In [ ]:
```
!mkdir -p ~/ .kaggle
!cp kaggle.json ~/.kaggle/
```

In [ ]:
```
!chmod 600 /root/.kaggle/kaggle.json
!kaggle datasets download -d ninadaithal/chess-pieces-dataset
```

```
Downloading chess-pieces-dataset.zip to /content
 83% 7.00M/8.41M [00:01<00:00, 8.13MB/s]
100% 8.41M/8.41M [00:01<00:00, 5.79MB/s]
```

In [ ]:
```
import zipfile
zip_ref = zipfile.ZipFile('/content/chess-pieces-dataset.zip','r')
zip_ref.extractall('/content')
zip_ref.close()
```

In [ ]:
```
pip install ultralytics
```

```
Collecting ultralytics
  Downloading ultralytics-8.0.211-py3-none-any.whl (645 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 645.4/645.4 kB 9.1 MB/s eta 0:00:00
Requirement already satisfied: matplotlib>=3.3.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (3.7.
1)
Requirement already satisfied: numpy>=1.22.2 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (1.23.5)
Requirement already satisfied: opencv-python>=4.6.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (4.
8.0.76)
Requirement already satisfied: pillow>=7.1.2 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (9.4.0)
Requirement already satisfied: pyyaml>=5.3.1 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (6.0.1)
Requirement already satisfied: requests>=2.23.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (2.31.
0)
Requirement already satisfied: scipy>=1.4.1 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (1.11.3)
Requirement already satisfied: torch>=1.8.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (2.1.0+cu11
8)
Requirement already satisfied: torchvision>=0.9.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (0.1
6.0+cu118)
Requirement already satisfied: tqdm>=4.64.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (4.66.1)
Requirement already satisfied: pandas>=1.1.4 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (1.5.3)
Requirement already satisfied: seaborn>=0.11.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (0.12.2)
Requirement already satisfied: psutil in /usr/local/lib/python3.10/dist-packages (from ultralytics) (5.9.5)
Requirement already satisfied: py-cpuinfo in /usr/local/lib/python3.10/dist-packages (from ultralytics) (9.0.0)
```

```
Collecting thop>=0.1.1 (from ultralytics)
  Downloading thop-0.1.1.post2209072238-py3-none-any.whl (15 kB)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->u
ltralytics) (1.2.0)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultra
lytics) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->
ultralytics) (4.44.0)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->
ultralytics) (1.4.5)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ul
tralytics) (23.2)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->u
ltralytics) (3.1.1)
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.
0->ultralytics) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.1.4->ultralyti
cs) (2023.3.post1)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.10/dist-packages (from requests>=2.
23.0->ultralytics) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages (from requests>=2.23.0->ultral
ytics) (3.4)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.10/dist-packages (from requests>=2.23.0->
ultralytics) (2.0.7)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from requests>=2.23.0->
ultralytics) (2023.7.22)
Requirement already satisfied: filelock in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics)
(3.13.1)
Requirement already satisfied: typing-extensions in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultra
lytics) (4.5.0)
Requirement already satisfied: sympy in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (1.1
2)
Requirement already satisfied: networkx in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics)
(3.2.1)
Requirement already satisfied: jinja2 in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (3.
1.2)
Requirement already satisfied: fsspec in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (20
23.6.0)
Requirement already satisfied: triton==2.1.0 in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralyti
cs) (2.1.0)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.7->matplo
```

```
tlib>=3.3.0->ultralytics) (1.16.0)
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.10/dist-packages (from jinja2->torch>=1.8.0-
>ultralytics) (2.1.3)
Requirement already satisfied: mpmath>=0.19 in /usr/local/lib/python3.10/dist-packages (from sympy->torch>=1.8.0->ult
ralytics) (1.3.0)
Installing collected packages: thop, ultralytics
Successfully installed thop-0.1.1.post2209072238 ultralytics-8.0.211
```

In [ ]:
```
!git clone https://github.com/ultralytics/ultralytics.git
```

```
Cloning into 'ultralytics'...
remote: Enumerating objects: 18113, done.
remote: Counting objects: 100% (1025/1025), done.
remote: Compressing objects: 100% (627/627), done.
remote: Total 18113 (delta 588), reused 668 (delta 377), pack-reused 17088
Receiving objects: 100% (18113/18113), 9.97 MiB | 10.26 MiB/s, done.
Resolving deltas: 100% (12549/12549), done.
```

In [ ]:
```
%cat data.yaml
```

```
train: ../train/images
val: ../valid/images
test: ../test/images

nc: 12
names: ['black-camel', 'black-elephant', 'black-horse', 'black-king', 'black-pawn', 'black-queen', 'white-camel', 'wh
ite-elephant', 'white-horse', 'white-king', 'white-pawn', 'white-queen']

roboflow:
  workspace: tutorial-knlj8
  project: chess-board-detection-uuppk
  version: 4
  license: CC BY 4.0
  url: https://universe.roboflow.com/tutorial-knlj8/chess-board-detection-uuppk/dataset/4
```

