

DSI Scholars Summer - UWIN

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Week 1 and 2:

- PC Setup
- Anaconda Installation <https://www.anaconda.com/download>
- Software Configuration - <https://www.tensorflow.org/install/pip#windows-native>,
<https://learn.microsoft.com/en-us/windows/ai/directml/gpu-tensorflow-plugin>
- CUIT Remote Access
- Remote Access and Vector Drive access figured out
- ~~Already done.~~ Goals for the upcoming week: Reading/ finding a way out to efficiently read the data

Week 3:

- Data Read and Augmentation, other preprocessing
- Training the first model - with the goal of eliminating empty vs. nonempty images ~~Started off with ResNet50.~~
- Try out different models for this - experiment with a set of hyperparameters and report progress.
- Need to figure out a way to copy all images from the server to the disk in a fast manner (current time to copy all is approx. ~26 HRS, using traditional copy), training taking a bit of time because of this.
- Repeated issues connecting from home, fix it (~~0x108, 0x10b, Black Screen~~) ~~Fixed with Note: Issue was due to GPU, using CPU for the moment.~~
- Similar issues persist while being on Columbia U Secure (~~0x108, 0x10b, Black Screen~~)

Week 4:

- Fix issues with GPU and CUDA. Make sure to resolve driver compatibility issues.
- Try out hugging face models - just as a first step
- Empty vs. Non-empty still in progress - Done
- Try out pre-trained models.
- Ran the Megadetector Model



MOULTRIE



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The Megadetector V5A Model.

Week 5:

- Run code on all the batches
- Estimated time: ~4hrs for 13k images
- Discuss the format of results
- Megadetector detects only Animals, Humans (amongst others) and has no ability to narrow down the species
- Write code for separating the empty from the non-empty images

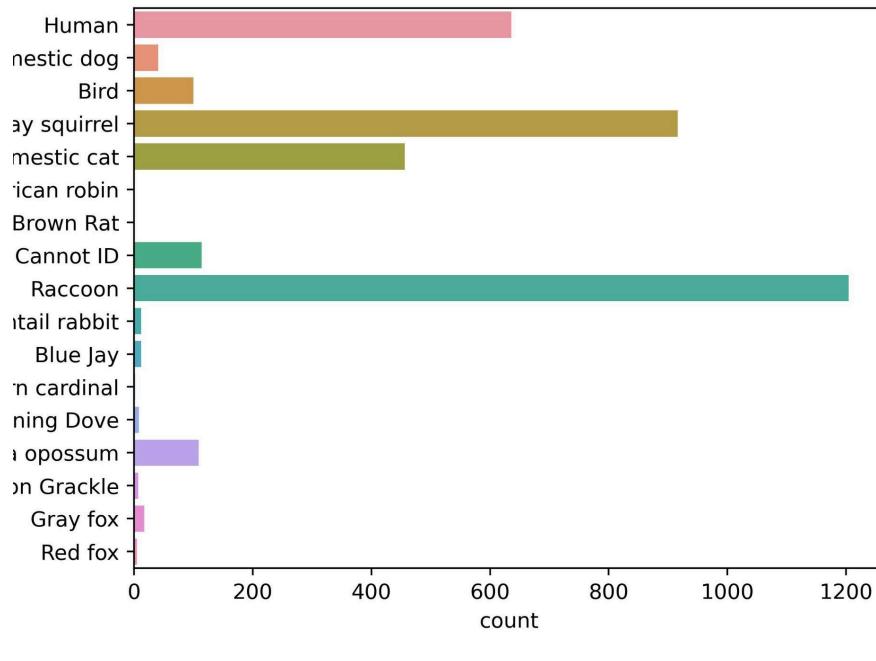
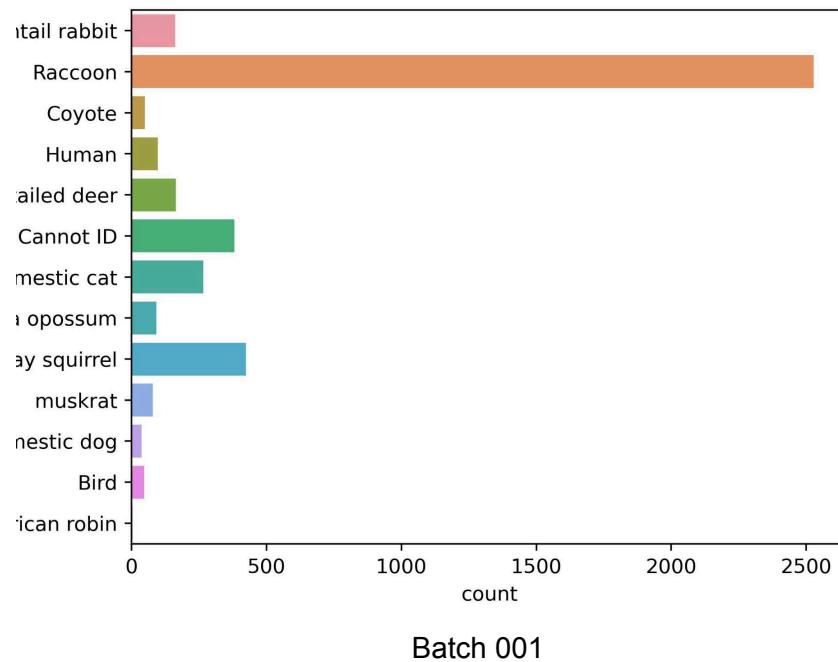
Week 6:

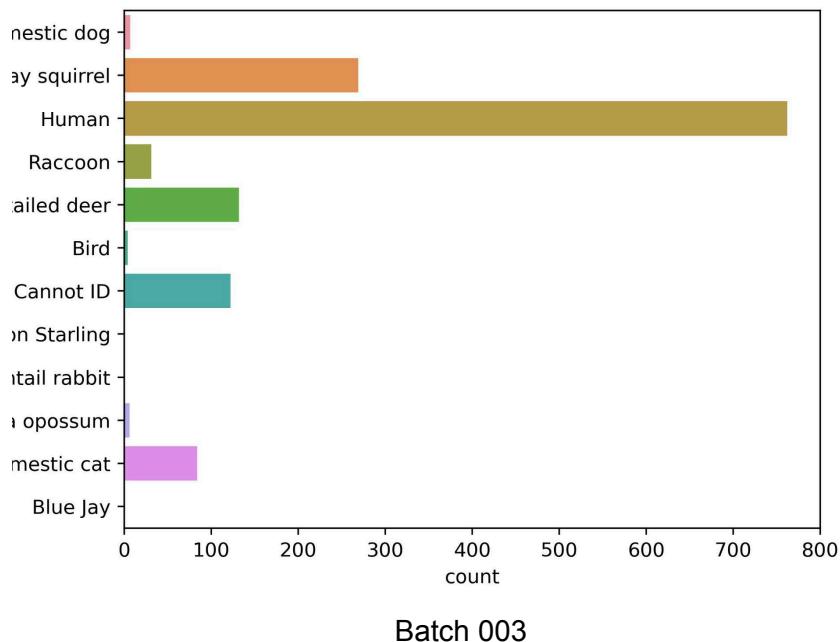
- Run the model on the remaining batches (June 2024)
- Separate the empty from the non-empty images in these batches
- MtPk folder all images blurry - check with Richie
- IMG 1328 - 1335 corrupt in NhCe Jun 2024 - Check

Week 7:

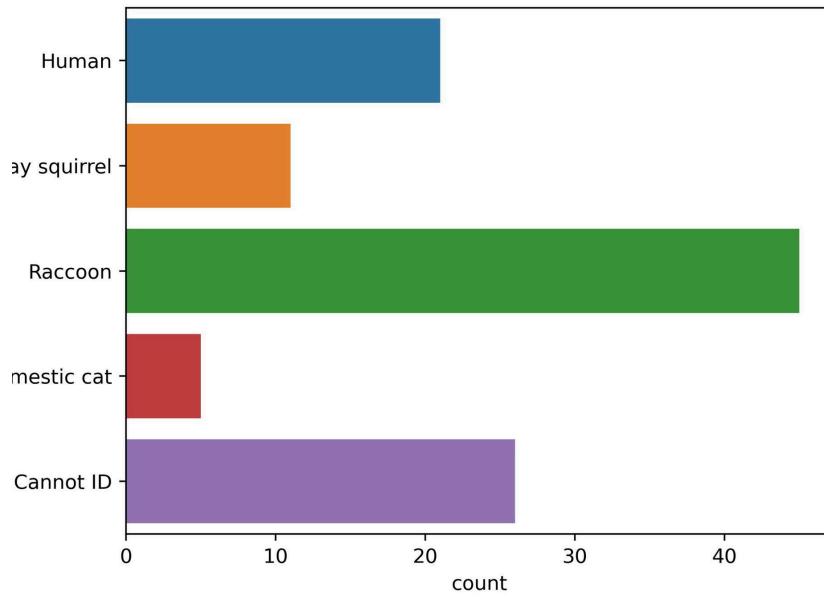
- Run on January 2024 batch
- Separate the empty from non-empty images
- Run a diagnostic test on data viability

- Found 29716 images with only single objects, hence proceeding - satisfying all data sanity checks
- Following distributions of data observed amongst the images satisfying criterion

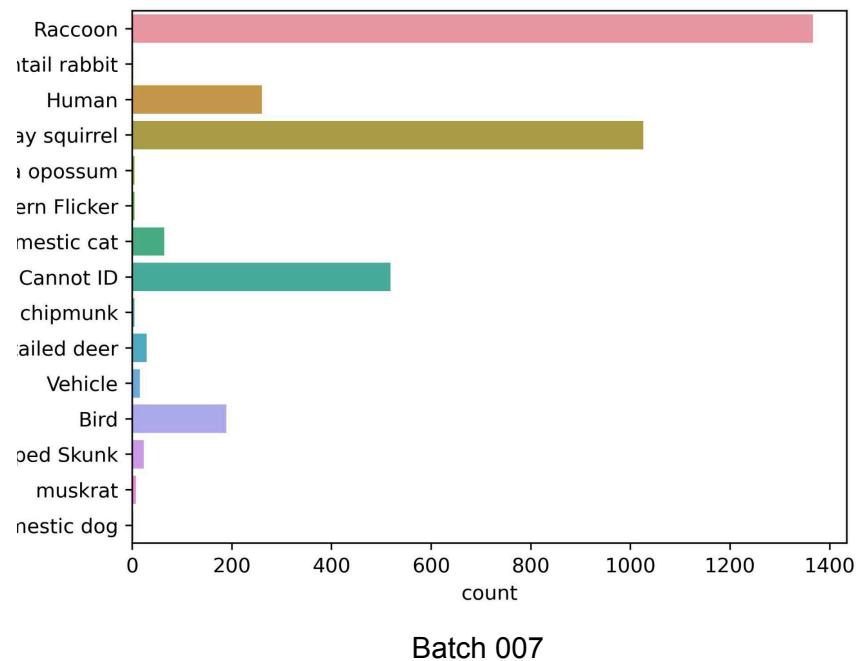
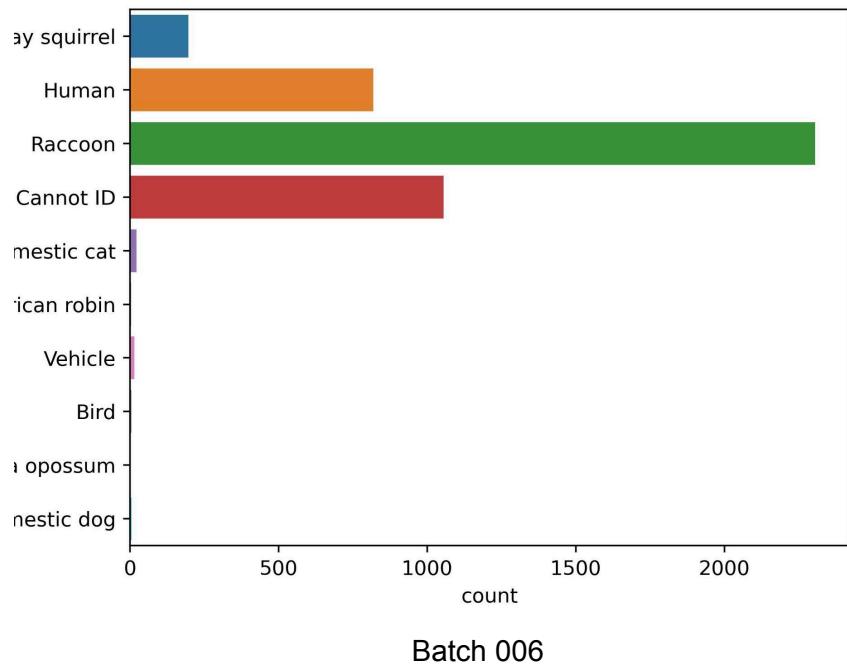


