yolov5

November 12, 2020

1 Setup

Clone repo, install dependencies, %cd into ./yolov5 folder and check GPU.

[1]:
```
!git clone https://github.com/ultralytics/yolov5  # clone repo
!pip install -qr yolov5/requirements.txt  # install dependencies (ignore errors)
%cd yolov5

import torch
from IPython.display import Image, clear_output  # to display images
from utils.google_utils import gdrive_download  # to download models/datasets

clear_output()
print('Setup complete. Using torch %s %s' % (torch.__version__, torch.cuda.
 ↪get_device_properties(0) if torch.cuda.is_available() else 'CPU'))
```

```
Setup complete. Using torch 1.6.0 _CudaDeviceProperties(name='Tesla
P100-PCIE-16GB', major=6, minor=0, total_memory=16280MB,
multi_processor_count=56)
```

2 2. Test

Test a model on COCO val or test-dev dataset to determine trained accuracy. Models are auto-downloaded from Google Drive. To show results by class use the --verbose flag. Note that pycocotools metrics may be 1-2% better than the equivalent repo metrics, as is visible below, due to slight differences in mAP computation.

2.0.1 2.1 val2017

Download COCO val 2017 dataset, 1GB, 5000 images, and test model accuracy.

[ ]:
```
# Download COCO val2017
gdrive_download('1Y6Kou6kEB0ZEMCCpJSKStCor4KAReE43','coco2017val.zip')  #␣
 ↪val2017 dataset
!mv ./coco ../  # move folder alongside /yolov5
```

[53]:
```
# Run YOLOv5x on COCO val2017
!python test.py --weights runs/exp1/weights/best.pt --data kkctbn.yaml --img 416
```

```
Namespace(augment=False, batch_size=32, conf_thres=0.001,
data='./data/kkctbn.yaml', device='', img_size=416, iou_thres=0.65, merge=False,
save_json=False, save_txt=False, single_cls=False, task='val', verbose=False,
weights=['runs/exp1/weights/best.pt'])
Fusing layers…
Scanning labels ../kkctbn/labels.cache (402 found, 0 missing, 0 empty, 0
duplicate, for 402 images): 402it [00:00, 10086.38it/s]
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.673       0.935       0.929
0.487
Speed: 1.8/1.8/3.6 ms inference/NMS/total per 416x416 image at batch-size 32
```

3 3. Train

[27]:
```
!mkdir ../kkctbn
!cp -r /kaggle/input/kkctbn ../kkctbn
```

```
mkdir: cannot create directory '../kkctbn': File exists
```

[19]:
```
!mkdir ../kkctbn/images
!mkdir ../kkctbn/labels
!mv ../kkctbn/dataset/*.txt ../kkctbn/labels
!mv ../kkctbn/dataset/*.jpg ../kkctbn/images
```

[30]:
```
!cp /kaggle/input/kkctbn/kkctbn.yaml ./data
!cp /kaggle/input/kkctbn/yolov5s.yaml ./models/yolov5s2.yml
```

[33]:
```
!ls ./models
```

```
__init__.py  experimental.py  yolo.py       yolov5s.yaml
__pycache__  export.py        yolov5l.yaml  yolov5s2.yml
common.py    hub              yolov5m.yaml  yolov5x.yaml
```

[31]:
```
!ls data
```

```
coco.yaml     hyp.finetune.yaml  kkctbn.yaml  voc.yaml
coco128.yaml  hyp.scratch.yaml   scripts
```

[ ]:
```
# Start tensorboard (optional)
%load_ext tensorboard
%tensorboard --logdir runs
```