In [ ]:
```
import yaml
with open("/content/data.yaml","r") as stream:
  num_classes = str(yaml.safe_load(stream)["nc"])
```

In [ ]:
```
num_classes
```

Out[ ]: '12'

In [ ]:
```
from ultralytics import YOLO
```

Training for detection on Chess Data using yolov8s.pt

In [ ]:
```
model = YOLO()
!yolo task=detect mode=train model=yolov8s.pt data= data.yaml epochs=101 imgsz=416 plots=True
```

```
Downloading https://github.com/ultralytics/assets/releases/download/v0.0.0/yolov8n.pt to 'yolov8n.pt'...
100%|██████████| 6.23M/6.23M [00:00<00:00, 254MB/s]
Downloading https://github.com/ultralytics/assets/releases/download/v0.0.0/yolov8s.pt to 'yolov8s.pt'...
100% 21.5M/21.5M [00:00<00:00, 375MB/s]
Ultralytics YOLOv8.0.211 🚀 Python-3.10.12 torch-2.1.0+cu118 CUDA:0 (Tesla T4, 15102MiB)
engine/trainer: task=detect, mode=train, model=yolov8s.pt, data=data.yaml, epochs=101, patience=50, batch=16, imgsz=4
16, save=True, save_period=-1, cache=False, device=None, workers=8, project=None, name=train, exist_ok=False, pretrai
ned=True, optimizer=auto, verbose=True, seed=0, deterministic=True, single_cls=False, rect=False, cos_lr=False, close
_mosaic=10, resume=False, amp=True, fraction=1.0, profile=False, freeze=None, overlap_mask=True, mask_ratio=4, dropou
t=0.0, val=True, split=val, save_json=False, save_hybrid=False, conf=None, iou=0.7, max_det=300, half=False, dnn=Fals
e, plots=True, source=None, show=False, save_txt=False, save_conf=False, save_crop=False, show_labels=True, show_conf
=True, vid_stride=1, stream_buffer=False, line_width=None, visualize=False, augment=False, agnostic_nms=False, classe
s=None, retina_masks=False, boxes=True, format=torchscript, keras=False, optimize=False, int8=False, dynamic=False, s
implify=False, opset=None, workspace=4, nms=False, lr0=0.01, lrf=0.01, momentum=0.937, weight_decay=0.0005, warmup_ep
ochs=3.0, warmup_momentum=0.8, warmup_bias_lr=0.1, box=7.5, cls=0.5, dfl=1.5, pose=12.0, kobj=1.0, label_smoothing=0.
0, nbs=64, hsv_h=0.015, hsv_s=0.7, hsv_v=0.4, degrees=0.0, translate=0.1, scale=0.5, shear=0.0, perspective=0.0, flip
ud=0.0, fliplr=0.5, mosaic=1.0, mixup=0.0, copy_paste=0.0, cfg=None, tracker=botsort.yaml, save_dir=runs/detect/train
Downloading https://ultralytics.com/assets/Arial.ttf to '/root/.config/Ultralytics/Arial.ttf'...
100% 755k/755k [00:00<00:00, 106MB/s]
2023-11-17 04:35:23.638656: E tensorflow/compiler/xla/stream_executor/cuda/cuda_dnn.cc:9342] Unable to register cuDNN
factory: Attempting to register factory for plugin cuDNN when one has already been registered
2023-11-17 04:35:23.638707: E tensorflow/compiler/xla/stream_executor/cuda/cuda_fft.cc:609] Unable to register cuFFT
factory: Attempting to register factory for plugin cuFFT when one has already been registered
2023-11-17 04:35:23.638756: E tensorflow/compiler/xla/stream_executor/cuda/cuda_blas.cc:1518] Unable to register cuBL
AS factory: Attempting to register factory for plugin cuBLAS when one has already been registered
Overriding model.yaml nc=80 with nc=12

                   from  n    params  module                                       arguments
  0                  -1  1       928  ultralytics.nn.modules.conv.Conv             [3, 32, 3, 2]
```

```
  1                  -1  1     18560  ultralytics.nn.modules.conv.Conv             [32, 64, 3, 2]
  2                  -1  1     29056  ultralytics.nn.modules.block.C2f             [64, 64, 1, True]
  3                  -1  1     73984  ultralytics.nn.modules.conv.Conv             [64, 128, 3, 2]
  4                  -1  2    197632  ultralytics.nn.modules.block.C2f             [128, 128, 2, True]
  5                  -1  1    295424  ultralytics.nn.modules.conv.Conv             [128, 256, 3, 2]
  6                  -1  2    788480  ultralytics.nn.modules.block.C2f             [256, 256, 2, True]
  7                  -1  1   1180672  ultralytics.nn.modules.conv.Conv             [256, 512, 3, 2]
  8                  -1  1   1838080  ultralytics.nn.modules.block.C2f             [512, 512, 1, True]
  9                  -1  1    656896  ultralytics.nn.modules.block.SPPF            [512, 512, 5]
 10                  -1  1         0  torch.nn.modules.upsampling.Upsample         [None, 2, 'nearest']
 11             [-1, 6]  1         0  ultralytics.nn.modules.conv.Concat           [1]
 12                  -1  1    591360  ultralytics.nn.modules.block.C2f             [768, 256, 1]
 13                  -1  1         0  torch.nn.modules.upsampling.Upsample         [None, 2, 'nearest']
 14             [-1, 4]  1         0  ultralytics.nn.modules.conv.Concat           [1]
 15                  -1  1    148224  ultralytics.nn.modules.block.C2f             [384, 128, 1]
 16                  -1  1    147712  ultralytics.nn.modules.conv.Conv             [128, 128, 3, 2]
 17            [-1, 12]  1         0  ultralytics.nn.modules.conv.Concat           [1]
 18                  -1  1    493056  ultralytics.nn.modules.block.C2f             [384, 256, 1]
 19                  -1  1    590336  ultralytics.nn.modules.conv.Conv             [256, 256, 3, 2]
 20             [-1, 9]  1         0  ultralytics.nn.modules.conv.Concat           [1]
 21                  -1  1   1969152  ultralytics.nn.modules.block.C2f             [768, 512, 1]
 22        [15, 18, 21]  1   2120692  ultralytics.nn.modules.head.Detect           [12, [128, 256, 512]]
Model summary: 225 layers, 11140244 parameters, 11140228 gradients, 28.7 GFLOPs

Transferred 349/355 items from pretrained weights
TensorBoard: Start with 'tensorboard --logdir runs/detect/train', view at http://localhost:6006/
Freezing layer 'model.22.dfl.conv.weight'
AMP: running Automatic Mixed Precision (AMP) checks with YOLOv8n...
AMP: checks passed ✅
train: Scanning /content/train/labels... 63 images, 0 backgrounds, 0 corrupt: 100% 63/63 [00:00<00:00, 1538.30it/s]
train: New cache created: /content/train/labels.cache
albumentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01, blur_limit=(3, 7)), ToGray(p=0.01), CLAHE(p=0.01,
clip_limit=(1, 4.0), tile_grid_size=(8, 8))
val: Scanning /content/valid/labels... 6 images, 0 backgrounds, 0 corrupt: 100% 6/6 [00:00<00:00, 1145.72it/s]
val: New cache created: /content/valid/labels.cache
Plotting labels to runs/detect/train/labels.jpg...
optimizer: 'optimizer=auto' found, ignoring 'lr0=0.01' and 'momentum=0.937' and determining best 'optimizer', 'lr0' a
nd 'momentum' automatically...
optimizer: AdamW(lr=0.000625, momentum=0.9) with parameter groups 57 weight(decay=0.0), 64 weight(decay=0.0005), 63 b
