Multiple Behavior Classification of Cage-free Laying Hens using Deep Learning

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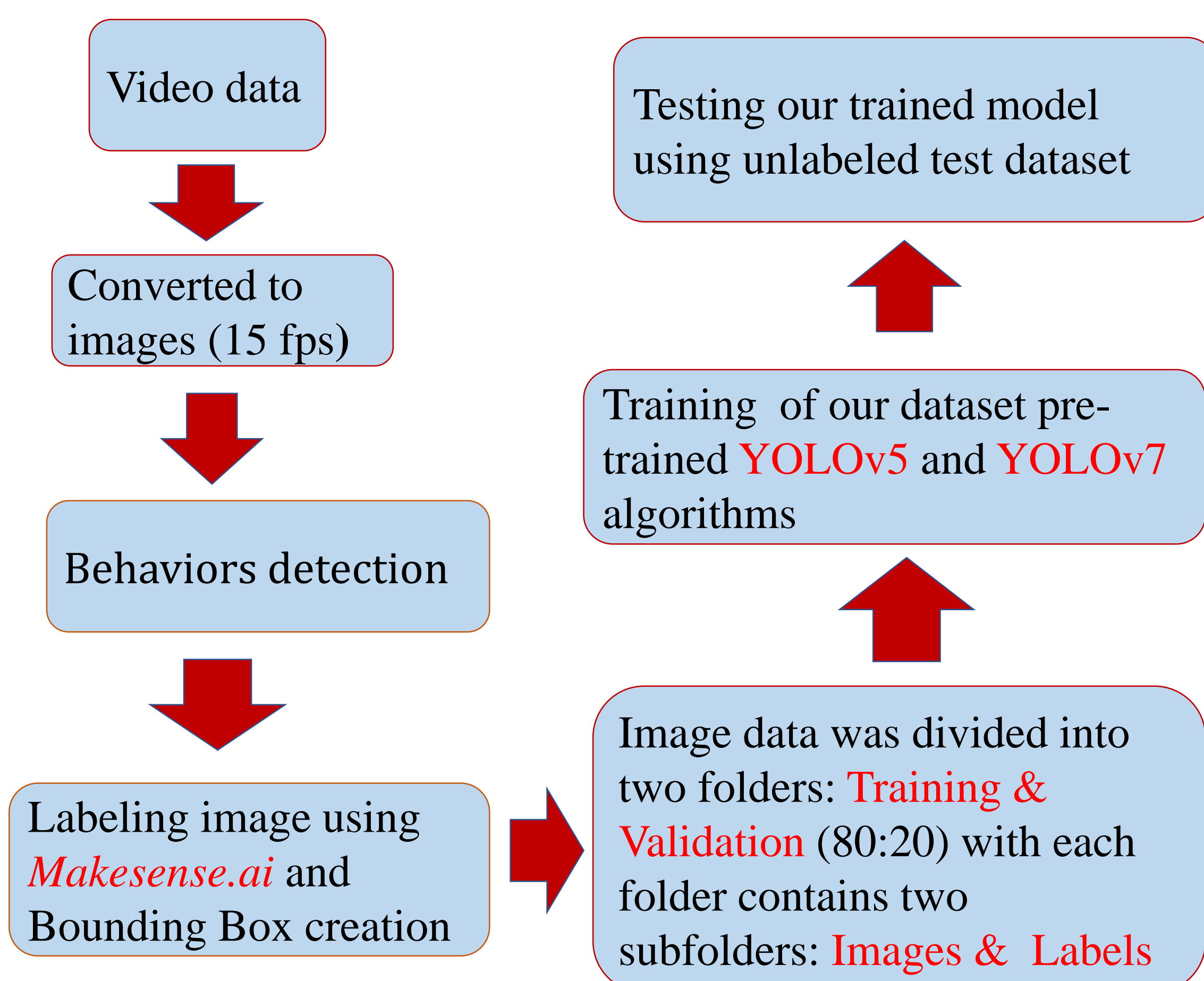
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INTRODUCTION

✓ The automatic detection of poultry behaviors helps identify deviations from normal behavior patterns that will notify egg producers in real time.

✓ Early detection of unexpected changes in activity and behaviors can benefit poultry's well-being and welfare.