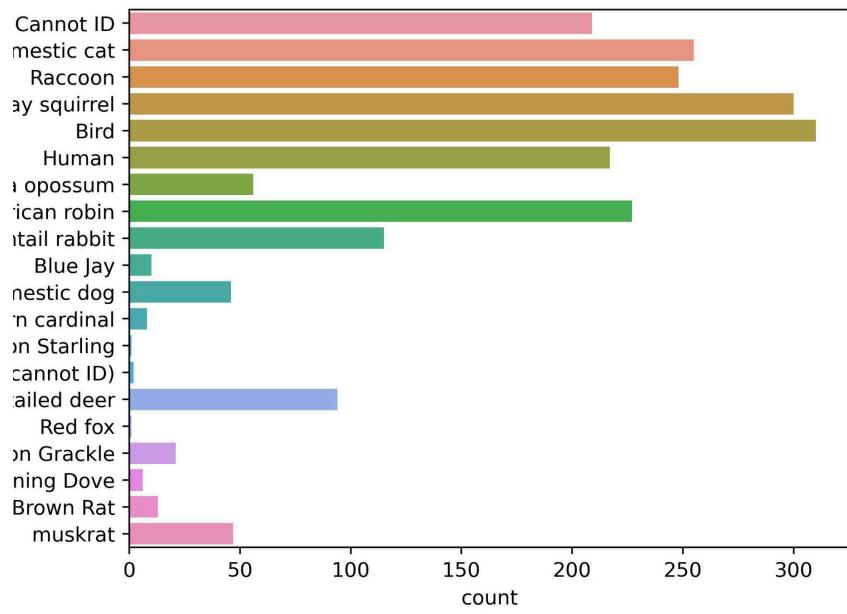


Batch 003

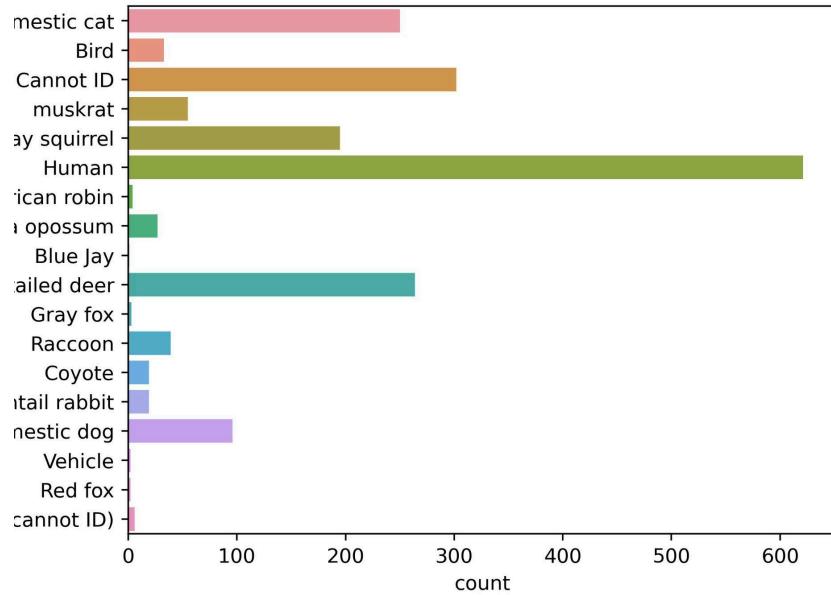


Batch 005

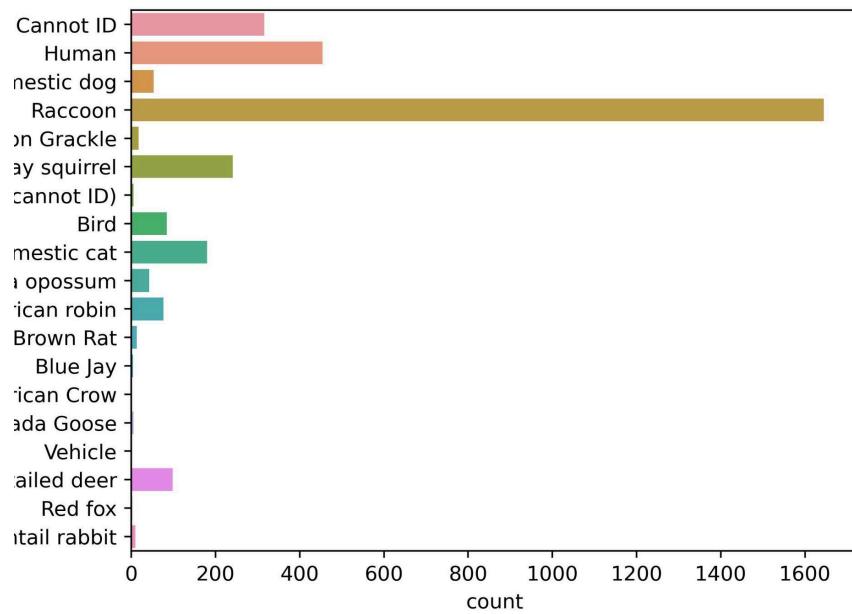




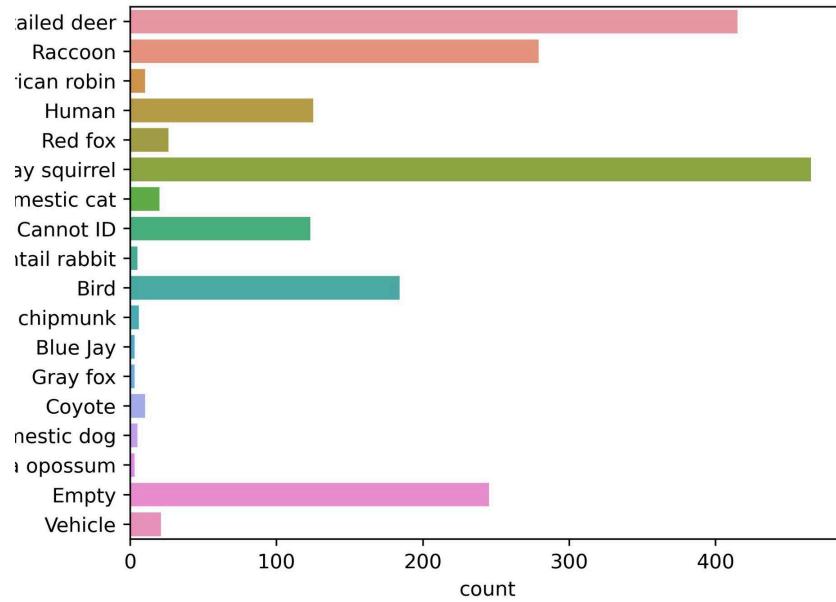
Batch 008



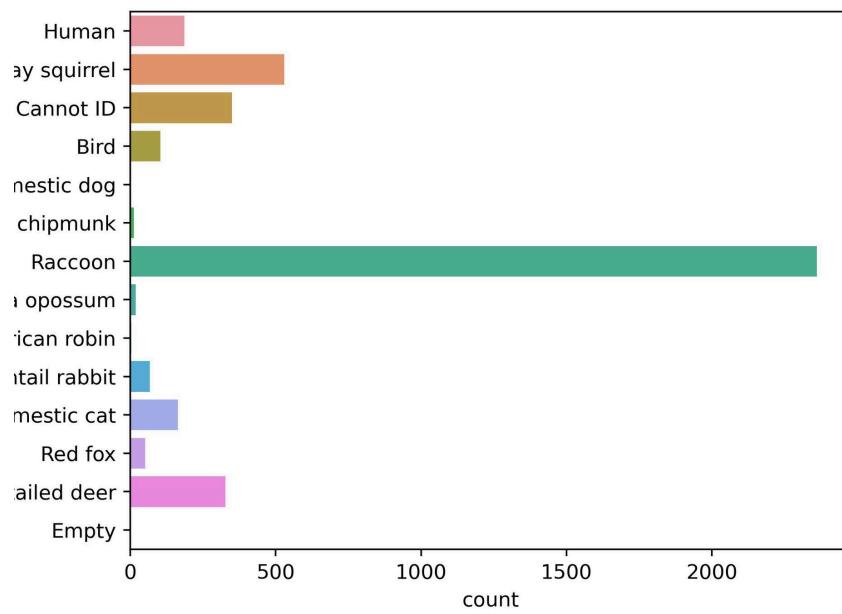
Batch 009



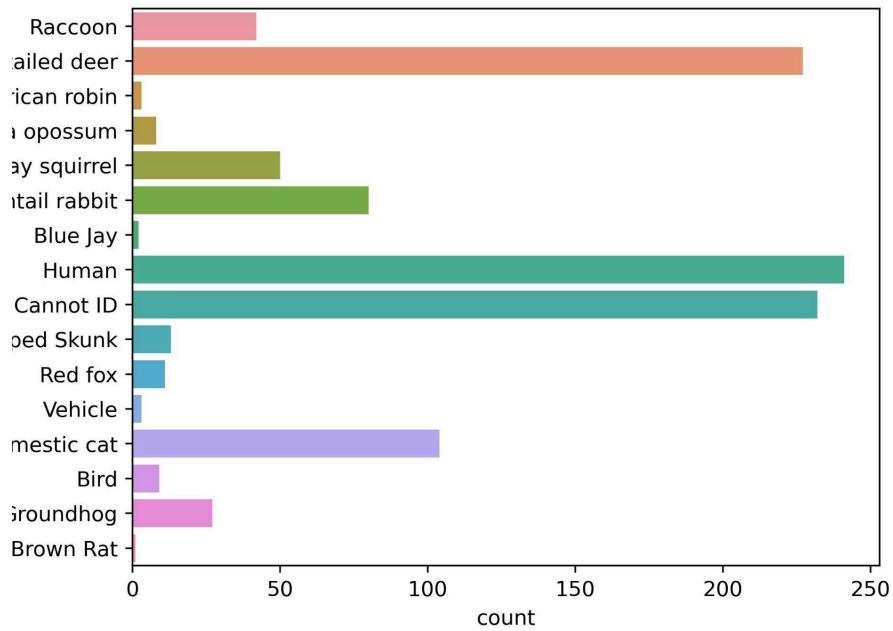
Batch 010



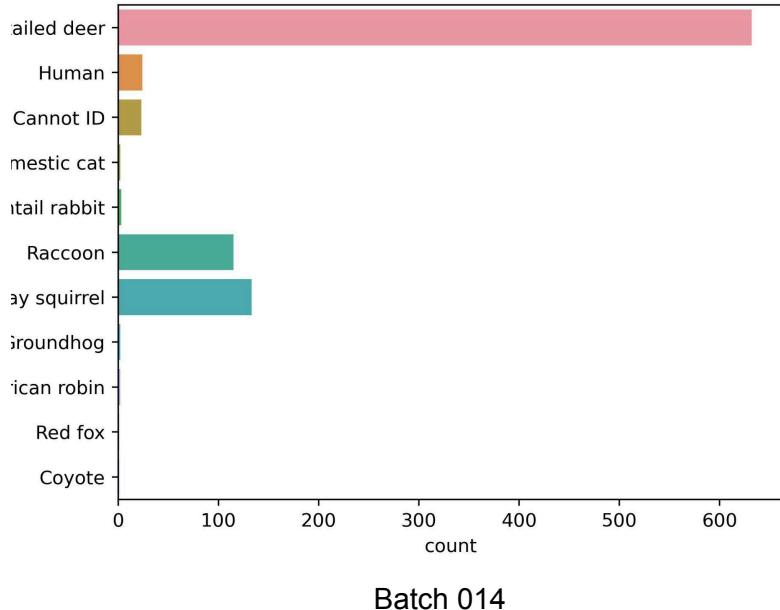
Batch 011



Batch 012



Batch 013



- Prepare Data for YOLO V5 model
- Do an initial pass over the YOLO V5 model

First Run - Results:

```

Epoch   GPU_mem  box_loss  obj_loss  cls_loss  Instances    Size
  0/2      0G     0.06557  0.01829  0.03551    15          640: 100%|██████████| 1521/1521 [1:17:49<00:00,  3.07s/it]
          Class  Images  Instances       P       R  mAP50  mAP50-95: 100%|██████████| 119/119 [09:53<00:00,  4.98s/it]
          all     3787     3787     0.856     0.175    0.207     0.0788

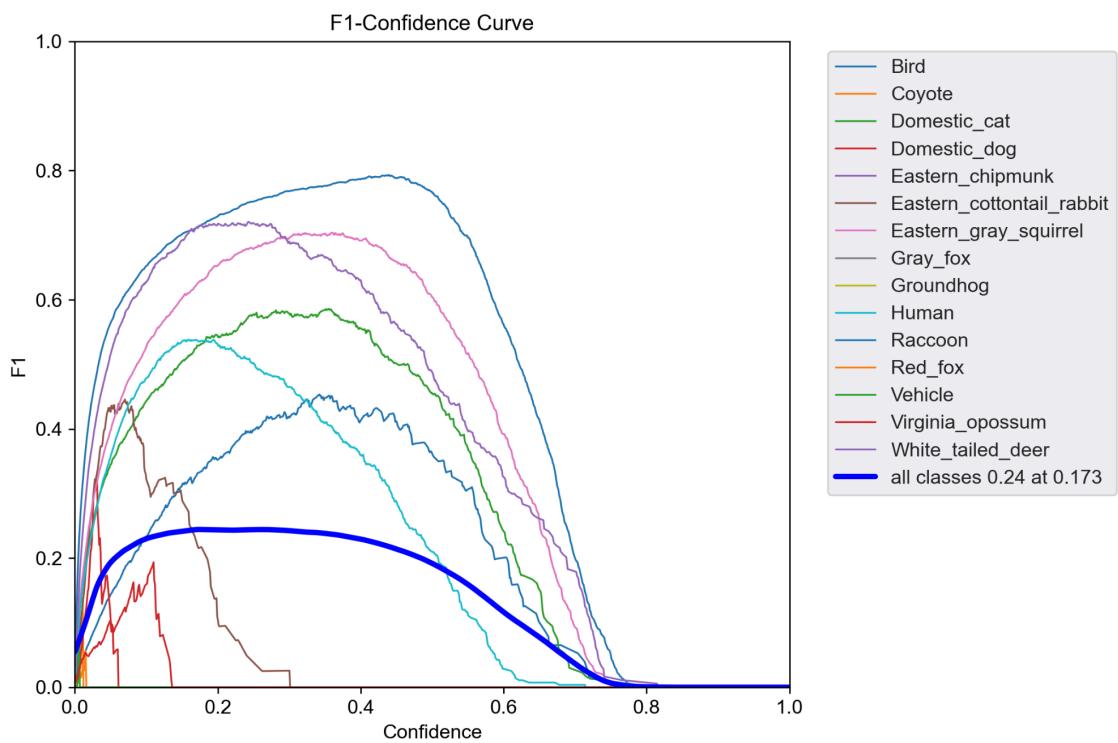
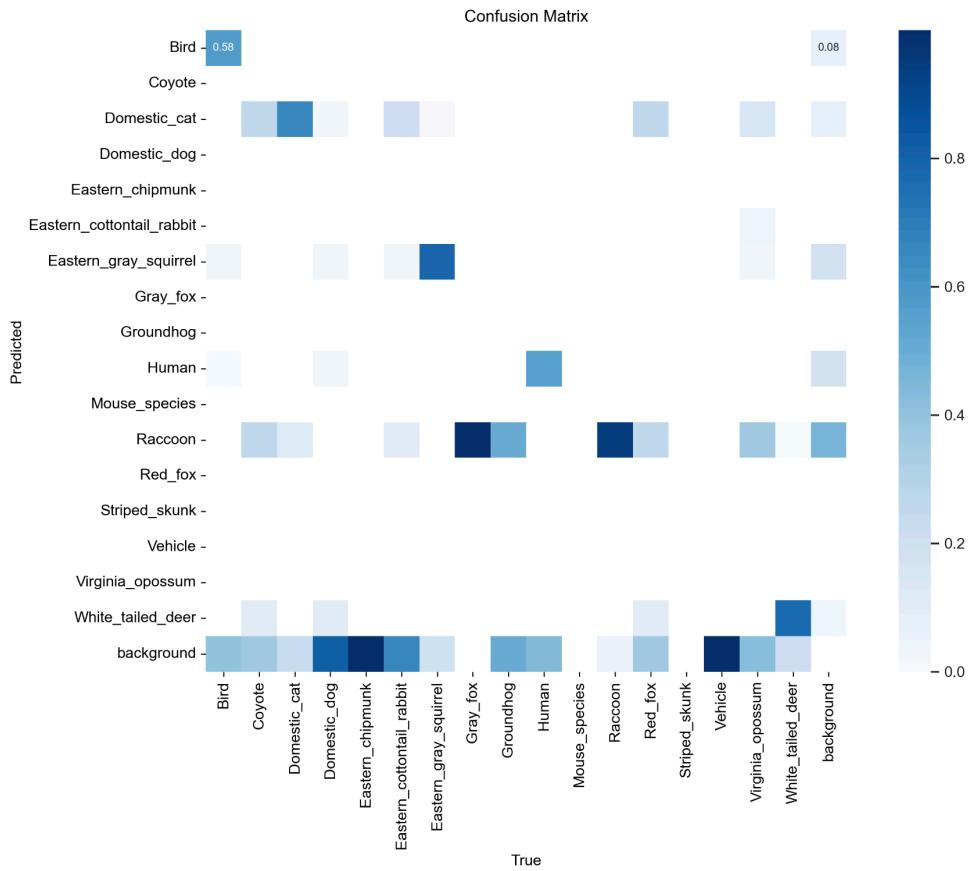
Epoch   GPU_mem  box_loss  obj_loss  cls_loss  Instances    Size
  1/2      0G     0.04915  0.01534  0.01724    14          640: 100%|██████████| 1521/1521 [1:18:35<00:00,  3.10s/it]
          Class  Images  Instances       P       R  mAP50  mAP50-95: 100%|██████████| 119/119 [02:48<00:00,  1.41s/it]
          all     3787     3787     0.836     0.262    0.272     0.123

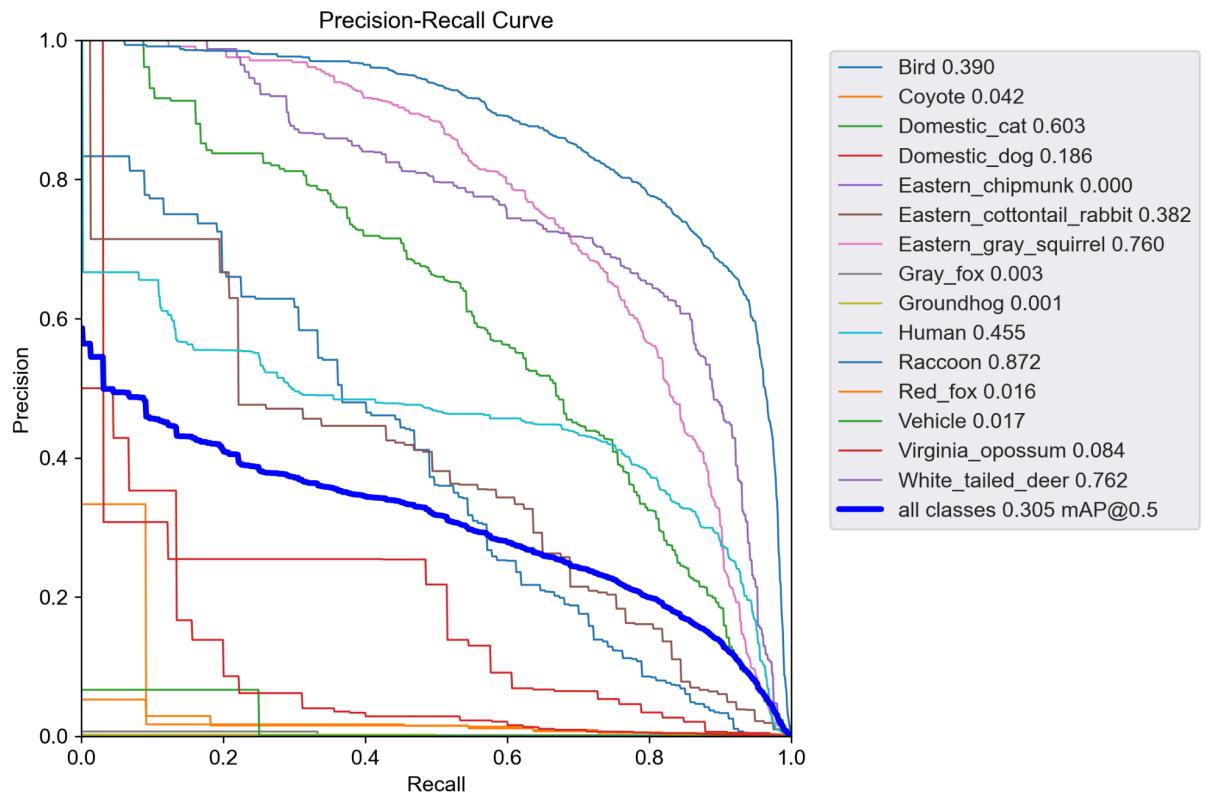
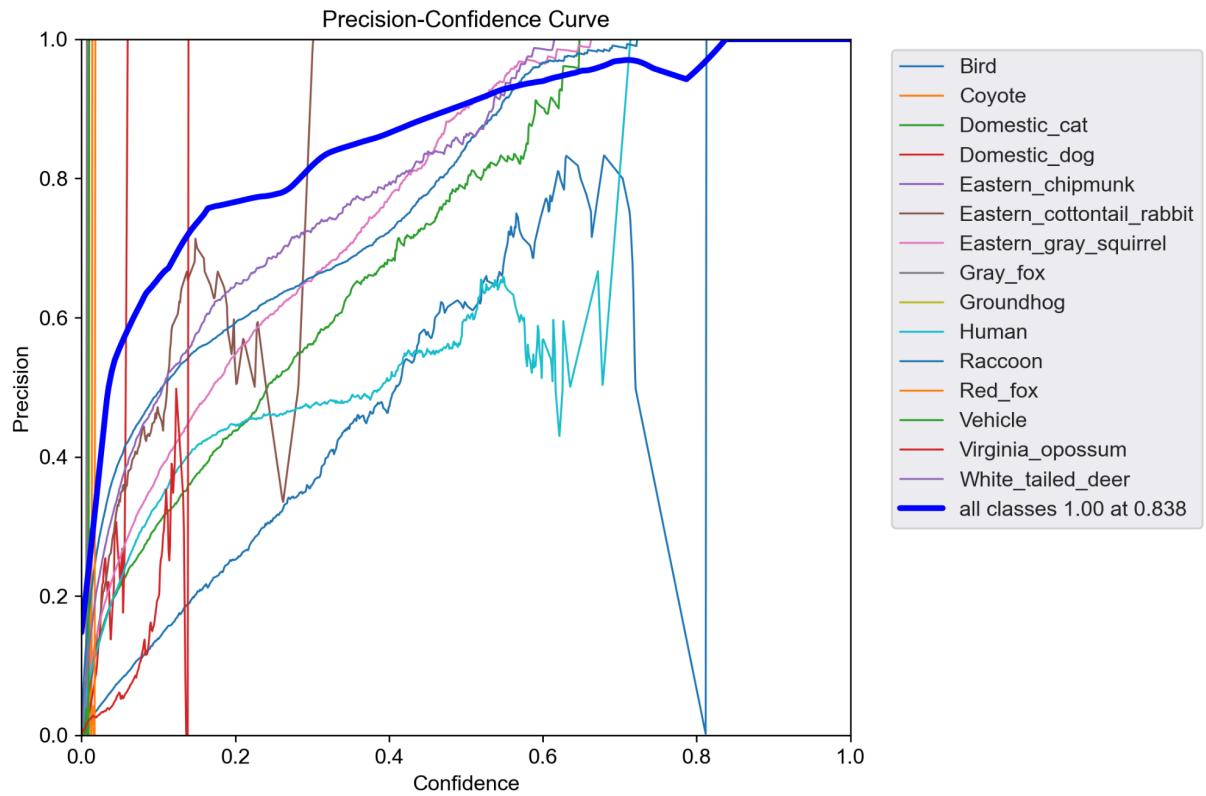
Epoch   GPU_mem  box_loss  obj_loss  cls_loss  Instances    Size
  2/2      0G     0.04328  0.01473  0.01352    16          640: 100%|██████████| 1521/1521 [1:17:33<00:00,  3.06s/it]
          Class  Images  Instances       P       R  mAP50  mAP50-95: 100%|██████████| 119/119 [02:46<00:00,  1.40s/it]