[42]:
```
# Train YOLOv5s on coco128 for 3 epochs
!python train.py --img 416 --batch 16 --epochs 50 --data kkctbn.yaml --cfg␣
 ↪yolov5s2.yml --weights yolov5s.pt --nosave --cache
```

```
2020-09-29 07:46:29.814952: I
tensorflow/stream_executor/platform/default/dso_loader.cc:48] Successfully
```

```
opened dynamic library libcudart.so.10.1
Overriding model.yaml nc=80 with nc=2

Scanning labels ../kkctbn/labels.cache (402 found, 0 missing, 0 empty, 0
duplicate, for 402 images): 402it [00:00, 10746.67it/s]
Caching images (0.2GB): 100%|         | 402/402 [00:01<00:00, 298.95it/s]
Scanning labels ../kkctbn/labels.cache (402 found, 0 missing, 0 empty, 0
duplicate, for 402 images): 402it [00:00, 2701.75it/s]
Caching images (0.2GB): 100%|         | 402/402 [00:02<00:00, 183.98it/s]

Analyzing anchors… anchors/target = 5.08, Best Possible Recall (BPR) = 1.0000
      0/49    0.818G    0.1241   0.05478   0.02647    0.2053         5       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03           0           0     0.00715
0.0022
      1/49     1.49G    0.1066   0.06273   0.01857    0.1879         3       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.963      0.0186      0.0948
0.0358
      2/49     1.49G   0.09701    0.0701   0.01275    0.1799         5       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.357       0.302       0.292
0.0926
      3/49     1.49G   0.08072   0.06094  0.007546    0.1492         1       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03      0.0679       0.887       0.437
0.147
      4/49     1.49G   0.07168   0.05538  0.004227    0.1313        11       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03      0.0768       0.915       0.495
0.173
      5/49     1.49G   0.06678   0.05039  0.002877      0.12         7       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.108       0.924       0.566
0.196
      6/49     1.49G   0.07032    0.0505  0.002292    0.1231         5       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03        0.14       0.919       0.648
0.217
      7/49     1.49G   0.07096   0.04988  0.001966    0.1228        13       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.152       0.836       0.495
0.171
      8/49     1.49G   0.06969   0.04679  0.001945    0.1184        10       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.172       0.914       0.588
0.2
      9/49     1.49G   0.06437   0.04825  0.001852    0.1145         8       416
```

```
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03        0.18       0.918       0.667
0.27
     10/49     1.49G   0.06548   0.04574  0.001859    0.1131         4       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.221       0.909       0.672
0.252
     11/49     1.49G    0.0634   0.05004  0.001818    0.1153        19       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.287       0.913       0.713
0.289
     12/49     1.49G   0.06078   0.04642  0.001707    0.1089         6       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.167        0.91       0.575
0.206
     13/49     1.49G   0.05666   0.04318  0.001522    0.1014         2       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03        0.24       0.915       0.716
0.291
     14/49     1.49G   0.05641   0.04423  0.001515    0.1022         9       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.296       0.912       0.786
0.335
     15/49     1.49G   0.05405   0.04439  0.001552   0.09998         6       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.301       0.917       0.784
0.327
     16/49     1.49G    0.0537   0.04673  0.001409    0.1018         5       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.359       0.912       0.735
0.302
     17/49     1.49G   0.05039   0.04472   0.00128   0.09639         4       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.429       0.907       0.859
0.37
     18/49     1.49G   0.05106    0.0435  0.001213   0.09577         7       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.357       0.899        0.74
0.276
     19/49     1.49G   0.05793   0.04487  0.001323    0.1041        18       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.338       0.917       0.802
0.344
     20/49     1.49G   0.05786   0.04459   0.00137    0.1038         6       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.345       0.923       0.732
0.32
     21/49     1.49G   0.05307   0.04272  0.001318   0.09711         2       416
```

```
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.419       0.902       0.811
0.335
     22/49     1.49G   0.05167   0.04609   0.00132   0.09908        10       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.504       0.898       0.872
0.402
     23/49     1.49G   0.04905   0.04325  0.001266   0.09356        12       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.401       0.904       0.839
0.367
     24/49     1.49G   0.04886   0.04674  0.001146   0.09675        24       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.569       0.903       0.778
0.329
     25/49     1.49G   0.04954   0.04529  0.001151   0.09598        22       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.549       0.912       0.896
0.426
     26/49     1.49G   0.04926   0.04467  0.001114   0.09504         4       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.445       0.915       0.818
0.337
     27/49     1.49G   0.04629   0.04426  0.001087   0.09164         6       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.466        0.92       0.832
0.372
     28/49     1.49G   0.04446   0.04094  0.001016   0.08641         3       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.582        0.91       0.888
0.429
     29/49     1.49G   0.04293   0.04005 0.0009504   0.08393         2       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.536       0.922       0.893
0.422
     30/49     1.49G   0.04364   0.04214 0.0009038   0.08668         8       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03        0.52       0.927       0.898
0.406
     31/49     1.49G   0.04252   0.04248 0.0008888   0.08589         7       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.663       0.917       0.899
0.434
     32/49     1.49G   0.04703   0.04387 0.0009314   0.09183        10       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.561       0.925       0.884
0.424
     33/49     1.49G   0.04817   0.04416 0.0009875   0.09331         1       416
```

```
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.617       0.912         0.9
0.424
     34/49     1.49G   0.04573   0.04302 0.0009362   0.08969         6       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.503        0.93       0.883
0.384
     35/49     1.49G   0.04273   0.04046 0.0009249   0.08411        10       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.633       0.925       0.906
0.45
     36/49     1.49G   0.04202   0.04391 0.0008563   0.08679         5       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.615       0.928       0.901
0.434
     37/49     1.49G   0.04016   0.03979 0.0008705   0.08082        12       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.639       0.921       0.905
0.445
     38/49     1.49G   0.03994   0.04174 0.0007848   0.08247         4       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.617       0.932       0.915
0.441
     39/49     1.49G   0.03955   0.04346 0.0007587   0.08377        13       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.671       0.912       0.894
0.431
     40/49     1.49G   0.03871   0.03958 0.0007388   0.07903         3       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.688       0.907       0.894
0.42
     41/49     1.49G   0.03822   0.04072  0.000698   0.07964         5       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.661       0.932       0.921
0.462
     42/49     1.49G   0.03847   0.04284 0.0006348   0.08194         1       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.597       0.927       0.911
0.452
     43/49     1.49G   0.03584   0.03823 0.0006067   0.07468         2       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.619       0.937       0.921
0.469
     44/49     1.49G   0.03671   0.04258 0.0005867   0.07988         6       416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03        0.67       0.931        0.92
0.464
     45/49     1.49G   0.03616   0.03944 0.0005387   0.07614         8       416
```

```
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.722       0.928       0.918
0.463
     46/49     1.49G   0.03723    0.0404  0.000551   0.07818           5         416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.702       0.936       0.924
0.47
     47/49     1.49G   0.03619   0.04299 0.0005315   0.07971          12         416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.717       0.928       0.922
0.474
     48/49     1.49G   0.03554   0.03967 0.0004738   0.07568          13         416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.695       0.937       0.929
0.474
     49/49     1.49G   0.03516   0.04059 0.0004458   0.07619          14         416
               Class      Images     Targets           P           R      mAP@.5
                 all         402    1.39e+03       0.744       0.925       0.923
0.48
Optimizer stripped from runs/exp1/weights/last.pt, 14.8MB
Optimizer stripped from runs/exp1/weights/best.pt, 14.8MB
```