✓ YOLO (You Only Look Once) is an advanced object detection technology with many advantages like high accuracy, fast speed, and small size.

✓ YOLO-based models like YOLOv5 and YOLOv7 have been used in face recognition, image recognition, and object detection.

✓ This study aims to develop and test a machine vision method for tracking the behaviors in cage-free hen houses.

Figure 1: Different Behaviors of Cage-Free Hens

METHODOLOGY

- Video data
- Converted to images (15 fps)
- Behaviors detection
- Labeling image using *Makesense.ai* and Bounding Box creation
- Image data was divided into two folders: Training & Validation (80:20) with each folder contains two subfolders: Images & Labels
- Training of our dataset pre-trained YOLOv5 and YOLOv7 algorithms
- Testing our trained model using unlabeled test dataset
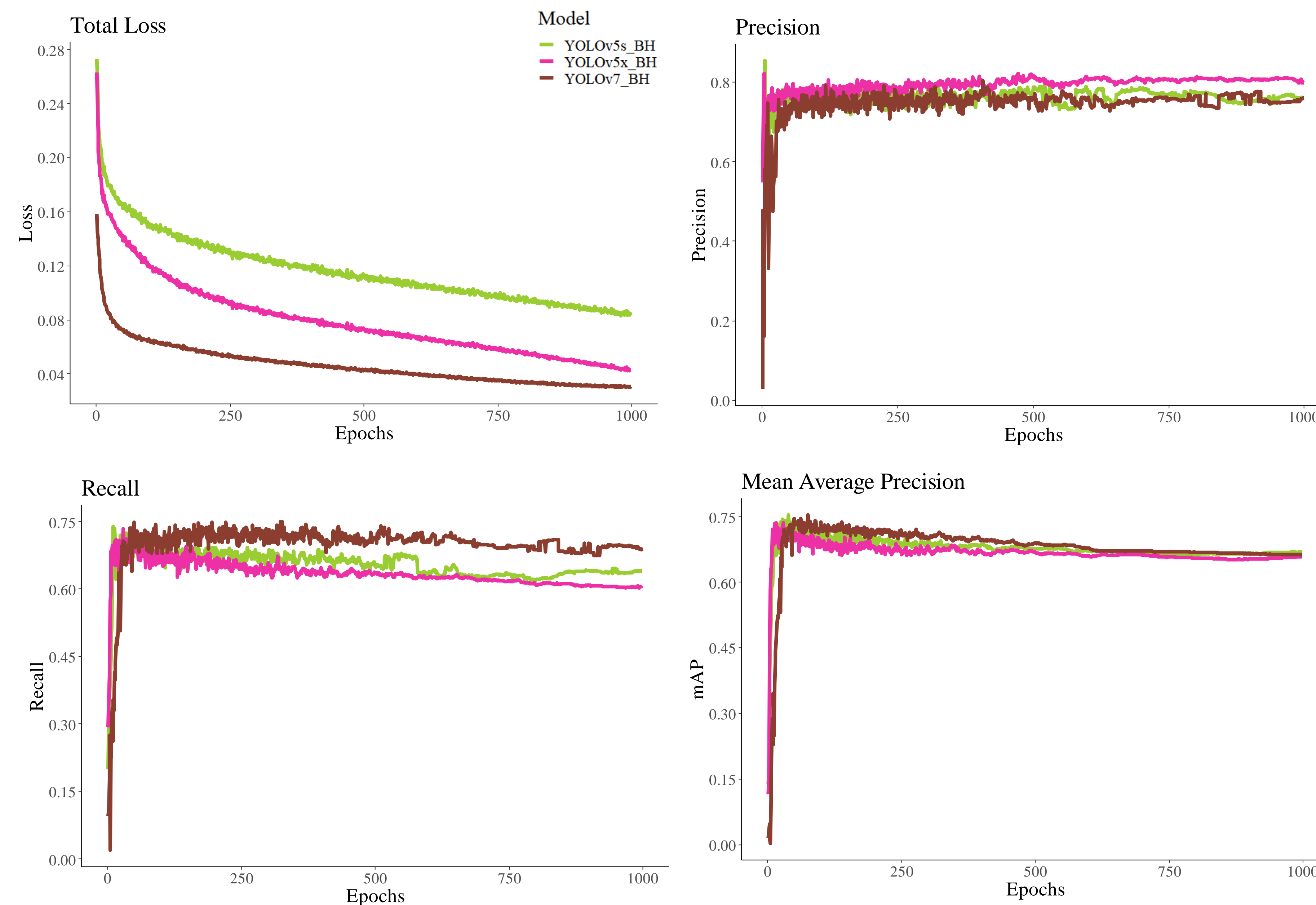
RESULTS