          all     3787     3787     0.771     0.293    0.305     0.145

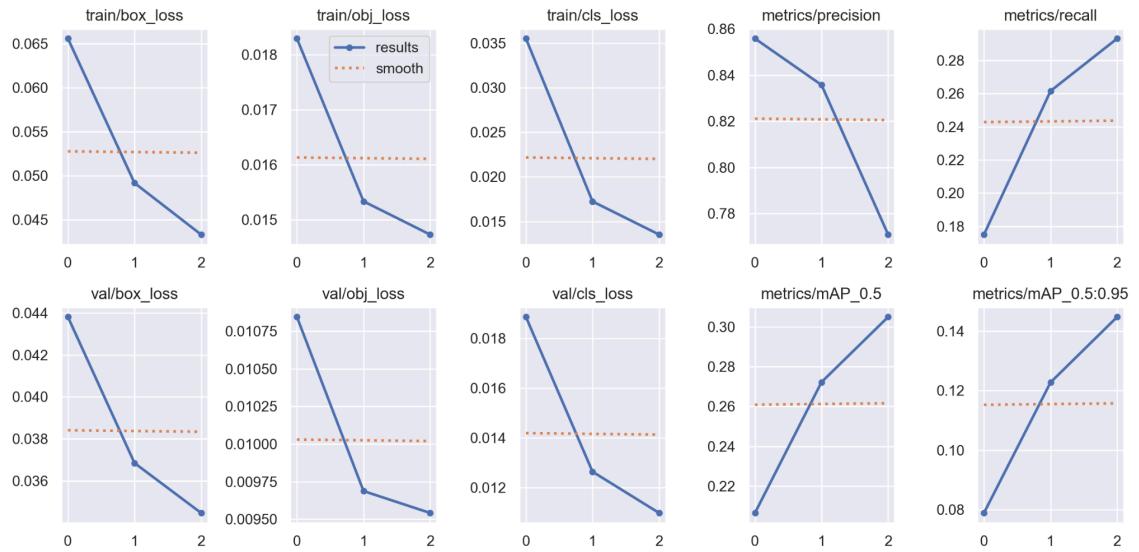
3 epochs completed in 4.158 hours.
Optimizer stripped from runs\train\exp13\weights\last.pt, 14.5MB
Optimizer stripped from runs\train\exp13\weights\best.pt, 14.5MB

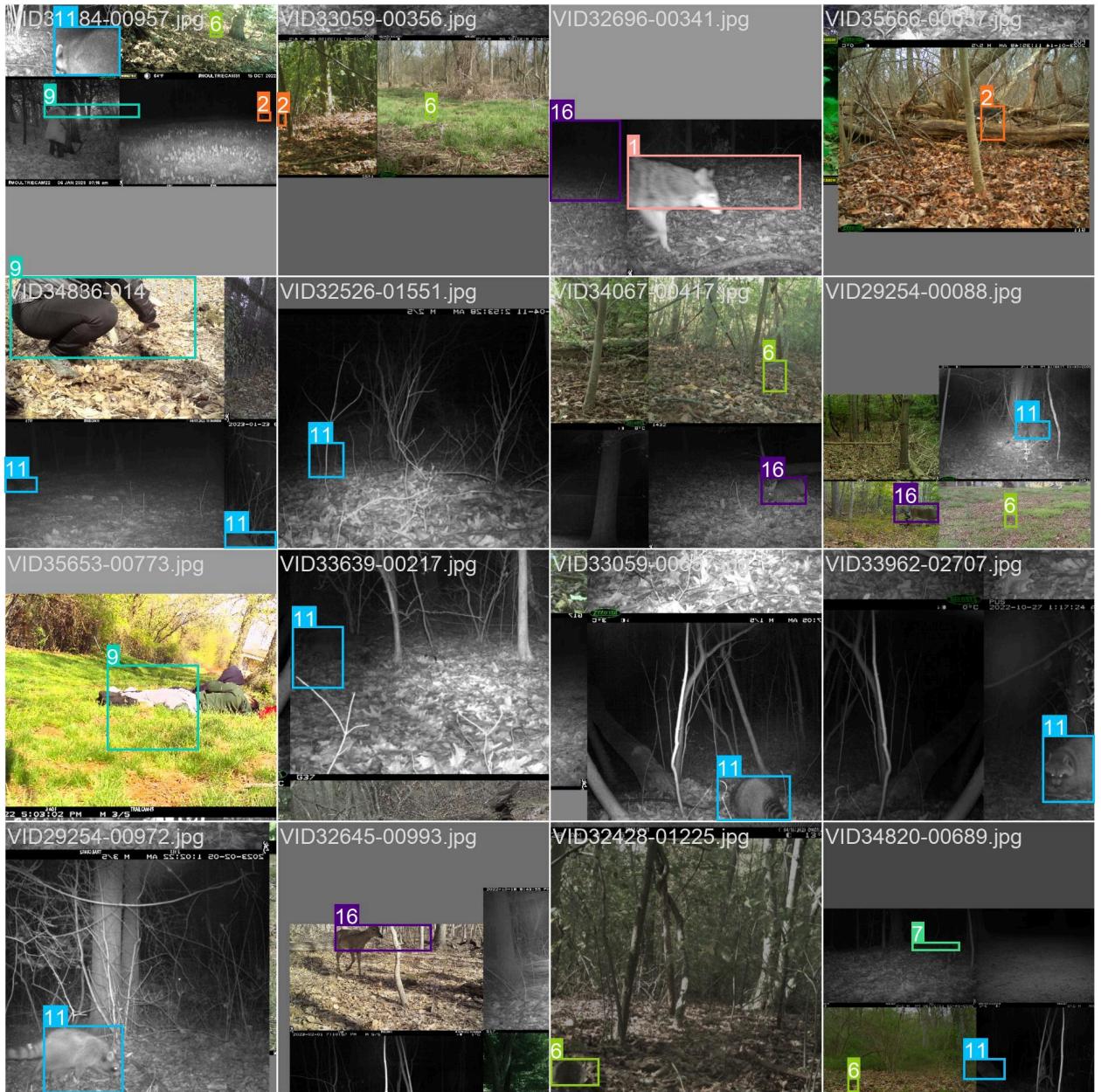
Validating runs\train\exp13\weights\best.pt...
Fusing layers...
Model summary: 157 layers, 7055974 parameters, 0 gradients, 15.9 GFLOPs
          Class  Images  Instances       P       R  mAP50  mAP50-95: 100%|██████████| 119/119 [02:34<00:00,  1.30s/it]
          all     3787     3787     0.771     0.293    0.305     0.145
          Bird    3787     147     0.284     0.571    0.39     0.138
          Coyote  3787     11      1       0     0.0421     0.0179
          Domestic_cat 3787     262     0.464     0.679    0.603     0.292
          Domestic_dog 3787     33      1       0     0.186     0.0799
          Eastern_chipmunk 3787      6      1       0     0.000137    4.12e-05
          Eastern_cottontail_rabbit 3787     77     0.501     0.0391    0.382     0.137
          Eastern_gray_squirrel 3787     677     0.581     0.79     0.76     0.34
          Gray_fox  3787      3      1       0     0.00317    0.00268
          Groundhog 3787      2      1       0     0.00112    0.000898
          Human    3787     544     0.455     0.599     0.455     0.212
          Raccoon  3787    1608     0.61     0.942     0.872     0.491
          Red_fox   3787     11      1       0     0.0158    0.00841
          Vehicle   3787      4      1       0     0.0167    0.0083
          Virginia_opossum 3787      45      1       0     0.0836    0.0269
          White_tailed_deer 3787     357     0.665     0.773     0.762     0.417