ias(decay=0.0)
Image sizes 416 train, 416 val
```

```
Using 2 dataloader workers
Logging results to runs/detect/train
Starting training for 101 epochs...

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      1/101      1.84G      1.985      4.808      1.384        456        416: 100% 4/4 [00:07<00:00,  1.78s/it]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:04<00:00,  4.0
8s/it]
                   all          6        118      0.036      0.337     0.0408     0.0219

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      2/101      1.86G      1.855      4.483      1.296        343        416: 100% 4/4 [00:00<00:00,  4.29it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  7.0
6it/s]
                   all          6        118     0.0588      0.411     0.0707     0.0419

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      3/101      1.91G      1.708      3.707      1.182        558        416: 100% 4/4 [00:00<00:00,  5.73it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.1
7it/s]
                   all          6        118     0.0881       0.62      0.136      0.083

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      4/101       1.9G      1.582       2.73      1.113        414        416: 100% 4/4 [00:00<00:00,  4.82it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.9
5it/s]
                   all          6        118      0.259      0.436      0.293       0.18

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      5/101      1.91G      1.536       2.18      1.078        499        416: 100% 4/4 [00:01<00:00,  3.71it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  3.5
3it/s]
                   all          6        118      0.221      0.595      0.347      0.216

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      6/101       1.9G      1.491      2.001      1.068        278        416: 100% 4/4 [00:01<00:00,  3.59it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.4
3it/s]
                   all          6        118      0.295      0.743      0.433      0.276

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
```

```
      7/101      1.91G      1.504       1.78      1.046        519        416: 100% 4/4 [00:00<00:00,  5.00it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.6
0it/s]
                   all          6        118      0.366      0.654      0.471      0.303

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      8/101      1.95G      1.468      1.644      1.056        451        416: 100% 4/4 [00:00<00:00,  4.87it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.9
8it/s]
                   all          6        118      0.304      0.759       0.45      0.287

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      9/101      1.89G      1.472        1.5      1.083        340        416: 100% 4/4 [00:01<00:00,  3.86it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  3.8
4it/s]
                   all          6        118      0.278      0.751      0.462       0.28

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     10/101       1.9G      1.391      1.373      1.038        400        416: 100% 4/4 [00:00<00:00,  5.64it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.8
2it/s]
                   all          6        118      0.401      0.676      0.523      0.318

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     11/101      1.95G       1.44      1.367      1.024        496        416: 100% 4/4 [00:00<00:00,  5.24it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.6
2it/s]
                   all          6        118      0.424      0.627      0.585      0.369

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     12/101      1.88G      1.478      1.275      1.071        425        416: 100% 4/4 [00:00<00:00,  4.62it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.5
9it/s]
                   all          6        118      0.486      0.533      0.602      0.373

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     13/101      1.89G        1.4      1.205      1.041        366        416: 100% 4/4 [00:01<00:00,  3.56it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  3.7
4it/s]
                   all          6        118      0.469      0.752      0.664      0.438
```

```
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     14/101       1.9G      1.387      1.145       1.02        496        416: 100% 4/4 [00:01<00:00,  3.45it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.5
0it/s]
                   all          6        118      0.546       0.78      0.697      0.463

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     15/101       1.9G      1.324      1.109      1.033        350        416: 100% 4/4 [00:00<00:00,  4.72it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  9.2
9it/s]
                   all          6        118      0.502      0.803      0.716      0.463

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     16/101      1.93G      1.347       1.06      1.028        367        416: 100% 4/4 [00:00<00:00,  5.06it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.4
2it/s]
                   all          6        118      0.519      0.809      0.705       0.46

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     17/101      1.91G       1.34      1.025      1.033        476        416: 100% 4/4 [00:00<00:00,  5.50it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.9
2it/s]
                   all          6        118      0.519      0.818      0.705      0.457

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     18/101      1.93G      1.405       1.03      1.044        440        416: 100% 4/4 [00:00<00:00,  4.84it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  7.1
6it/s]
                   all          6        118      0.676       0.79      0.751      0.484

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     19/101      1.89G      1.311     0.9627     0.9913        471        416: 100% 4/4 [00:01<00:00,  3.33it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.6
0it/s]
                   all          6        118      0.677       0.78      0.772      0.498

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     20/101      1.87G      1.317     0.9277      1.027        492        416: 100% 4/4 [00:01<00:00,  3.52it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.1
6it/s]
                   all          6        118      0.628      0.777      0.783      0.498
```