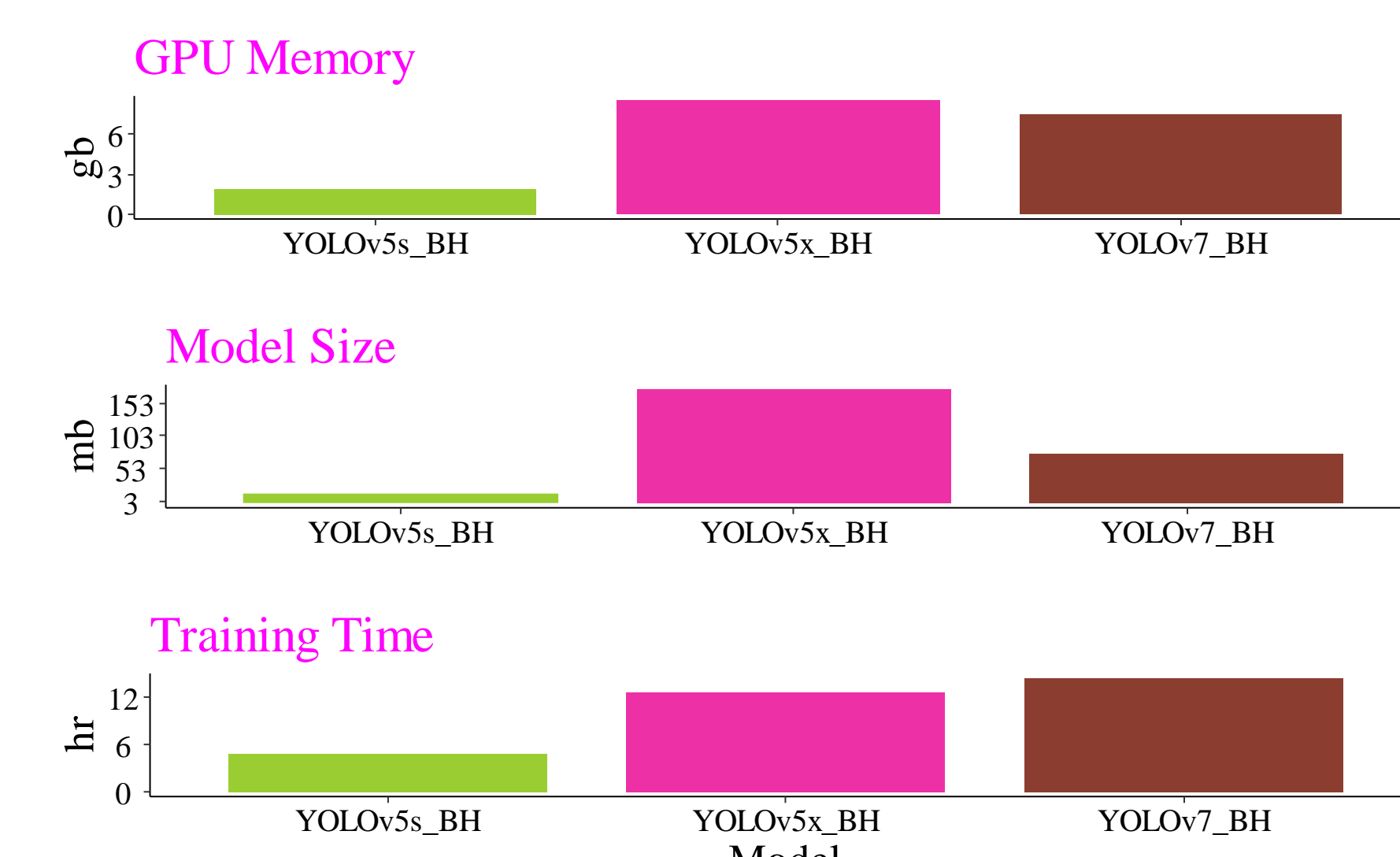Figure 2: Performance of egg detection models in data training and validation