```









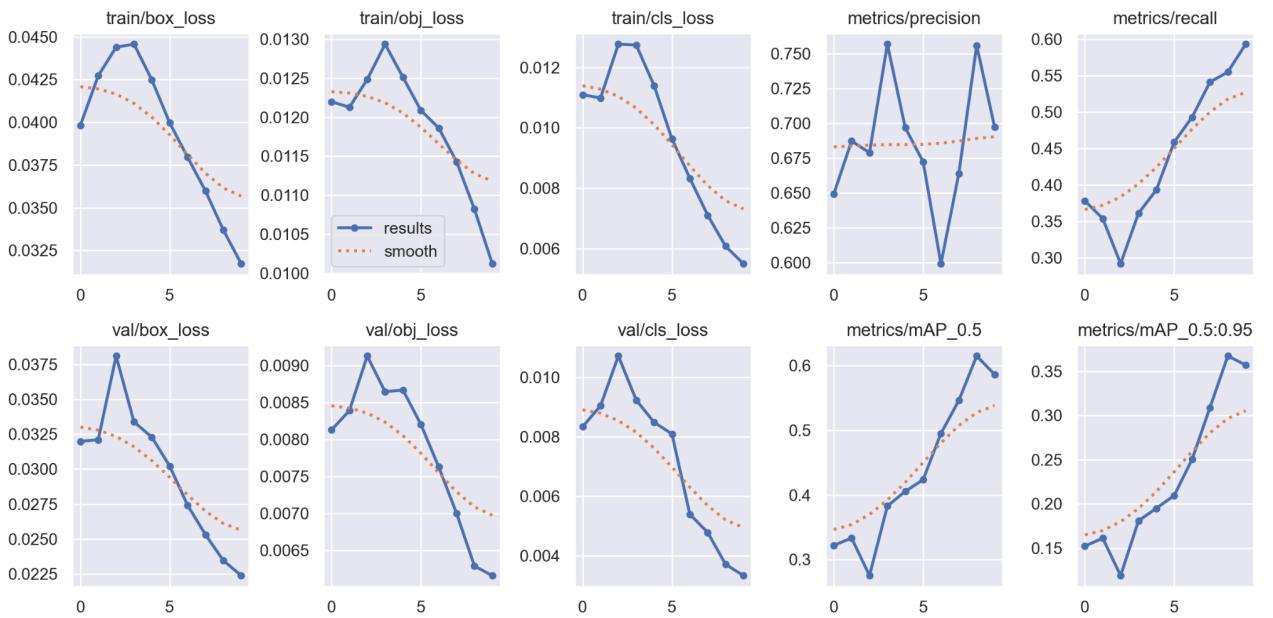
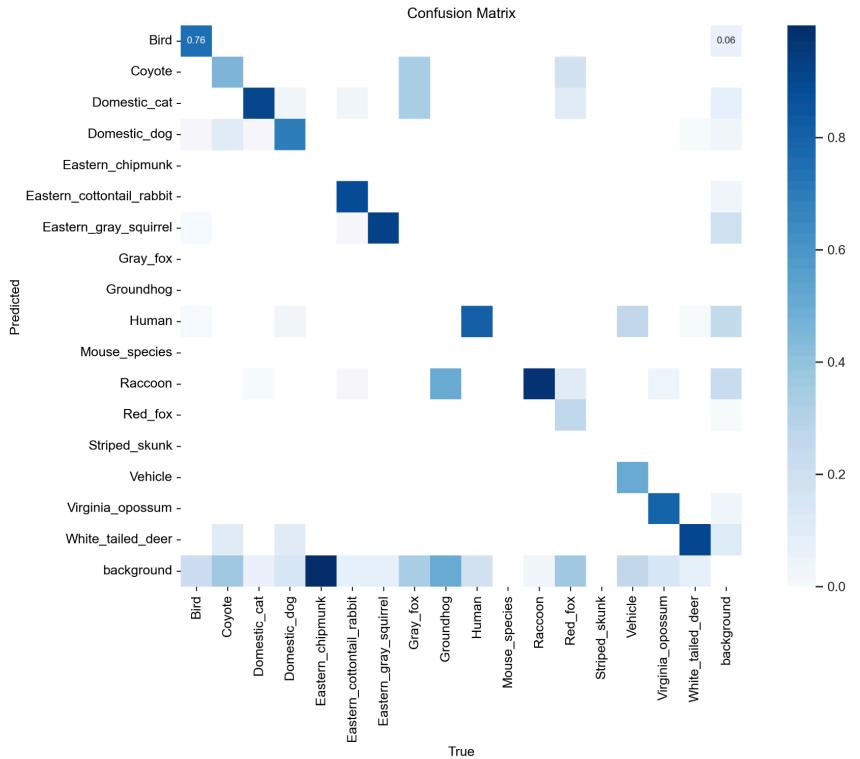