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      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     21/101      1.95G      1.356     0.9814       1.01        368        416: 100% 4/4 [00:00<00:00,  5.00it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  7.4
0it/s]
                   all          6        118      0.708      0.851      0.835      0.539

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     22/101      1.88G      1.317     0.9503      1.033        361        416: 100% 4/4 [00:00<00:00,  4.67it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  7.1
5it/s]
                   all          6        118      0.792      0.873       0.87      0.553

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     23/101       1.9G      1.273     0.8684      1.001        340        416: 100% 4/4 [00:01<00:00,  3.25it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.4
1it/s]
                   all          6        118      0.799      0.838      0.886      0.576

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     24/101      1.92G      1.281     0.8037       1.03        318        416: 100% 4/4 [00:00<00:00,  5.37it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.4
7it/s]
                   all          6        118      0.808      0.834      0.886      0.588

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     25/101      1.88G      1.247     0.8384     0.9827        450        416: 100% 4/4 [00:00<00:00,  4.89it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.2
2it/s]
                   all          6        118      0.775      0.871      0.876      0.583

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     26/101       1.9G      1.248      0.816     0.9979        539        416: 100% 4/4 [00:00<00:00,  5.21it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.6
0it/s]
                   all          6        118      0.754      0.926      0.891      0.574

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     27/101      1.87G      1.229     0.7699     0.9757        596        416: 100% 4/4 [00:00<00:00,  4.67it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.5
1it/s]
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                 all          6        118      0.774      0.864      0.871      0.555

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     28/101      1.89G      1.225     0.7594     0.9933        432        416: 100% 4/4 [00:00<00:00,  5.61it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  3.7
2it/s]
                 all          6        118      0.768      0.835      0.887      0.578

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     29/101      1.91G      1.194     0.7404     0.9912        494        416: 100% 4/4 [00:00<00:00,  4.60it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  3.9
4it/s]
                 all          6        118       0.78      0.876      0.906      0.575

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     30/101      1.97G      1.245     0.7598     0.9853        632        416: 100% 4/4 [00:01<00:00,  3.35it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.0
2it/s]
                 all          6        118      0.828       0.88      0.916      0.528

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     31/101      1.99G      1.197     0.7495     0.9728        539        416: 100% 4/4 [00:00<00:00,  4.59it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  8.5
9it/s]
                 all          6        118      0.863      0.789      0.901      0.512

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     32/101      1.92G      1.211     0.7352     0.9909        439        416: 100% 4/4 [00:00<00:00,  5.46it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.2
1it/s]
                 all          6        118      0.858      0.846      0.913      0.536

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     33/101      1.96G      1.176     0.7116     0.9774        456        416: 100% 4/4 [00:00<00:00,  5.99it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  9.0
4it/s]
                 all          6        118      0.866      0.843      0.915      0.549

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     34/101      1.91G      1.195     0.7128      0.973        616        416: 100% 4/4 [00:00<00:00,  4.99it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 15.4
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7it/s]
                 all          6        118      0.859      0.839      0.914      0.527

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     35/101      1.93G      1.176     0.7031     0.9811        411        416: 100% 4/4 [00:00<00:00,  4.89it/s]
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.6
1it/s]
                 all          6        118      0.896      0.853      0.918      0.523