4 4. Visualize

View `runs/exp0/train*.jpg` images to see training images, labels and augmentation effects. A **Mosaic Dataloader** is used for training (shown below), a new concept developed by Ultralytics and first featured in YOLOv4.

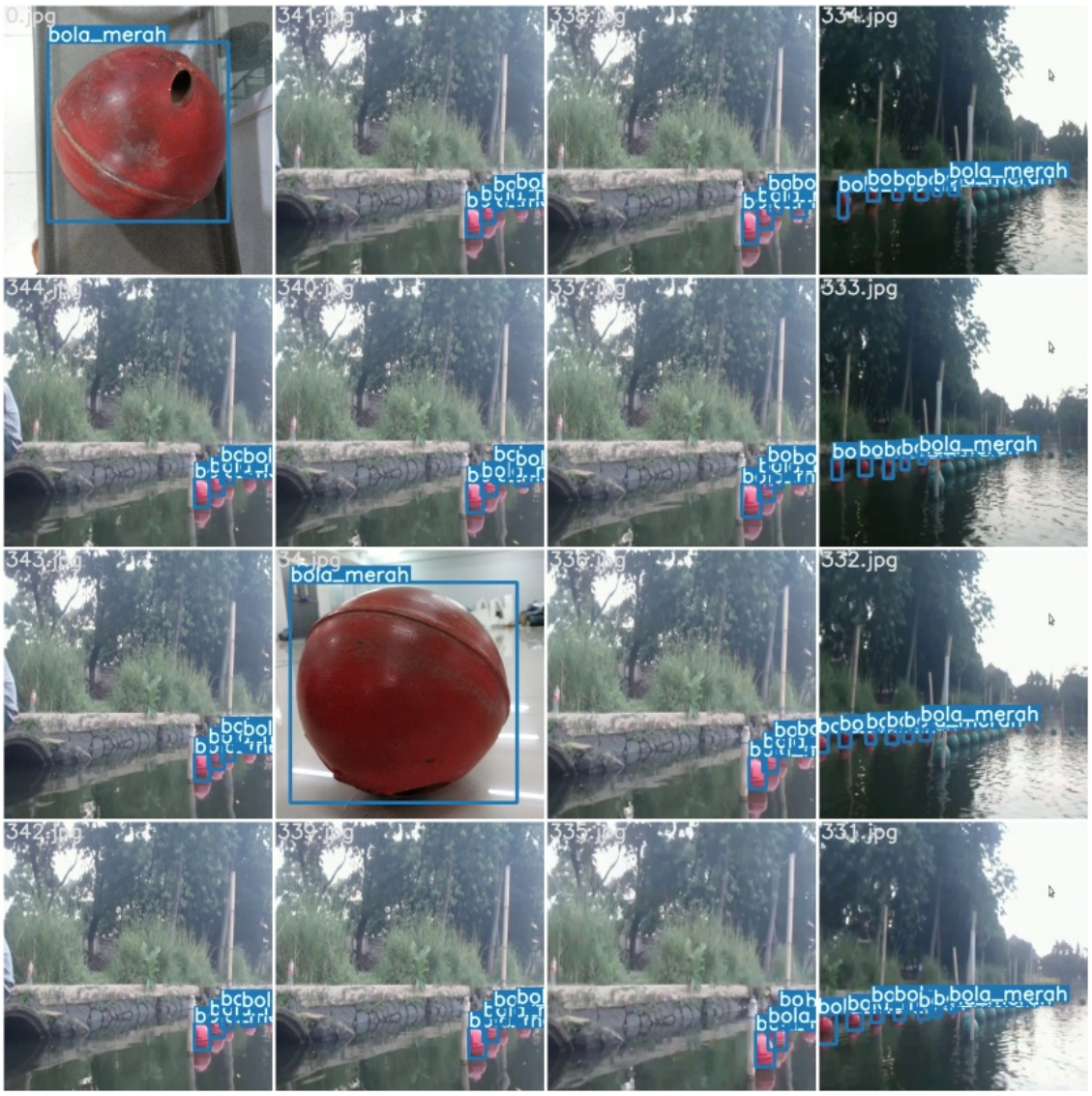
[43]:
```
Image(filename='runs/exp0/train_batch1.jpg', width=900)  # view augmented␣
↪training mosaics
```