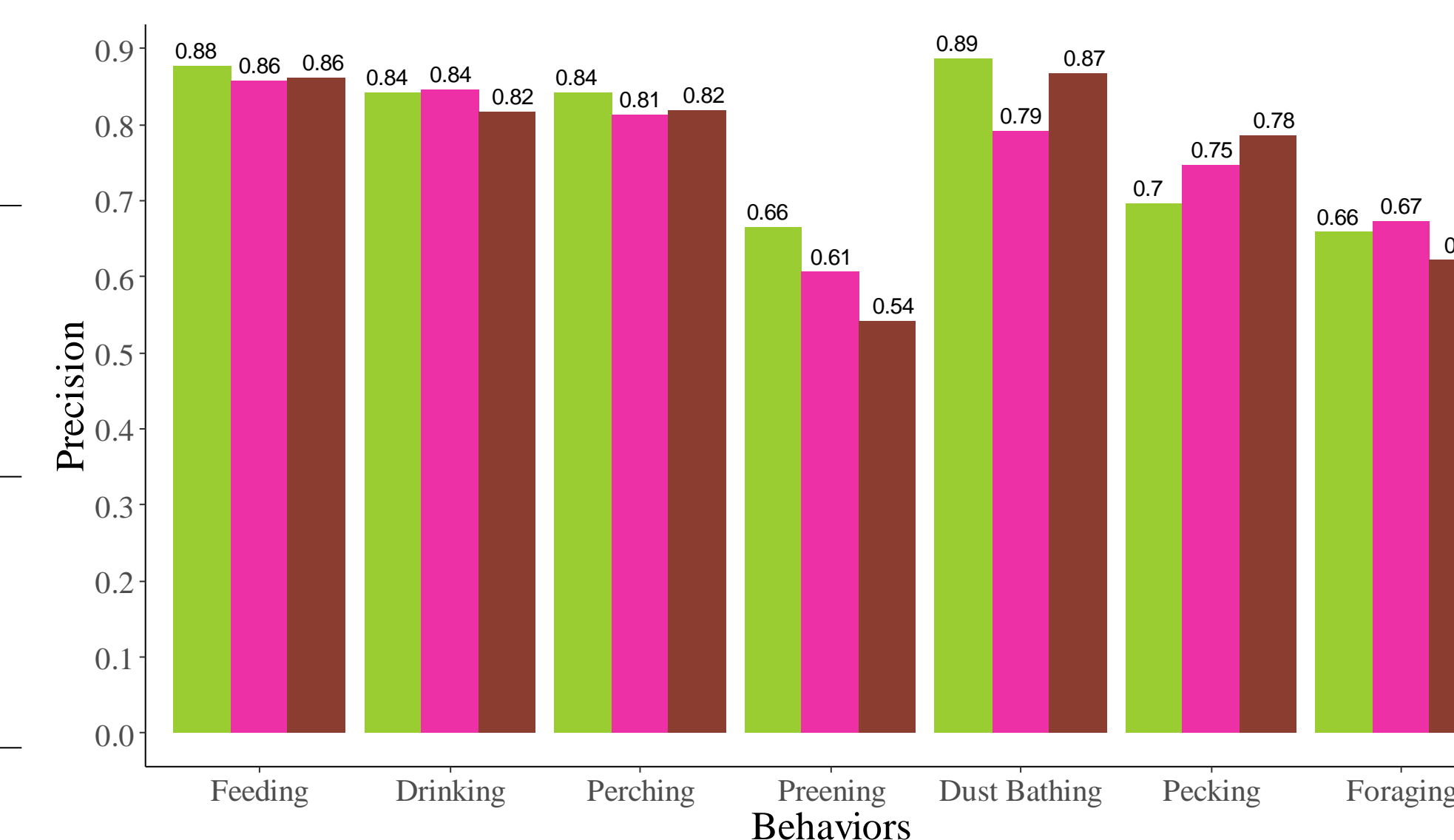Figure 3: YOLO models in memory size, model size & training time