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     36/101      1.94G      1.151     0.6751     0.9569        479        416: 100% 4/4 [00:01<00:00,  3.67it/s]
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.2
6it/s]
                 all          6        118      0.854      0.813      0.894      0.532

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     37/101      1.89G      1.146      0.664     0.9777        396        416: 100% 4/4 [00:01<00:00,  3.60it/s]
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.1
0it/s]
                 all          6        118      0.809      0.784      0.865      0.523

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     38/101      1.91G      1.157     0.6675     0.9528        555        416: 100% 4/4 [00:00<00:00,  5.31it/s]
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.6
9it/s]
                 all          6        118       0.73      0.831       0.86      0.518

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     39/101      1.88G      1.089     0.6261      0.957        418        416: 100% 4/4 [00:00<00:00,  5.49it/s]
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.8
5it/s]
                 all          6        118      0.729       0.86      0.865      0.516

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     40/101      1.89G      1.079     0.6288       0.96        403        416: 100% 4/4 [00:00<00:00,  6.27it/s]
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.4
8it/s]
                 all          6        118      0.805      0.881      0.885      0.542

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     41/101      1.96G      1.104      0.637     0.9554        480        416: 100% 4/4 [00:00<00:00,  6.06it/s]
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                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.1
9it/s]
                   all          6        118      0.802       0.86       0.89      0.549

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     42/101      1.91G      1.064     0.6353      0.928        563        416: 100% 4/4 [00:01<00:00,  3.58it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.2
3it/s]
                   all          6        118      0.799      0.864      0.895      0.524

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     43/101      1.92G        1.1     0.6339     0.9512        414        416: 100% 4/4 [00:00<00:00,  4.55it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.1
5it/s]
                   all          6        118      0.774      0.903      0.901      0.548

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     44/101      1.97G      1.076     0.6078     0.9319        506        416: 100% 4/4 [00:00<00:00,  5.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  7.5
9it/s]
                   all          6        118      0.791      0.875      0.896      0.568

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     45/101      1.86G      1.051     0.6328     0.9487        492        416: 100% 4/4 [00:00<00:00,  5.18it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  8.9
1it/s]
                   all          6        118      0.813      0.866        0.9      0.573

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     46/101      1.91G      1.052     0.5966     0.9376        505        416: 100% 4/4 [00:00<00:00,  5.67it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.0
1it/s]
                   all          6        118      0.815        0.9      0.917      0.578

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     47/101      1.92G      1.067     0.5997     0.9396        496        416: 100% 4/4 [00:00<00:00,  5.73it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  7.0
7it/s]
                   all          6        118      0.854       0.91      0.933       0.59