[43]:

View test_batch0_gt.jpg to see test batch 0 *ground truth* labels.

[44]:
```
Image(filename='runs/exp0/test_batch0_gt.jpg', width=900)  # view test image␣
↪labels
```

[44]:



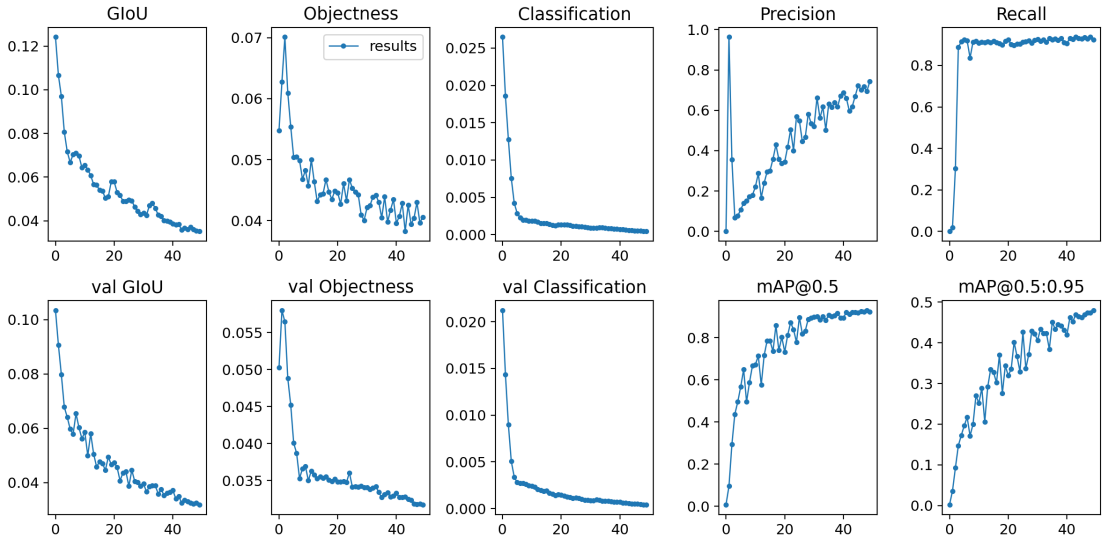
View test_batch0_pred.jpg to see test batch 0 *predictions*.