Figure 4: Precision of all models in detecting different behaviors
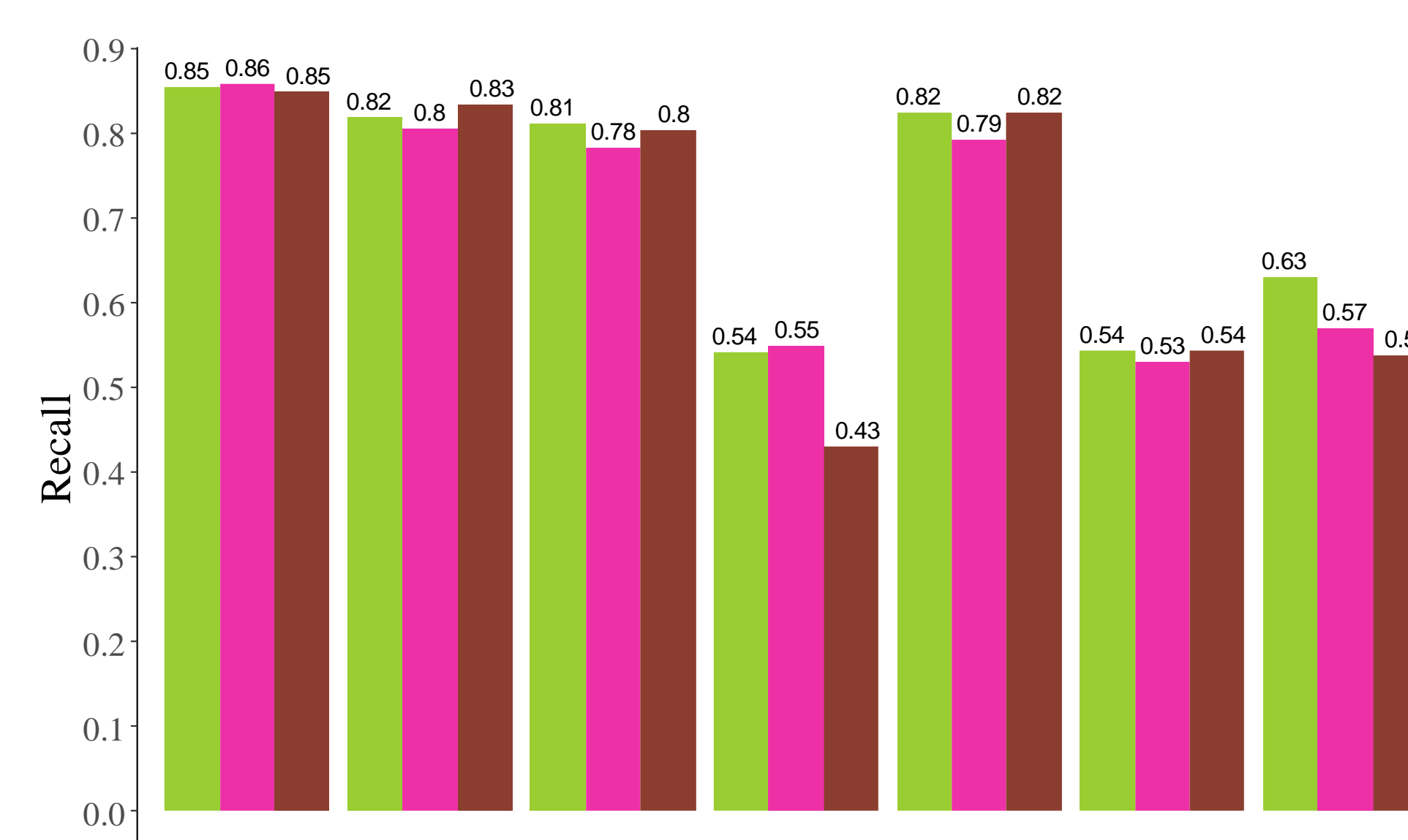