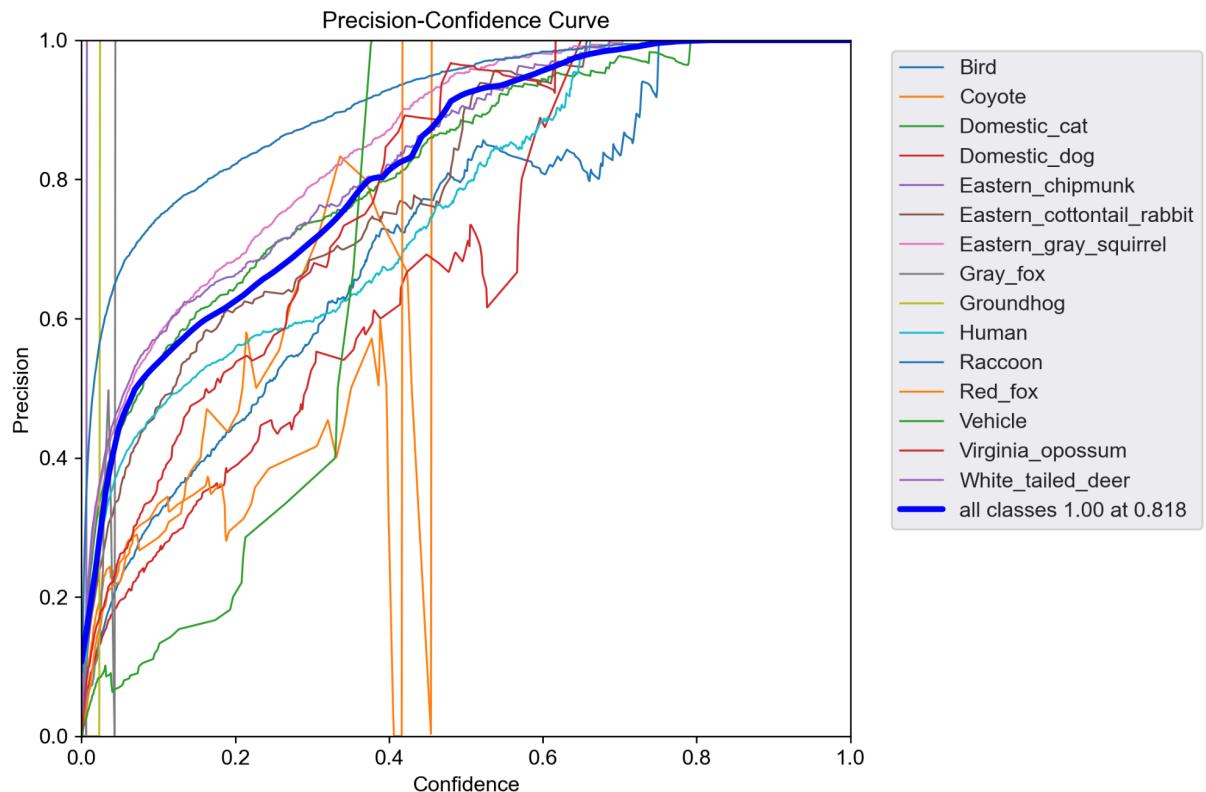
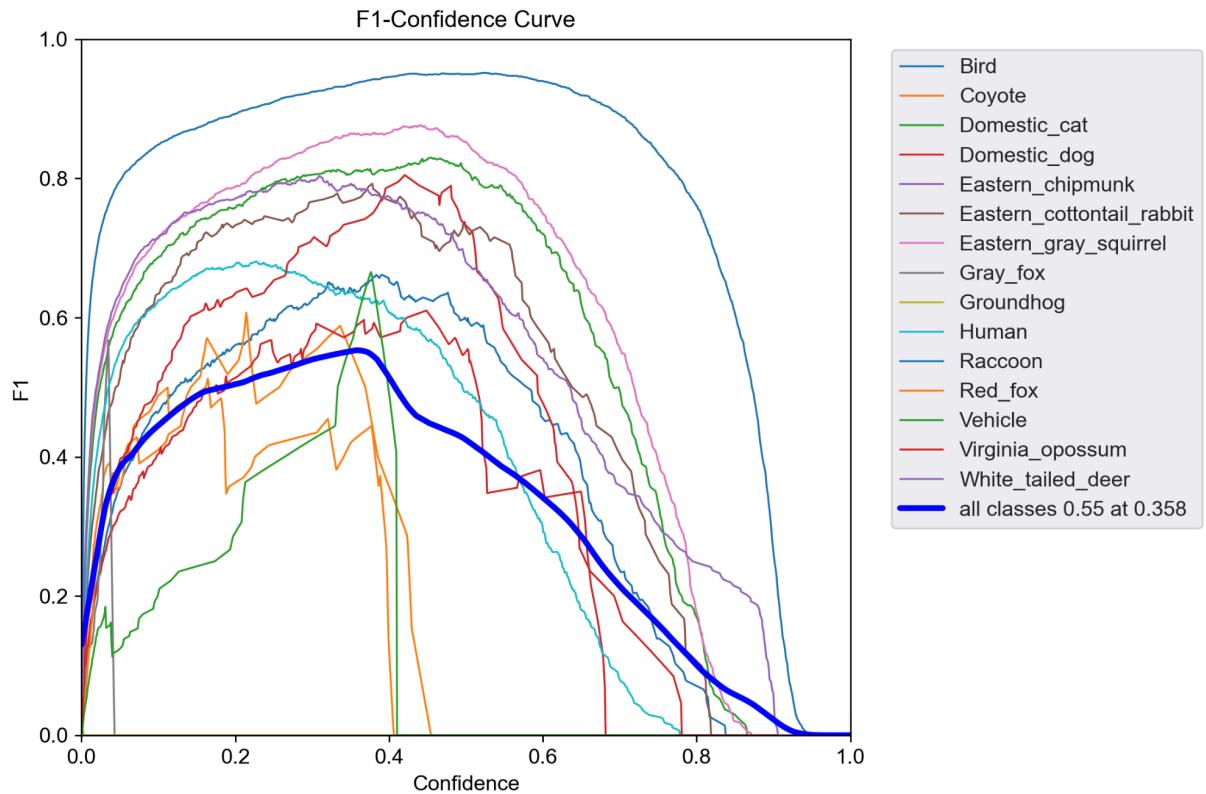
- First run complete, results attached
- Training for 10 epochs from saved model

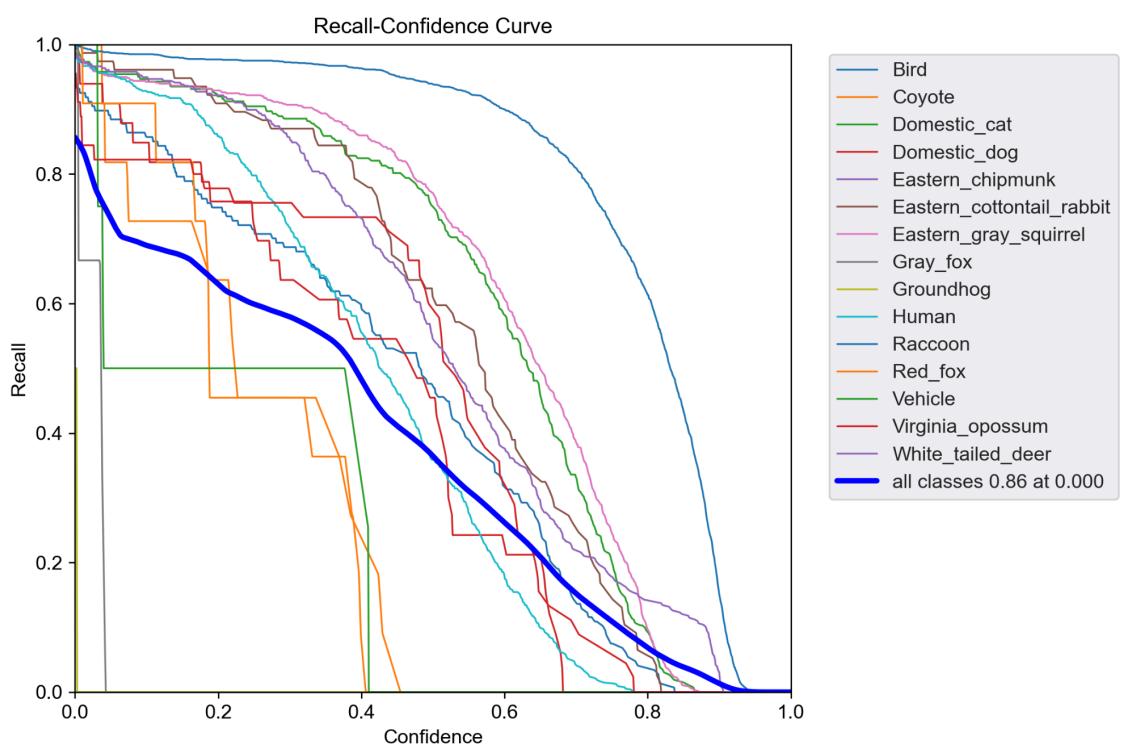
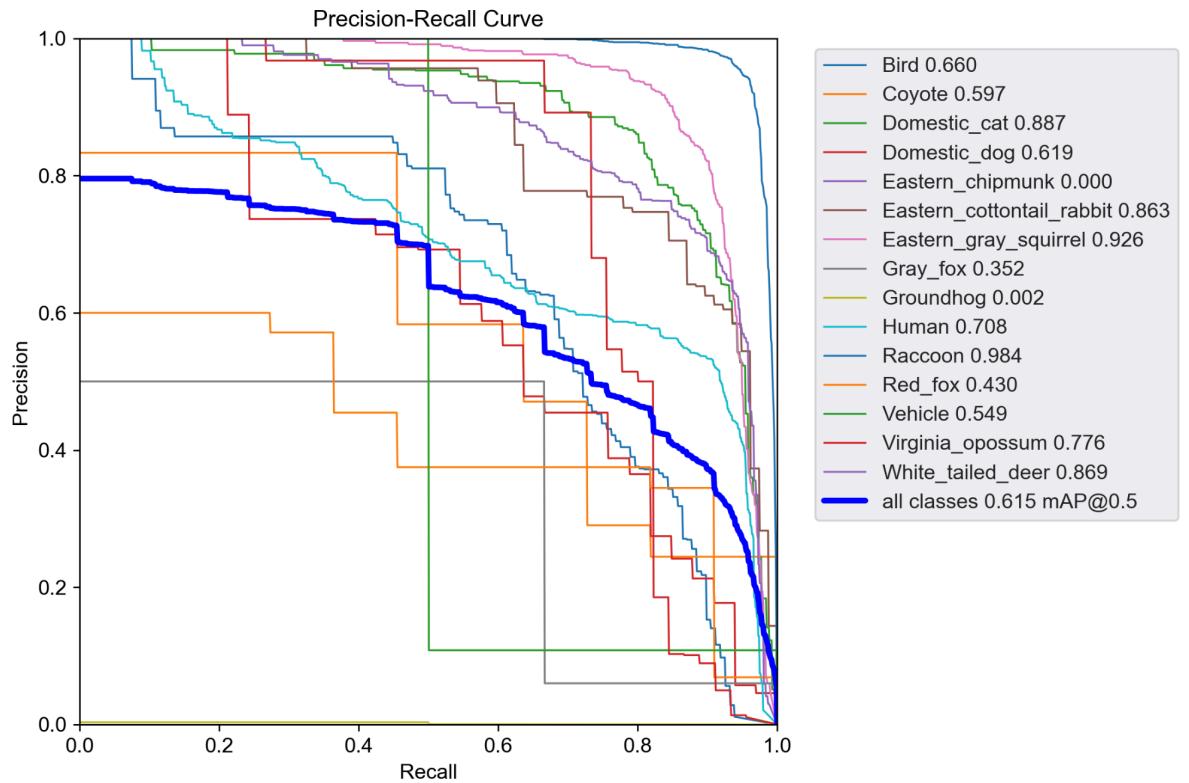
```

Validating runs\train\exp15\weights\best.pt...
Fusing layers...
Model summary: 157 layers, 7055974 parameters, 0 gradients, 15.9 GFLOPs
      Class   Images  Instances       P       R   mAP50   mAP50-95: 100% | 67/67 [03:11<00:00,  2.86s/it]
        all    4235     3787  0.756  0.554  0.615  0.367
        Bird    4235     147  0.628  0.639  0.66  0.312
        Coyote   4235      11  0.827  0.438  0.597  0.378
        Domestic_cat  4235    262  0.755  0.869  0.887  0.58
        Domestic_dog   4235     33  0.542  0.606  0.619  0.356
        Eastern_chipmunk  4235      6  1  0  0  0
        Eastern_cottontail_rabbit  4235     77  0.7  0.844  0.863  0.47
        Eastern_gray_squirrel  4235    677  0.831  0.895  0.926  0.56
        Gray_fox   4235      3  1  0  0.352  0.243
        Groundhog  4235      2  1  0  0.00166  0.00116
        Human    4235    544  0.625  0.644  0.708  0.407
        Raccoon   4235    1608  0.898  0.969  0.984  0.759
        Red_fox    4235     11  0.452  0.364  0.43  0.283
        Vehicle   4235      4  0.576  0.5  0.549  0.192
        Virginia_o possum  4235     45  0.734  0.733  0.776  0.39
        White_tailed_deer  4235    357  0.775  0.801  0.869  0.575
Results saved to runs\train\exp15

