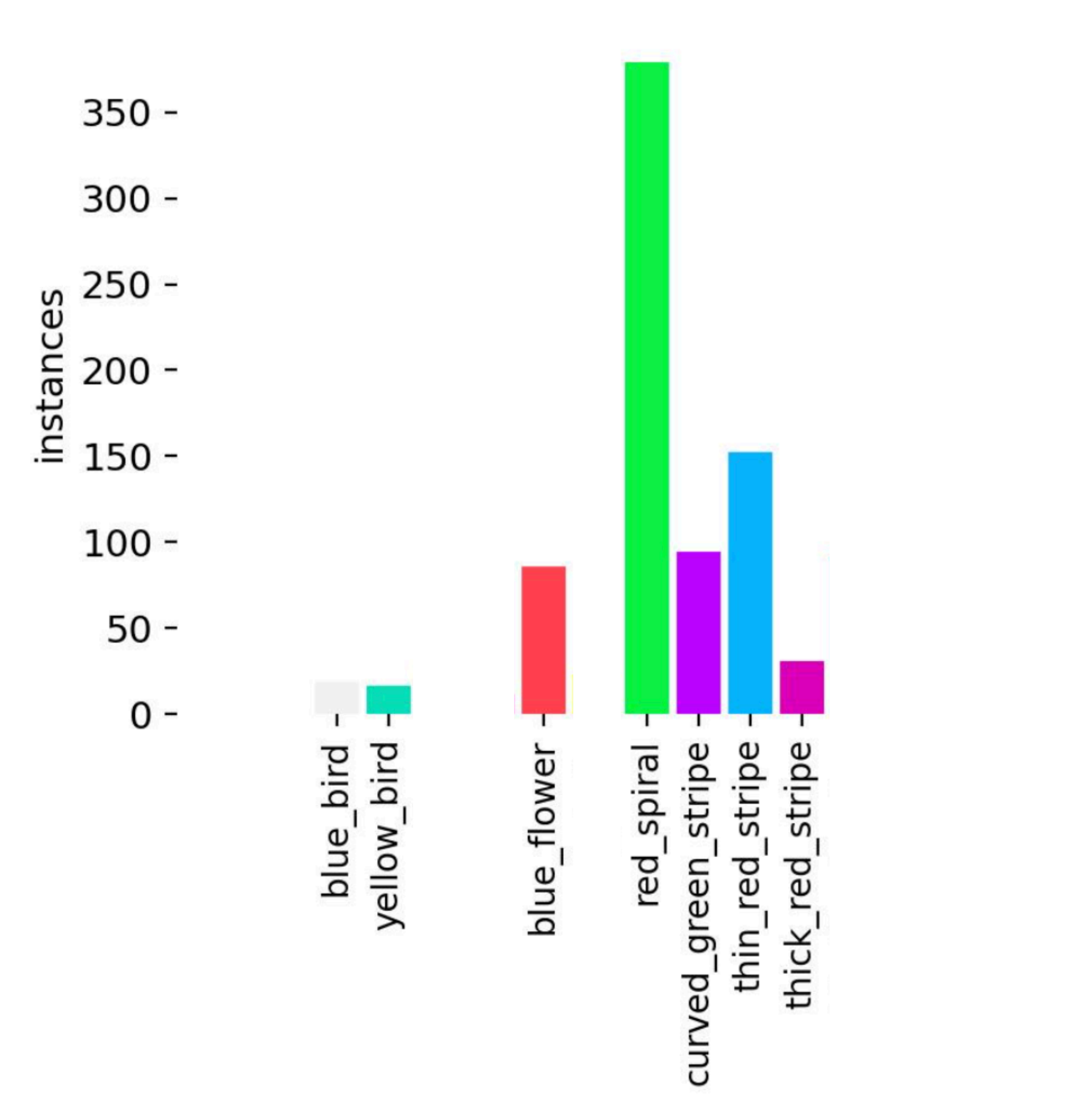


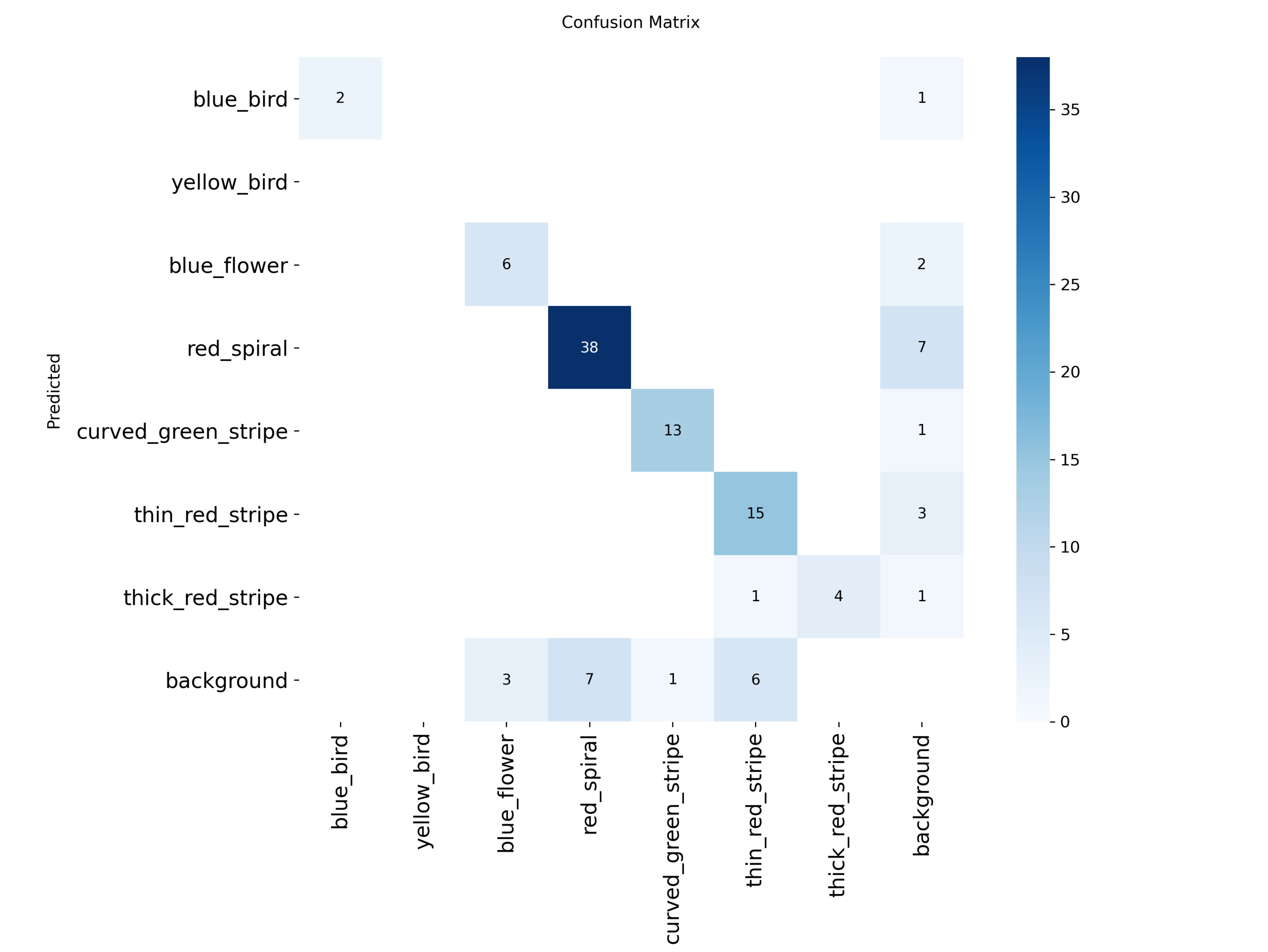
# Step 1: Training 7 class model

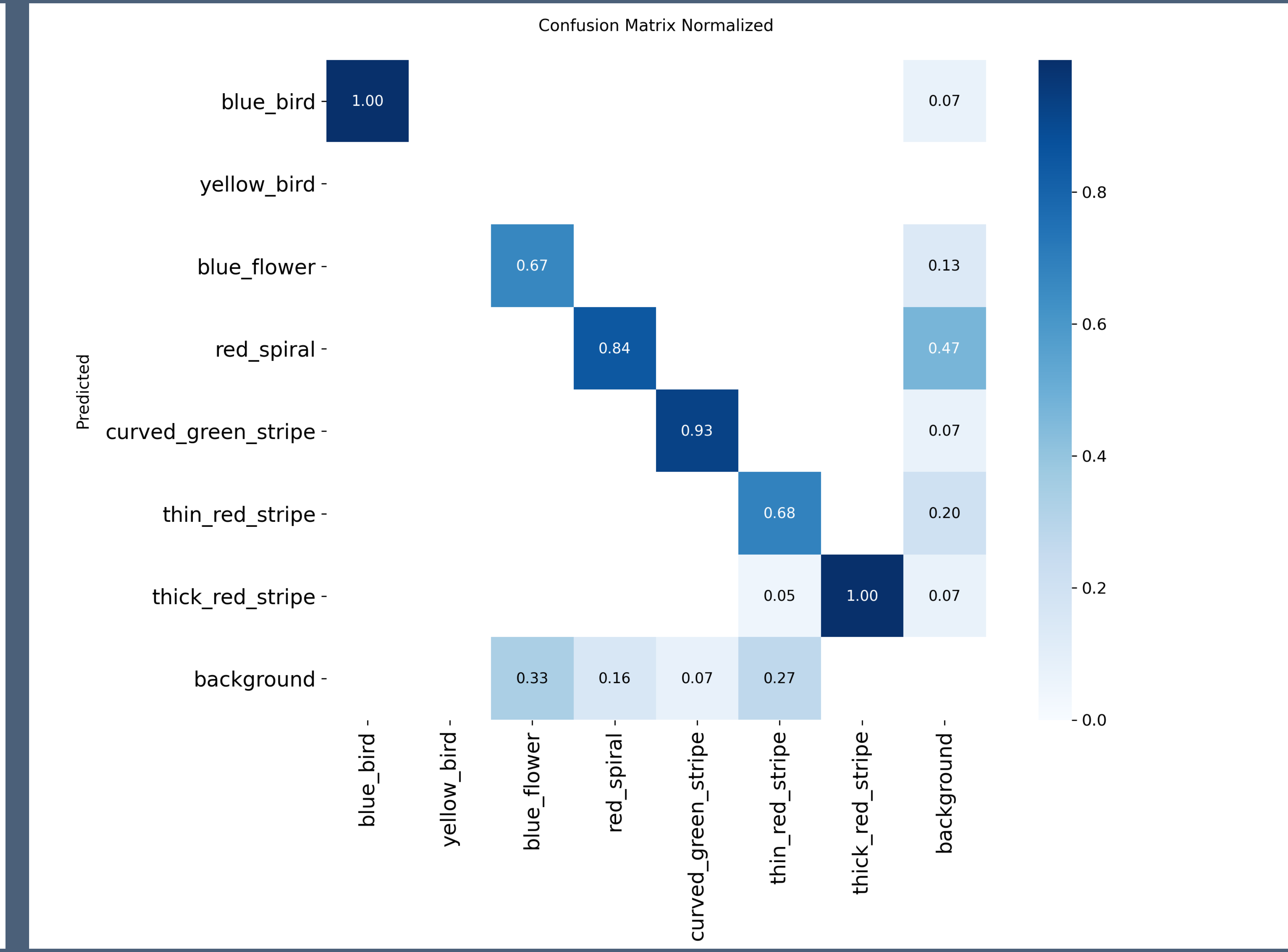
## Training Results

| Metrics | Bounding Box | | | Segmentation | | |
|---|---|---|---|---|---|---|
| | Precision | Recall | mAP@50 | Precision | Recall | mAP@50 |
| **14 Class** | 0.7866 | **0.8659** | 0.8439 | **0.8961** | 0.8113 | 0.9025 |
| **7 Class** | **0.8241** | 0.8577 | **0.9203** | 0.8241 | **0.8577** | **0.9203** |