[48]:
```
!ls runs/exp1
```

```
events.out.tfevents.1601365591.6416aa4de09b.1060.0  test_batch0_gt.jpg
hyp.yaml                                            test_batch0_pred.jpg
labels.png                                          train_batch0.jpg
labels_correlogram.png                              train_batch1.jpg
opt.yaml                                            train_batch2.jpg
results.png                                         weights
results.txt
```

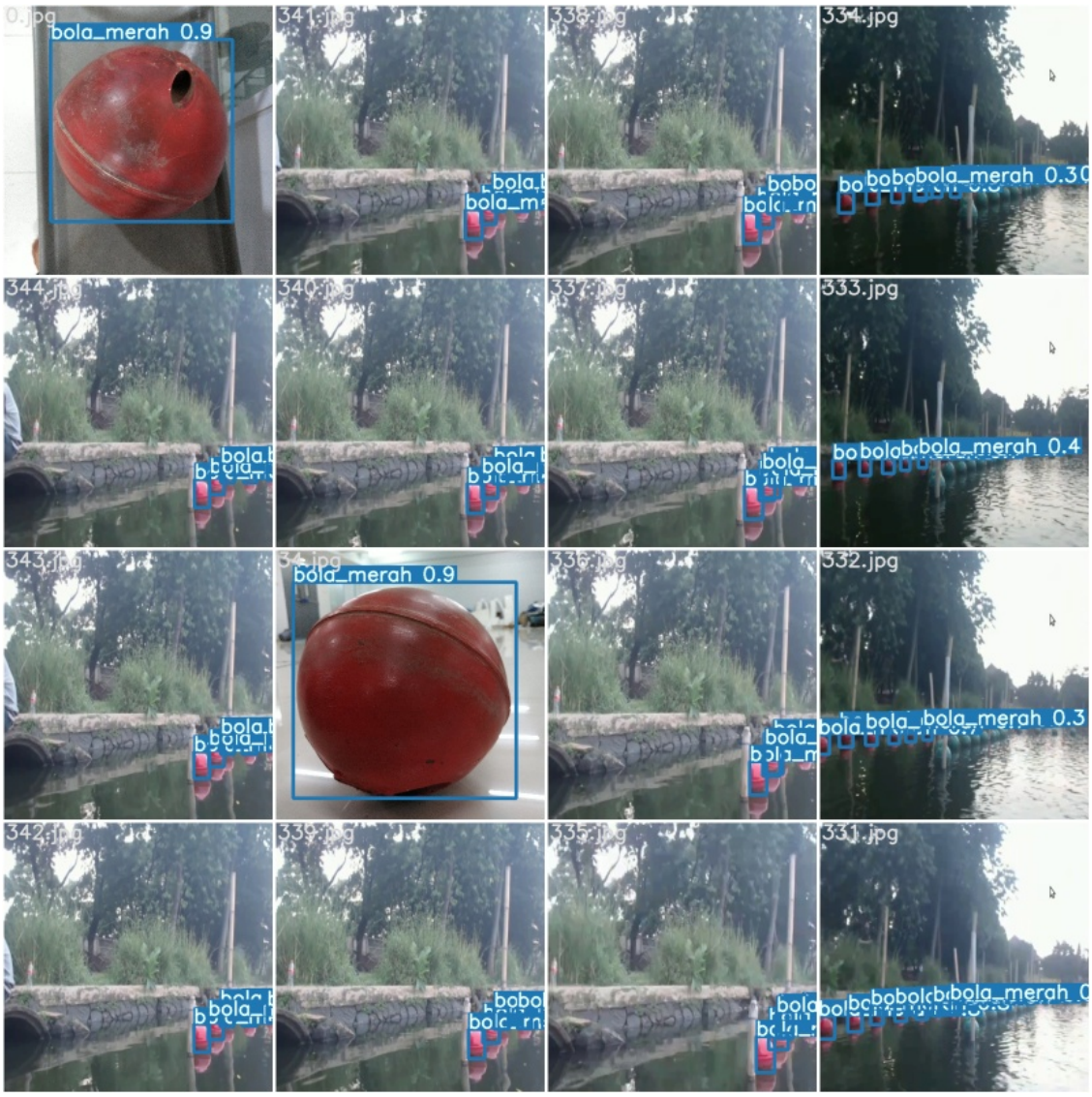
[52]:
```
Image(filename='runs/exp1/results.png', width=900)
```

[52]:



[51]:
```
Image(filename='runs/exp1/test_batch0_pred.jpg', width=900)  # view test image␣
↪predictions
```

[51]:



Training losses and performance metrics are saved to Tensorboard and also to a runs/exp0/results.txt logfile. results.txt is plotted as results.png after training completes. Partially completed results.txt files can be plotted with from utils.utils import plot_results; plot_results(). Here we show YOLOv5s trained on coco128 to 300 epochs, starting from scratch (blue), and from pretrained yolov5s.pt (orange).