```







Some outputs on the validation set:

Actual:



Pred:



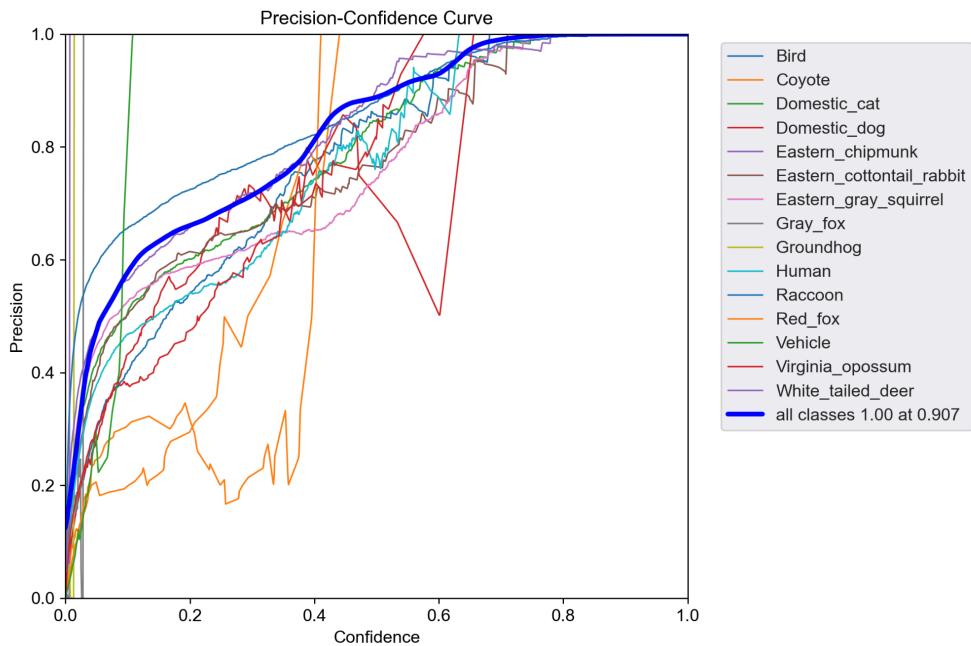
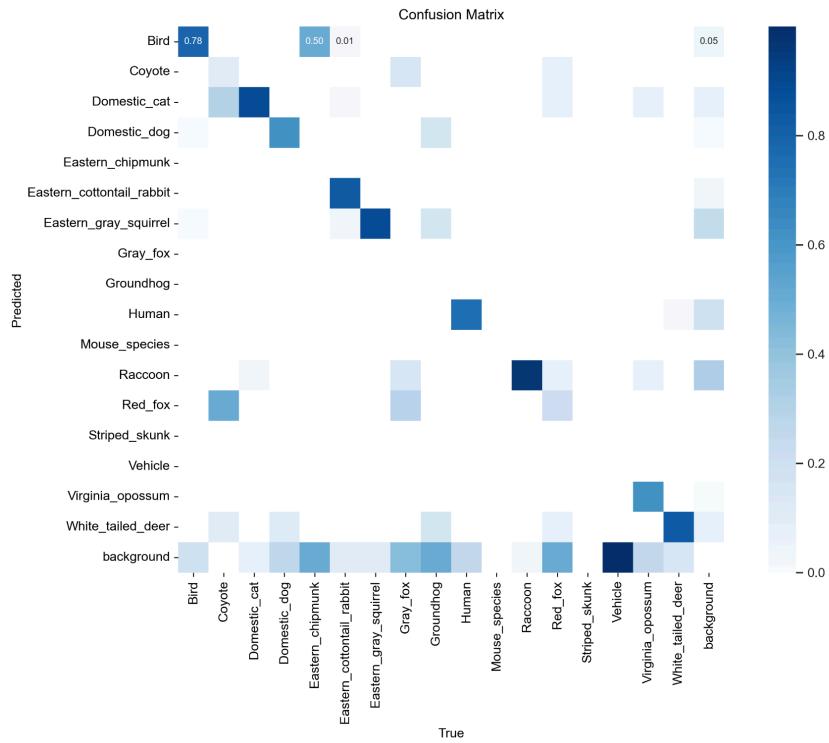
Actual:

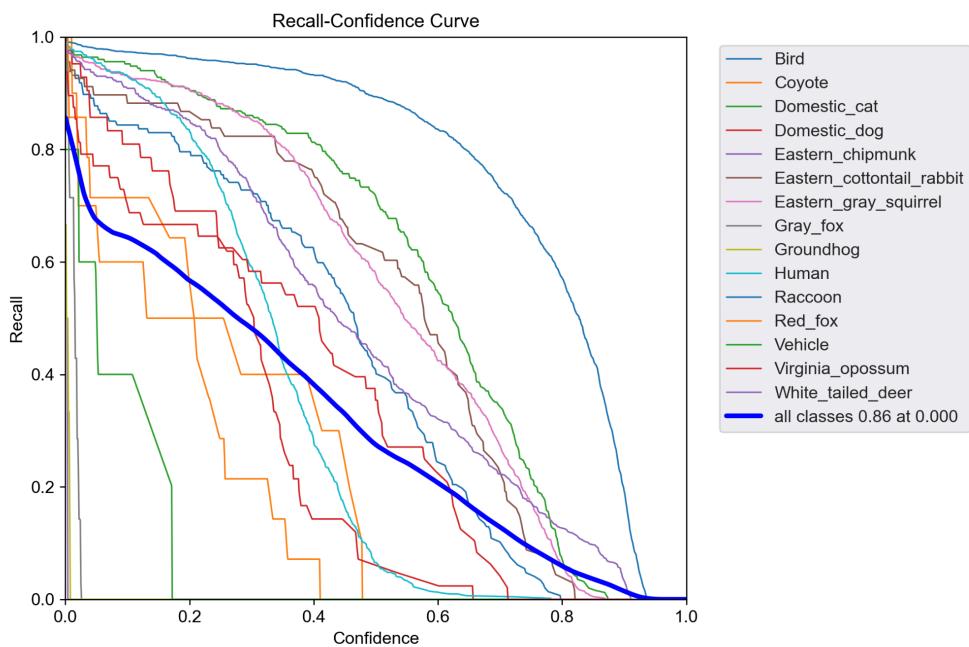
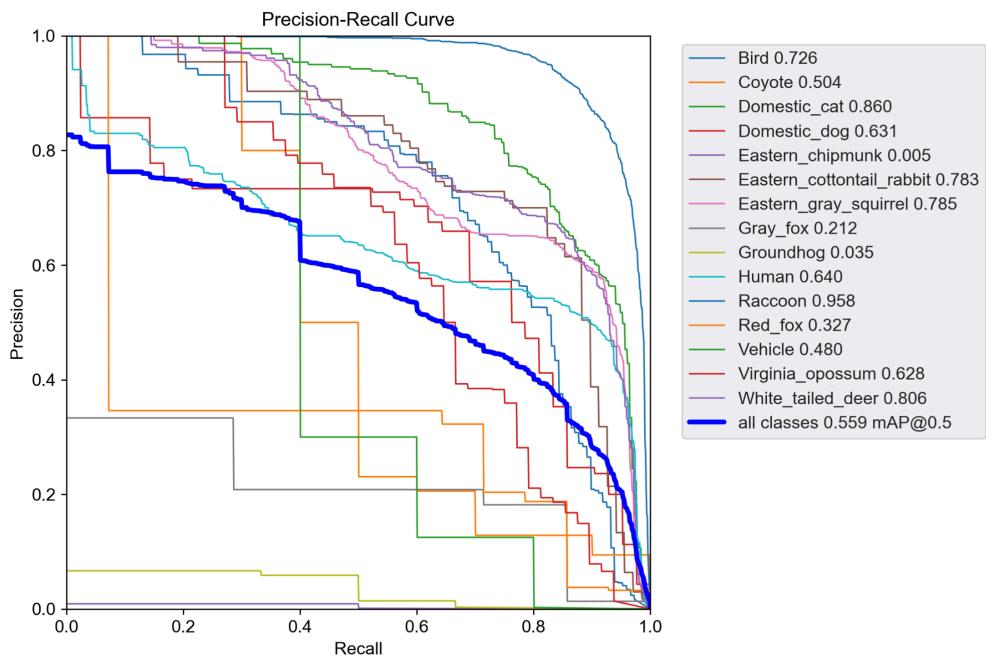