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
```

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     48/101       1.9G      1.035     0.5946     0.9482        476        416: 100% 4/4 [00:00<00:00,  4.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.6
2it/s]
                   all          6        118      0.858      0.911      0.932      0.591

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     49/101      1.87G      1.009     0.5796     0.9431        424        416: 100% 4/4 [00:00<00:00,  5.58it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.7
5it/s]
                   all          6        118      0.916      0.857      0.939      0.593

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     50/101      1.93G      1.077     0.6266     0.9486        337        416: 100% 4/4 [00:00<00:00,  6.18it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  9.8
5it/s]
                   all          6        118      0.895      0.884      0.942       0.59

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     51/101      1.87G      1.022     0.5871     0.9319        372        416: 100% 4/4 [00:00<00:00,  6.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.4
6it/s]
                   all          6        118      0.901      0.876      0.942      0.558

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     52/101      1.87G      1.019     0.5945     0.9296        392        416: 100% 4/4 [00:00<00:00,  4.68it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.6
1it/s]
                   all          6        118      0.903       0.88      0.941      0.553

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     53/101      1.99G       1.01      0.586     0.9229        412        416: 100% 4/4 [00:00<00:00,  5.11it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  7.1
1it/s]
                   all          6        118      0.899      0.881      0.937      0.567

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     54/101      1.94G     0.9874     0.5738     0.9259        426        416: 100% 4/4 [00:01<00:00,  3.70it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  3.7
5it/s]
                   all          6        118      0.899      0.884      0.929      0.584
```

```
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     55/101      1.87G     0.9768     0.5453     0.9324        364        416: 100% 4/4 [00:01<00:00,  3.97it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.9
4it/s]
                   all          6        118      0.892      0.875       0.92       0.59

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     56/101      1.91G      1.037      0.577     0.9431        451        416: 100% 4/4 [00:00<00:00,  4.98it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.5
4it/s]
                   all          6        118      0.874      0.849      0.896      0.566

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     57/101      1.93G     0.9642     0.5602     0.9122        411        416: 100% 4/4 [00:00<00:00,  4.97it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.9
4it/s]
                   all          6        118      0.866       0.87      0.902      0.521

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     58/101      1.88G     0.9974     0.5693     0.9236        391        416: 100% 4/4 [00:00<00:00,  5.67it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.2
7it/s]
                   all          6        118      0.861      0.869        0.9      0.498

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     59/101      1.89G      1.027     0.5668     0.9329        345        416: 100% 4/4 [00:00<00:00,  4.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.2
6it/s]
                   all          6        118       0.86      0.867      0.899      0.502

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     60/101       1.9G     0.9912     0.5649      0.919        528        416: 100% 4/4 [00:01<00:00,  3.45it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  3.8
7it/s]
                   all          6        118      0.856      0.871      0.899      0.511

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     61/101      1.88G     0.9528     0.5352     0.9217        425        416: 100% 4/4 [00:01<00:00,  3.87it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.1
8it/s]
                   all          6        118      0.866       0.87      0.901      0.545
```

```
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     62/101      1.88G     0.9374     0.5449     0.9194        426        416: 100% 4/4 [00:00<00:00,  5.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.9
7it/s]
                   all          6        118      0.828      0.889      0.893       0.56

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     63/101       1.9G     0.9709     0.5542     0.9084        556        416: 100% 4/4 [00:00<00:00,  6.58it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.2
7it/s]
                   all          6        118      0.866      0.868      0.919       0.57

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     64/101       1.9G     0.9427     0.5301     0.9075        501        416: 100% 4/4 [00:00<00:00,  5.35it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  8.4
0it/s]
                   all          6        118      0.867      0.864       0.92      0.566

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     65/101      1.92G     0.9282     0.5494      0.908        408        416: 100% 4/4 [00:00<00:00,  4.91it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  9.8
9it/s]
                   all          6        118      0.849      0.905      0.916      0.559

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     66/101      1.87G     0.9415     0.5358     0.9189        458        416: 100% 4/4 [00:01<00:00,  3.52it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.0
2it/s]
                   all          6        118      0.836      0.909      0.915      0.569

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     67/101      1.89G     0.9393     0.5293     0.9156        372        416: 100% 4/4 [00:01<00:00,  3.83it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.2
3it/s]
                   all          6        118      0.826       0.91      0.916      0.576

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     68/101      1.93G     0.9167     0.5465     0.9111        388        416: 100% 4/4 [00:00<00:00,  6.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  8.2
9it/s]
```

```
                 all          6        118      0.899      0.827      0.909      0.582

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     69/101      1.93G     0.9049     0.5439     0.8912        417        416: 100% 4/4 [00:00<00:00,  5.93it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  7.5
9it/s]
                 all          6        118      0.909      0.841      0.922      0.578

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     70/101      1.89G     0.8661     0.5192     0.9102        402        416: 100% 4/4 [00:00<00:00,  5.28it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.0
0it/s]
                 all          6        118      0.904      0.835      0.916      0.572

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     71/101      1.94G     0.9245     0.5313     0.8976        517        416: 100% 4/4 [00:00<00:00,  5.21it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.4
8it/s]
                 all          6        118      0.903      0.834      0.918      0.569

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     72/101      1.89G     0.8951     0.5125     0.9033        429        416: 100% 4/4 [00:01<00:00,  3.91it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.9
5it/s]
                 all          6        118        0.9      0.833      0.908       0.56

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     73/101      1.91G     0.9053     0.5195     0.8962        469        416: 100% 4/4 [00:01<00:00,  3.34it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.3
8it/s]
                 all          6        118      0.877       0.85      0.913      0.568

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     74/101      1.93G     0.8894     0.5352     0.9052        369        416: 100% 4/4 [00:00<00:00,  4.98it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.6
0it/s]
                 all          6        118      0.883      0.852      0.913      0.568

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     75/101      1.96G     0.8641     0.5092     0.8922        378        416: 100% 4/4 [00:00<00:00,  4.72it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 14.0
```

```
2it/s]
                 all          6        118      0.888      0.861       0.91      0.562

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     76/101      1.94G     0.8738     0.5085     0.8786        361        416: 100% 4/4 [00:00<00:00,  4.83it/s]
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  7.1
0it/s]
                 all          6        118      0.892      0.853      0.912      0.567

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     77/101      1.88G     0.8477     0.5007     0.8856        661        416: 100% 4/4 [00:00<00:00,  5.58it/s]