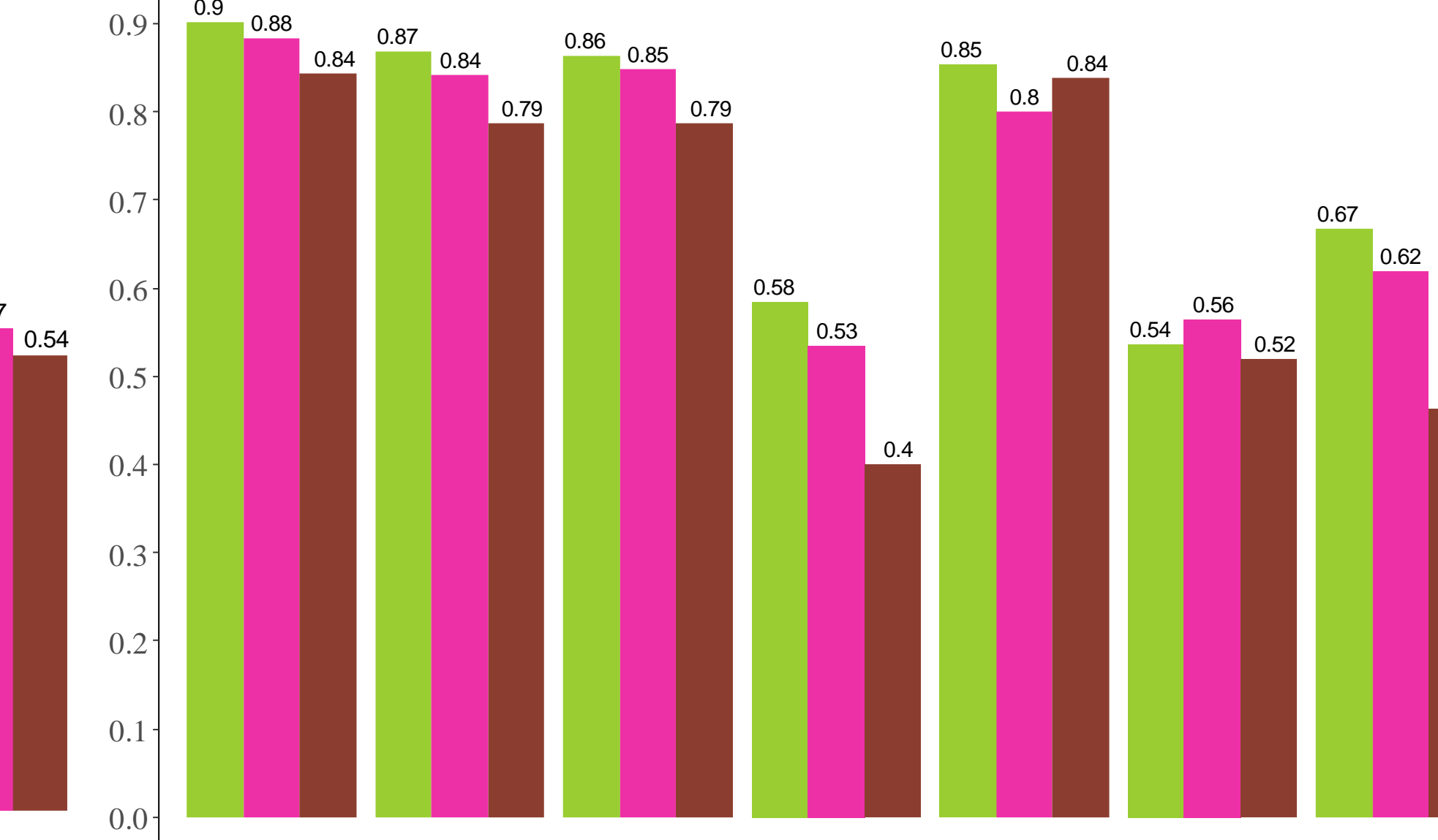Figure 5: Recall of all models in detecting different behaviors