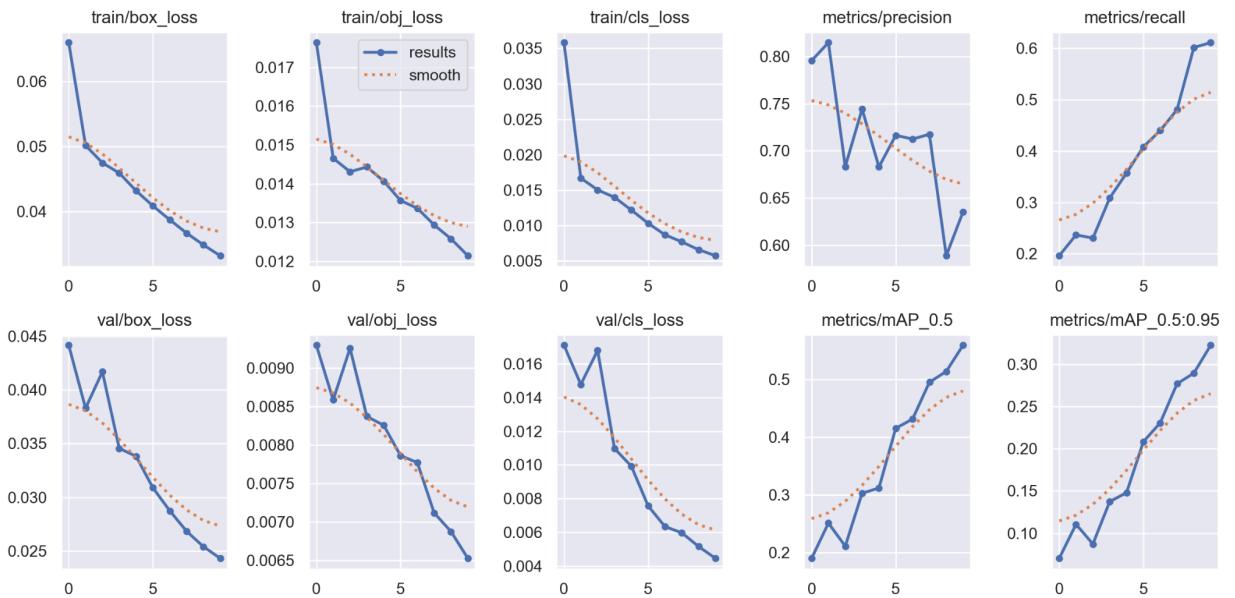
Pred:



- Need much better annotations for better outputs, and GPU for speed
 - Ran with ~~better annotations~~, satisfactory results







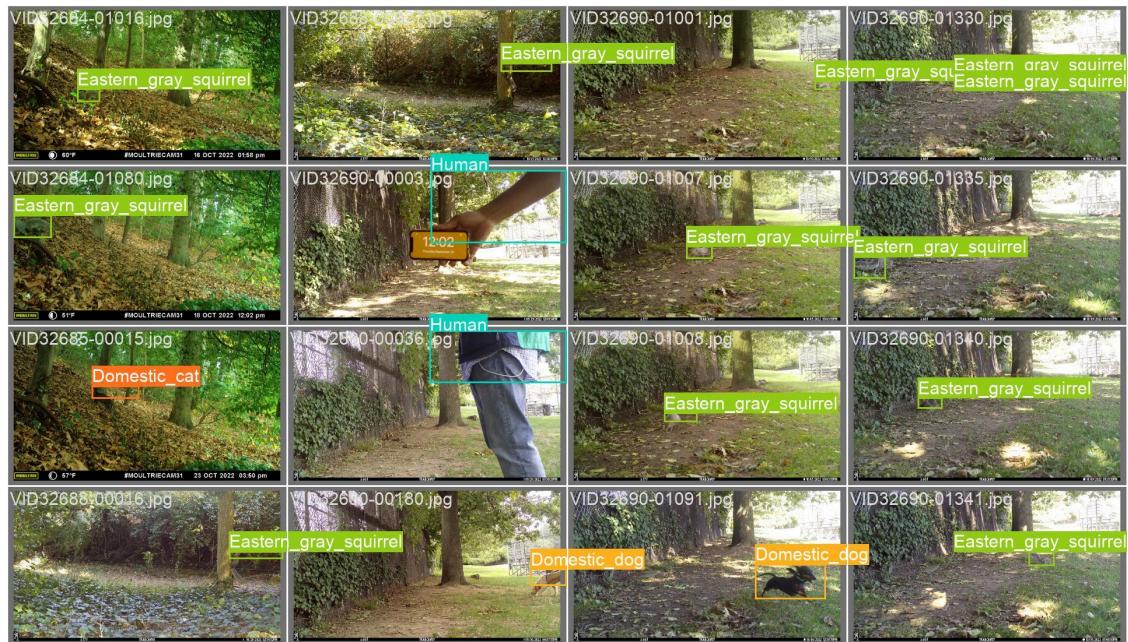
Actual:



Pred:



Actual:



Pred:



Actual:



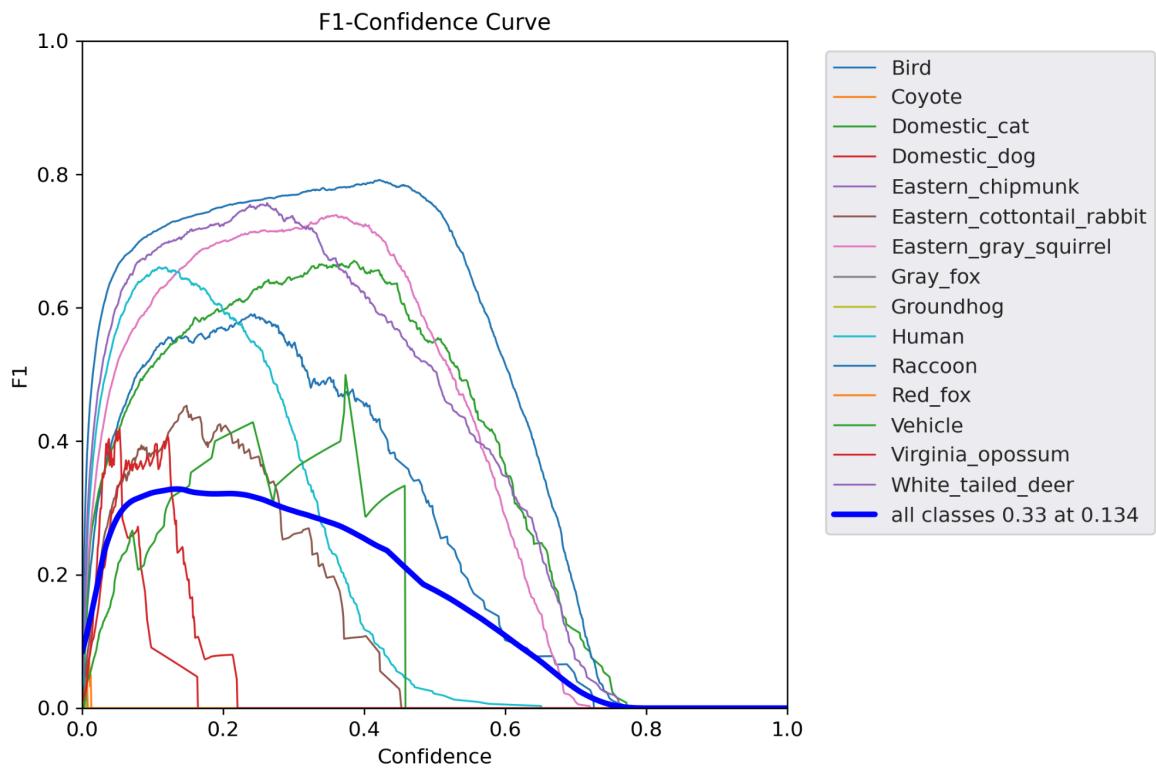
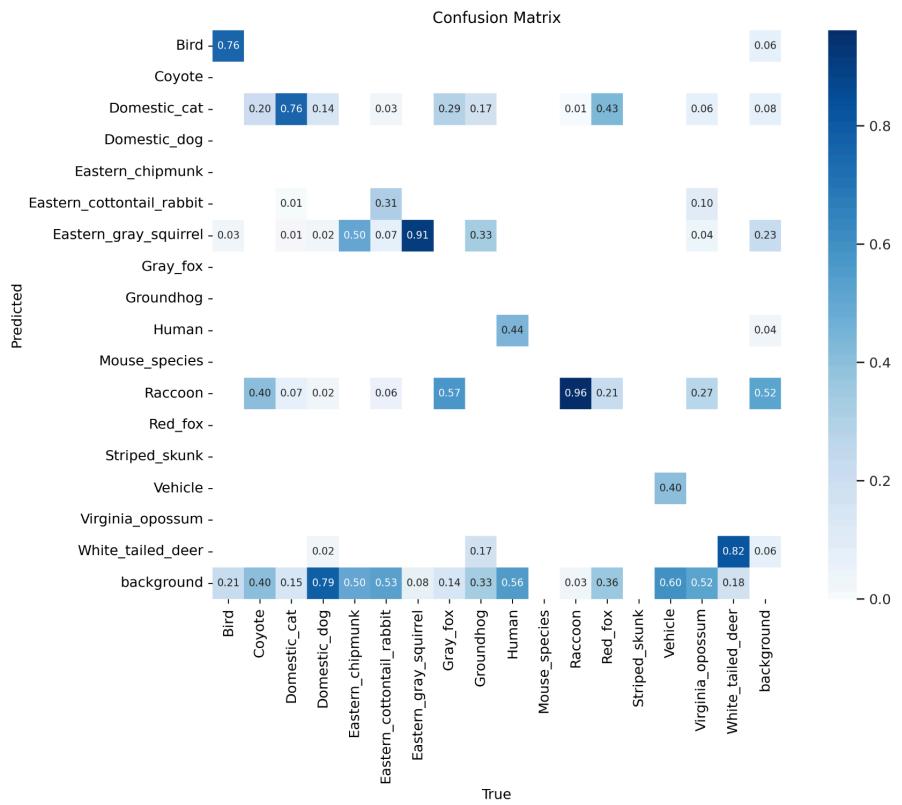
Pred:

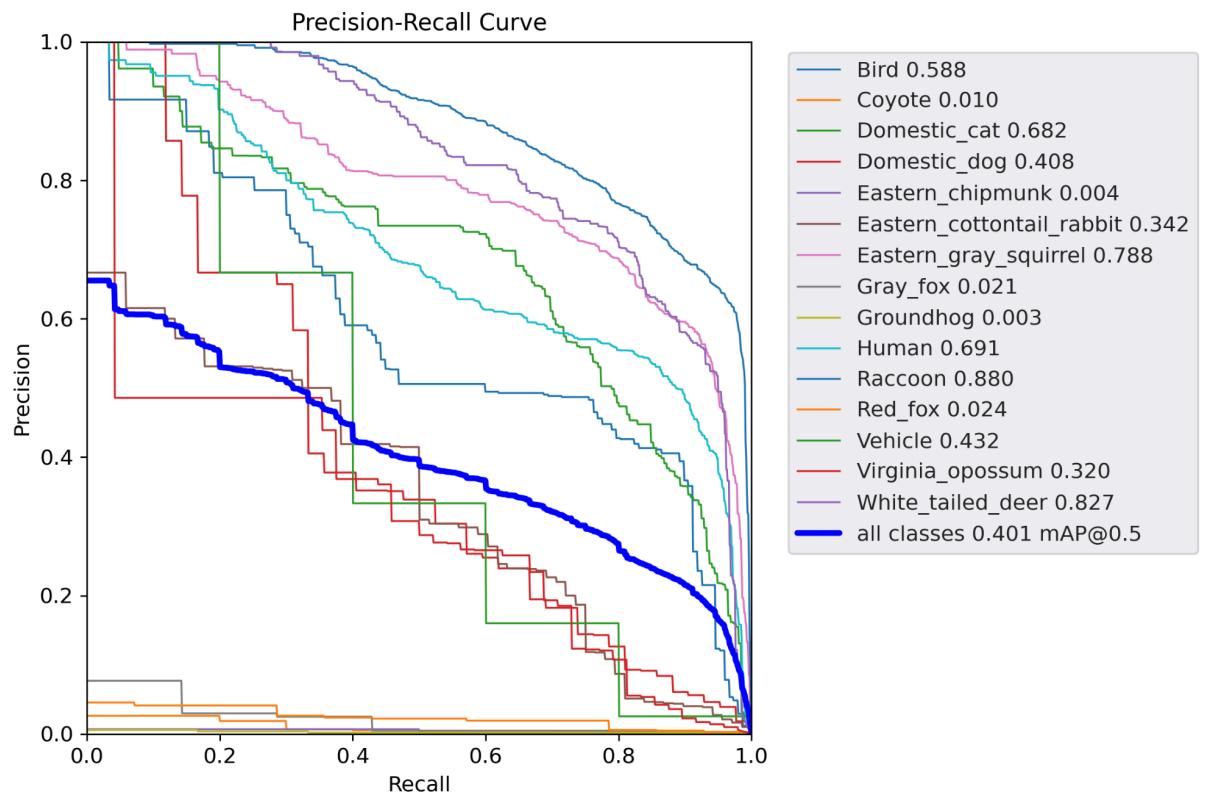
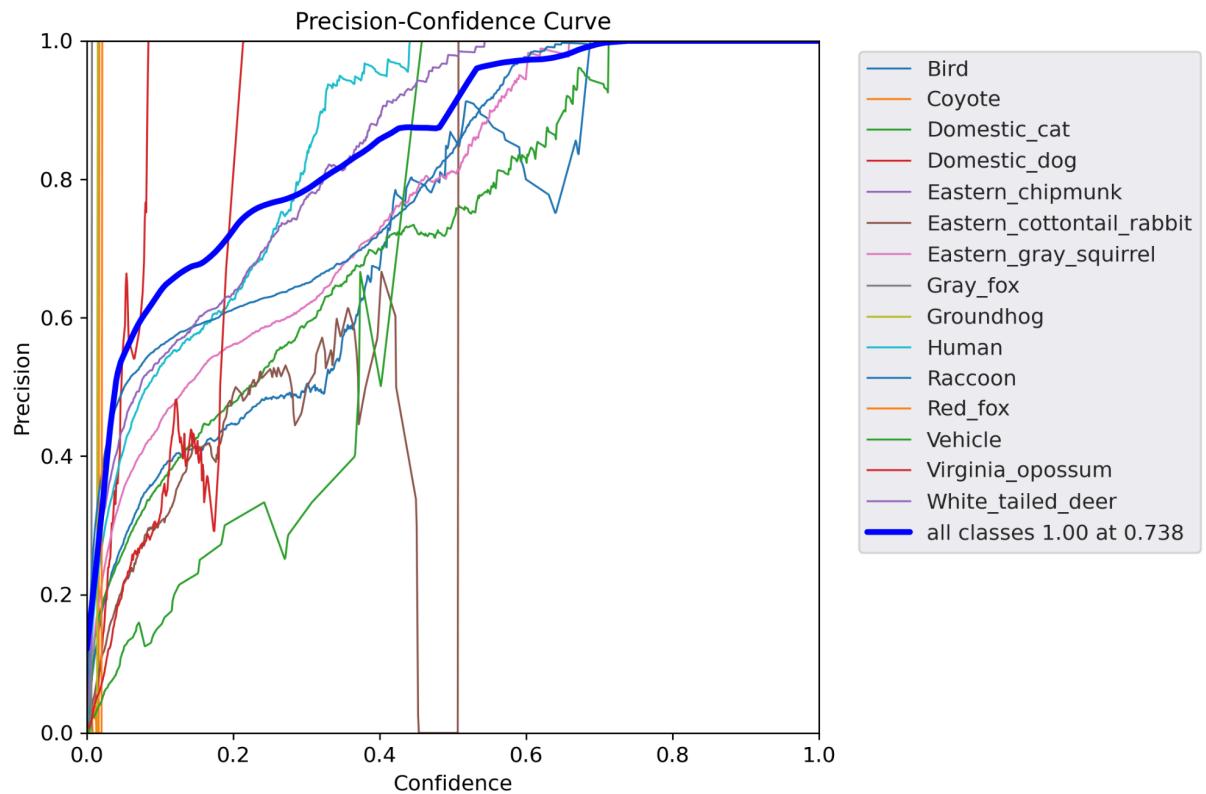