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.4
2it/s]
                 all          6        118      0.862      0.881      0.911      0.557

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     78/101      1.88G     0.8538      0.508     0.8999        333        416: 100% 4/4 [00:01<00:00,  3.25it/s]
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  3.2
8it/s]
                 all          6        118      0.919      0.809      0.919      0.547

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     79/101      1.88G     0.8711     0.5164     0.8783        488        416: 100% 4/4 [00:01<00:00,  3.29it/s]
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.8
8it/s]
                 all          6        118      0.891      0.817      0.916      0.549

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     80/101       1.9G      0.863     0.5051     0.8848        507        416: 100% 4/4 [00:00<00:00,  4.63it/s]
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  8.1
7it/s]
                 all          6        118      0.902      0.796      0.915      0.548

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     81/101      1.89G     0.8694     0.5272     0.8941        385        416: 100% 4/4 [00:00<00:00,  5.70it/s]
                Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.2
4it/s]
                 all          6        118      0.918       0.78      0.908      0.544

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     82/101       1.9G     0.8301     0.4965      0.879        543        416: 100% 4/4 [00:00<00:00,  5.06it/s]
```

```
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 12.6
8it/s]
                   all          6        118       0.91      0.781      0.906      0.542

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     83/101       1.9G     0.8144     0.4885     0.8848        414        416: 100% 4/4 [00:00<00:00,  5.48it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.9
0it/s]
                   all          6        118      0.796      0.897      0.899      0.547

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     84/101      1.92G     0.8293     0.4848     0.8917        502        416: 100% 4/4 [00:00<00:00,  4.16it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  3.7
1it/s]
                   all          6        118       0.83      0.877      0.905      0.551

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     85/101      1.88G     0.8429     0.4957     0.8929        475        416: 100% 4/4 [00:01<00:00,  3.69it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.4
4it/s]
                   all          6        118      0.848      0.875      0.907      0.556

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     86/101      1.89G     0.8344     0.4914      0.878        504        416: 100% 4/4 [00:01<00:00,  3.63it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.7
6it/s]
                   all          6        118      0.871      0.881      0.912      0.552

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     87/101      1.91G      0.798     0.4857     0.8852        385        416: 100% 4/4 [00:00<00:00,  5.02it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  7.1
0it/s]
                   all          6        118      0.876      0.847      0.905      0.548

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     88/101      1.89G     0.7939      0.477     0.8692        406        416: 100% 4/4 [00:00<00:00,  4.93it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.4
0it/s]
                   all          6        118      0.883      0.865      0.906      0.555

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
```

```
     89/101      1.96G     0.7975     0.4748     0.8767        402        416: 100% 4/4 [00:00<00:00,  4.62it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  7.3
7it/s]
                   all          6        118      0.883      0.863      0.906      0.563

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     90/101      1.93G     0.7964     0.4805     0.8717        441        416: 100% 4/4 [00:00<00:00,  4.91it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  6.0
6it/s]
                   all          6        118      0.884      0.862      0.911      0.568

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     91/101      1.94G     0.7844     0.4756     0.8704        350        416: 100% 4/4 [00:01<00:00,  3.55it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  3.4
9it/s]
                   all          6        118      0.891      0.843      0.909      0.568
Closing dataloader mosaic
albumentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01, blur_limit=(3, 7)), ToGray(p=0.01), CLAHE(p=0.01,
clip_limit=(1, 4.0), tile_grid_size=(8, 8))

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     92/101      1.95G     0.7509     0.4487     0.8844        351        416: 100% 4/4 [00:03<00:00,  1.18it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:02<00:00,  2.5
9s/it]
                   all          6        118        0.9      0.844      0.912      0.577

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     93/101      1.82G     0.7275     0.4337     0.8703        318        416: 100% 4/4 [00:00<00:00,  5.71it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  7.4
4it/s]
                   all          6        118      0.907      0.847       0.91      0.564

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     94/101      1.83G     0.7189     0.4265     0.8725        255        416: 100% 4/4 [00:00<00:00,  6.48it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.9
8it/s]
                   all          6        118      0.907       0.85      0.909      0.573

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     95/101      1.83G     0.7361     0.4457     0.8618        230        416: 100% 4/4 [00:00<00:00,  4.33it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  3.6
```

```
8it/s]
                   all          6        118       0.87      0.852      0.906      0.572

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     96/101      1.82G     0.7388      0.435     0.8783        267        416: 100% 4/4 [00:00<00:00,  4.26it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  4.0
0it/s]
                   all          6        118      0.872      0.848      0.906      0.569

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     97/101      1.83G     0.7255     0.4482     0.8744        317        416: 100% 4/4 [00:00<00:00,  4.86it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 10.8
6it/s]
                   all          6        118       0.87      0.848      0.899      0.562

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     98/101      1.83G     0.7024     0.4196     0.8596        274        416: 100% 4/4 [00:00<00:00,  5.48it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 10.0
1it/s]
                   all          6        118      0.876      0.854      0.903      0.563

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     99/101      1.83G     0.6968     0.4229     0.8593        321        416: 100% 4/4 [00:00<00:00,  4.76it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 15.4
7it/s]
                   all          6        118      0.872      0.817      0.895      0.556
Stopping training early as no improvement observed in last 50 epochs. Best results observed at epoch 49, best model s
aved as best.pt.
To update EarlyStopping(patience=50) pass a new patience value, i.e. `patience=300` or use `patience=0` to disable Ea
rlyStopping.

99 epochs completed in 0.077 hours.
Optimizer stripped from runs/detect/train/weights/last.pt, 22.5MB
Optimizer stripped from runs/detect/train/weights/best.pt, 22.5MB

Validating runs/detect/train/weights/best.pt...
Ultralytics YOLOv8.0.211 🚀 Python-3.10.12 torch-2.1.0+cu118 CUDA:0 (Tesla T4, 15102MiB)
Model summary (fused): 168 layers, 11130228 parameters, 0 gradients, 28.5 GFLOPs
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.9
3it/s]
                   all          6        118      0.917      0.857      0.939      0.593
```

```
           black-camel          6         10          1      0.675      0.951      0.555
         black-elephant         6          9      0.864      0.889      0.975      0.502
           black-horse          6         10      0.951        0.8      0.926      0.576
            black-king          6          5          1      0.983      0.995      0.647
            black-pawn          6         34       0.97      0.953      0.954      0.578
           black-queen          6          4      0.742      0.726      0.849      0.546
           white-camel          6          8          1      0.838      0.907      0.631
         white-elephant         6          6      0.902          1      0.995       0.65
           white-horse          6          8      0.942      0.875      0.962      0.691
            white-king          6          3          1      0.697      0.995      0.651
            white-pawn          6         18      0.891      0.907       0.93      0.604
           white-queen          6          3      0.737      0.947       0.83      0.489
Speed: 0.1ms preprocess, 4.0ms inference, 0.0ms loss, 3.0ms postprocess per image
Results saved to runs/detect/train
💡 Learn more at https://docs.ultralytics.com/modes/train
```