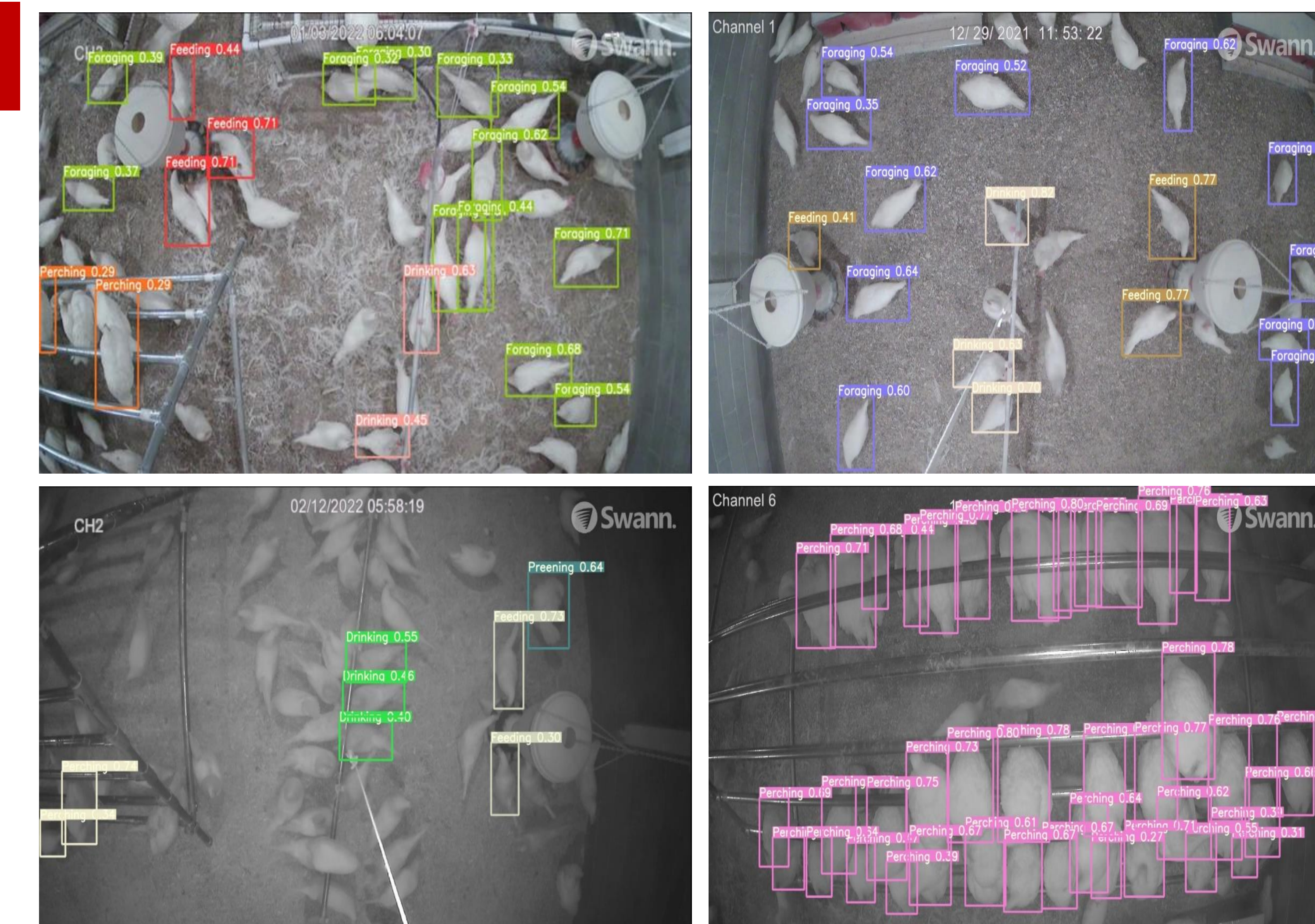Figure 6: mAP of all models in detecting different behaviors

Figure 7: Detection of Feeding, Drinking, Perching, Preening & Foraging behaviors

DISCUSSIONS

✓ The loss function rapidly decreased while running in 1000 epochs.

✓ The precision, recall, and mAP for behavior detection were more than 65 percent.

✓ YOLOv5s_BH model seems to perform better than YOLOv5x_BH and YOLOv7_BH models for most behaviors.

✓ Feeding and Dust Bathing are the behaviors with the highest overall performance in terms of mAP.

✓ Preening and Foraging are the behaviors with the lowest overall performance in terms of precision, recall, and mAP.

CONCLUSIONS

✓ Our model automatically detects and classifies behaviors in cage-free facilities.

✓ YOLOv5s_BH performs better in terms of precision, recall and mAP, than YOLOv5s_BH and YOLOv7_BH

✓ This study provides a reference for cage-free producers that poultry behaviors could be monitored automatically.