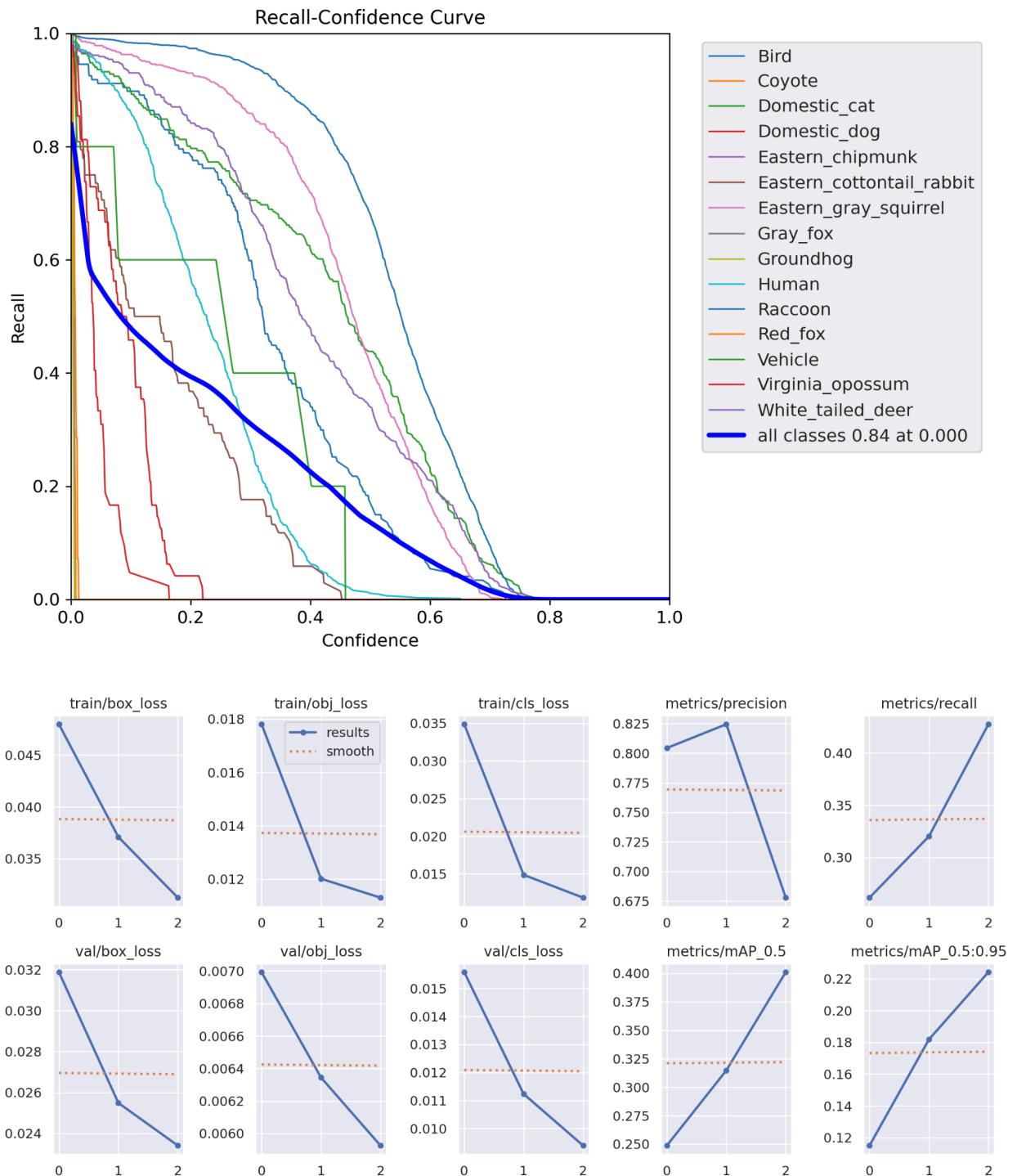
- About ~36ms/image for detections

Speed: 0.6ms pre-process, 34.4ms inference, 0.3ms NMS per image at shape (1, 3, 640, 640)

- Human Review needed - I have run a batch from the 2024 June period. Please take a look, the folder will be placed on the D drive, as FkB, alongside a csv file for the detections.
- Fine tuned the MdV5a model







Train:

```
Starting training for 3 epochs...
Epoch 0/2 GPU_mem box_loss obj_loss cls_loss Instances Size
17.3G 0.1091 0.03572 0.07351 54 896: 0%| 0/843 [01:11<?, ?it/s]WARNING △ TensorBoard graph visu
18.9G 0.04796 0.0178 0.03488 26 896: 100%|██████████| 843/843 [1:40:09<00:00, 7.13s/it]
Class Images Instances P R mAP50 mAP50-95: 100%|██████████| 74/74 [18:20<00:00, 14.88s/it]
all 4689 4000 0.804 0.262 0.249 0.115

Epoch 1/2 GPU_mem box_loss obj_loss cls_loss Instances Size
18.7G 0.03709 0.01202 0.01487 35 896: 100%|██████████| 843/843 [3:29:58<00:00, 14.95s/it]
Class Images Instances P R mAP50 mAP50-95: 100%|██████████| 74/74 [11:07<00:00, 9.03s/it]
all 4689 4000 0.824 0.32 0.315 0.182

Epoch 2/2 GPU_mem box_loss obj_loss cls_loss Instances Size
18.7G 0.03125 0.01131 0.01184 30 896: 100%|██████████| 843/843 [3:41:41<00:00, 15.78s/it]
Class Images Instances P R mAP50 mAP50-95: 100%|██████████| 74/74 [12:47<00:00, 10.37s/it]
all 4689 4000 0.678 0.427 0.401 0.224
```

Val:

```
Validating runs/train/exp3/weights/best.pt...
Fusing layers...
Model summary: 416 layers, 140124664 parameters, 0 gradients, 208.2 GFLOPs
Class Images Instances P R mAP50 mAP50-95: 100%|██████████| 74/74 [12:13<00:00, 9.91s/it]
all 4689 4000 0.68 0.427 0.401 0.224
Bird 4689 147 0.409 0.835 0.588 0.321
Coyote 4689 10 1 0 0.0101 0.00629
Domestic_cat 4689 251 0.433 0.849 0.682 0.373
Domestic_dog 4689 42 1 0.0273 0.408 0.194
Eastern_chipmunk 4689 2 1 0 0.0039 0.00264
Eastern_cottontail_rabbit 4689 68 0.414 0.471 0.342 0.174
Eastern_gray_squirrel 4689 700 0.521 0.943 0.788 0.471
Gray_fox 4689 7 1 0 0.0212 0.0154
Groundhog 4689 6 1 0 0.00273 0.0017
Human 4689 627 0.58 0.71 0.691 0.389
Raccoon 4689 1657 0.59 0.979 0.88 0.613
Red_fox 4689 14 1 0 0.0239 0.0136
Vehicle 4689 5 0.25 0.6 0.432 0.111
Virginia_opossum 4689 48 0.397 0.104 0.32 0.154
White_tailed_deer 4689 416 0.602 0.887 0.827 0.525
```

Actual:



Pred:



Actual:



Pred:



Actual:



Pred:



Week 8:

- Explore bigger models, and try running them

Week 9:

- Extract Sung-Joo's images, and separate them
- Keep working on the GPU issues

Future Steps:

<https://roboflow.com/formats/yolov5-pytorch-txt?ref=ultralytics> - the format of data required for training the YOLO (v5) model

```
python train.py --img 640 --batch 16 --epochs 3 --data UWIN.yaml --weights yolov5s.pt
```

```
set KMP_DUPLICATE_LIB_OK=TRUE
echo %KMP_DUPLICATE_LIB_OK%
set CUDA_LAUNCH_BLOCKING=1
```

Resolving issues while starting training:

You can resolve this issue by explicitly specifying the encoding while reading the YAML file. Modify the `check_dataset` function in

`C:\Users\ab5640\Desktop\Python\yolov5\utils\loggers\comet__init__.py` to open the file with the correct encoding.

```
def check_dataset(self, data_file):
    """Validates the dataset configuration by loading the YAML
file specified in `data_file`."""
    with io.open(data_file, 'r', encoding='utf-8') as f:
        data_config = yaml.safe_load(f)

    path = data_config.get("path")
    if path and path.startswith(COMET_PREFIX):
```

```
    path = data_config["path"].replace(COMET_PREFIX, "")
    return self.download_dataset_artifact(path)
    self.log_asset(self.opt.data, metadata={"type":
"data-config-file"})

    return check_dataset(data_file)
```

```
File "C:\Users\ab5640\Desktop\Python\yolov5\val.py", line 381, in run
    correct = process_batch(predn, labelsn, iouv)
               ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
File "C:\Users\ab5640\Desktop\Python\yolov5\val.py", line 177, in process_batch
    matches = torch.cat((torch.stack(x, 1), iou[x[0], x[1]][:, None]), 1).cpu().numpy() # [label, detect, iou]
               ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
RuntimeError: CUDA error: unspecified launch failure
Compile with 'TORCH_USE_CUDA_DSA' to enable device-side assertions.
```