# Step 1: Training 7 class model

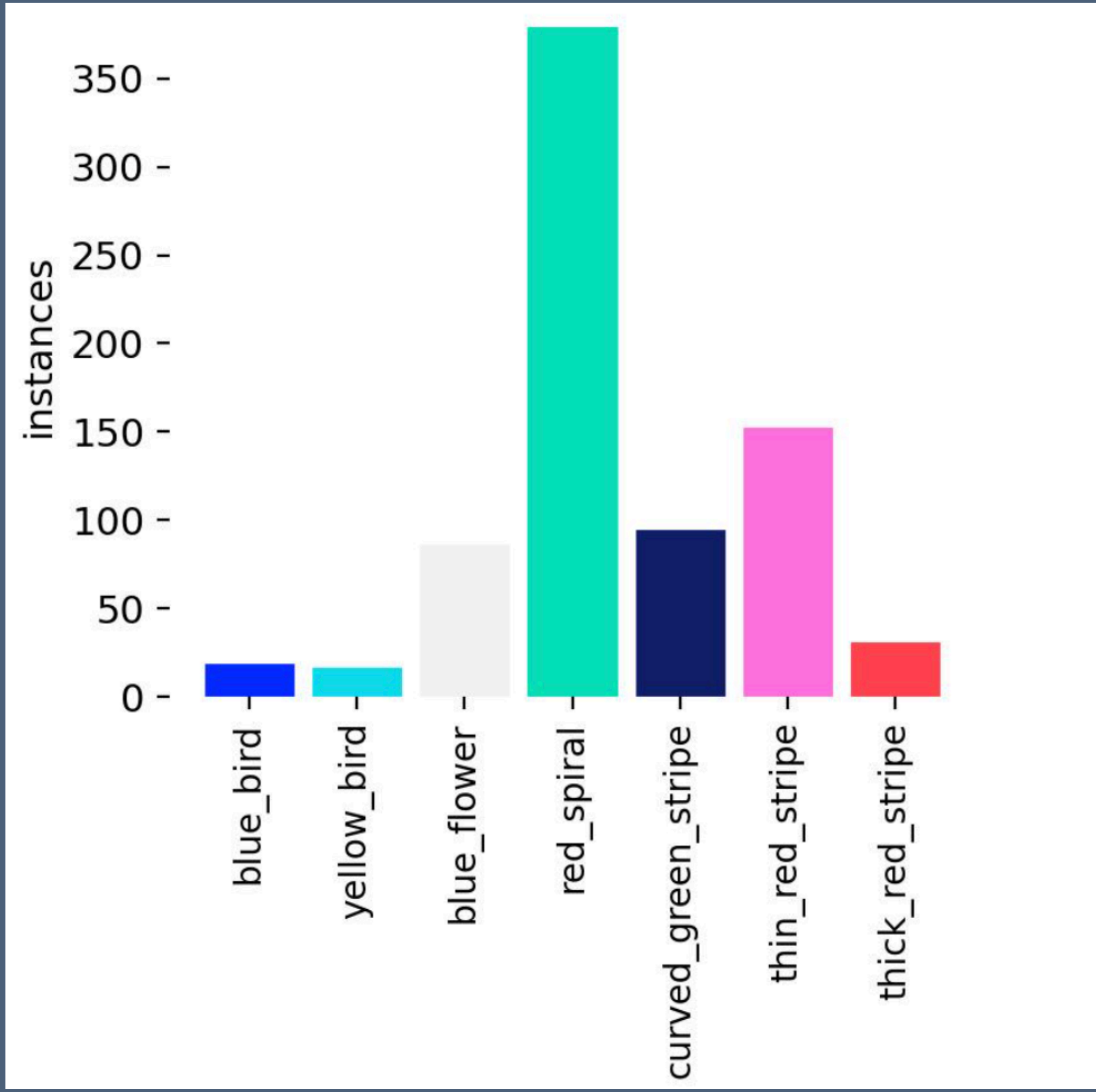
## Training More Results



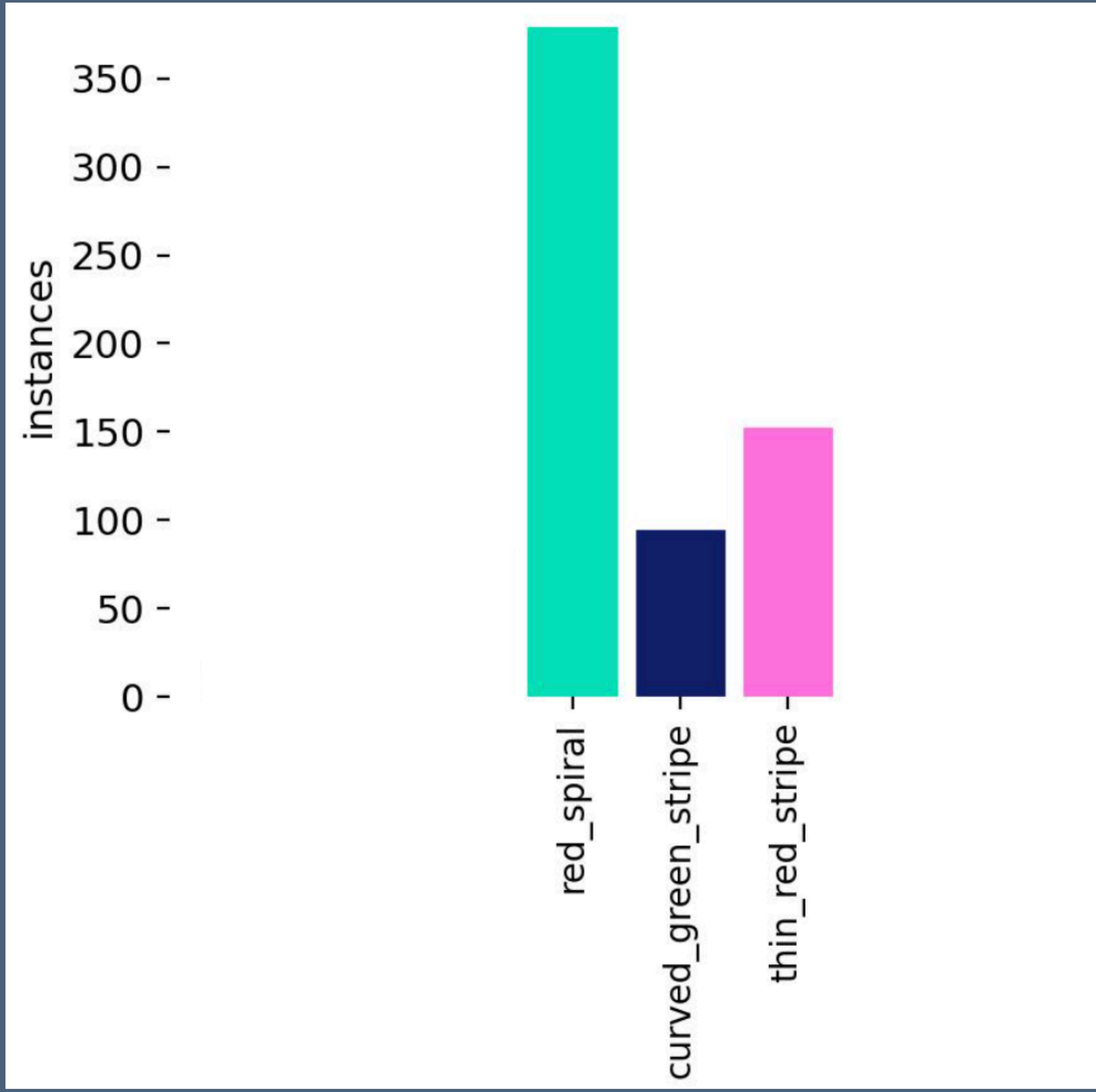
# Step 1: Training 3 class model

## Training



# Step 1: Training 3 class model

Training



# Step 1: Training 3 class model

## Training Results

| Metrics | Bounding Box | | | Segmentation | | |
|---|---|---|---|---|---|---|
| | Precision | Recall | mAP@50 | Precision | Recall | mAP@50 |
| **14 Class** | 0.7866 | **0.8659** | 0.8439 | **0.8961** | 0.8113 | 0.9025 |
| **7 Class** | **0.8241** | 0.8577 | **0.9203** | 0.8241 | 0.8577 | **0.9203** |
| **3 Class** | 0.8112 | **0.8953** | 0.8977 | 0.8112 | **0.8953** | 0.8977 |

# Step 1: Compare Models

## Class Precision