Prediction on test Images

In [ ]:
```
model = YOLO("/content/runs/detect/train/weights/best.pt")
model.predict(source = "/content/test/images", show=True, save=True, show_labels=True, show_conf=True, conf=0.5, sav
```

```
WARNING ⚠️ Environment does not support cv2.imshow() or PIL Image.show()


image 1/5 /content/test/images/20230315_193509_jpg.rf.6a788bb87d85fc2661fdec5a6f4c0a6b.jpg: 416x416 2 white-camels, 1
white-elephant, 2 white-horses, 1 white-king, 8 white-pawns, 10.5ms
image 2/5 /content/test/images/20230315_194307_jpg.rf.20dcc57ba2dcfdd1ca6c921cd3fc6c14.jpg: 416x416 2 black-camels, 2
black-elephants, 2 black-horses, 1 black-king, 2 black-pawns, 1 black-queen, 1 white-camel, 2 white-elephants, 2 whit
e-horses, 1 white-king, 2 white-pawns, 11.0ms
image 3/5 /content/test/images/20230315_195331_jpg.rf.d4e8d549a869a7b3cf03aa58b18ecb85.jpg: 416x416 1 black-camel, 2
black-elephants, 2 black-horses, 1 white-camel, 2 white-elephants, 2 white-horses, 10.5ms
image 4/5 /content/test/images/20230315_195425_jpg.rf.ade863ff45e600f66303e669849b0ff9.jpg: 416x416 2 black-camels, 2
black-elephants, 2 black-horses, 1 black-queen, 3 white-camels, 1 white-elephant, 2 white-horses, 1 white-king, 10.4m
s
image 5/5 /content/test/images/photo_2023-03-07-12-31-27_jpeg.rf.f0e8a63e3376386e3163dd79d7499054.jpg: 320x416 1 blac
k-camel, 2 black-elephants, 2 black-horses, 1 black-king, 8 black-pawns, 1 black-queen, 2 white-camels, 2 white-eleph
ants, 2 white-horses, 1 white-king, 8 white-pawns, 1 white-queen, 71.1ms
Speed: 4.0ms preprocess, 22.7ms inference, 1.5ms postprocess per image at shape (1, 3, 320, 416)
Results saved to runs/detect/predict2
```

Out[ ]:
```
[ultralytics.engine.results.Results object with attributes:

 boxes: ultralytics.engine.results.Boxes object
 keypoints: None
 masks: None
 names: {0: 'black-camel', 1: 'black-elephant', 2: 'black-horse', 3: 'black-king', 4: 'black-pawn', 5: 'black-queen', 6: 'white-camel', 7: 'white-elephant', 8: 'white-horse', 9: 'white-king', 10: 'white-pawn', 11: 'white-queen'}
 orig_img: array([[[10, 10, 10],
         [10, 10, 10],
         [10, 10, 10],
         ...,
         [21, 19, 19],
         [22, 20, 20],
         [23, 21, 21]],

        [[10, 10, 10],
         [10, 10, 10],
         [10, 10, 10],
         ...,
         [20, 18, 18],
         [20, 18, 18],
         [21, 19, 19]],

        [[10, 10, 10],
         [10, 10, 10],
         [10, 10, 10],
         ...,
         [21, 19, 19],
         [21, 19, 19],
         [21, 19, 19]],

        ...,

        [[35, 29, 22],
         [39, 33, 26],
         [40, 34, 27],
         ...,
         [37, 31, 26],
         [31, 25, 20],
         [22, 16, 11]],
```

```
        [[34, 28, 23],
         [40, 34, 29],
         [41, 35, 30],
         ...,
         [37, 31, 26],
         [34, 28, 23],
         [25, 19, 14]],

        [[31, 25, 20],
         [37, 31, 26],
         [40, 34, 29],
         ...,
         [38, 32, 27],
         [35, 29, 24],
         [27, 21, 16]]], dtype=uint8)
 orig_shape: (640, 640)
 path: '/content/test/images/20230315_193509_jpg.rf.6a788bb87d85fc2661fdec5a6f4c0a6b.jpg'
 probs: None
 save_dir: 'runs/detect/predict2'
 speed: {'preprocess': 14.227151870727539, 'inference': 10.537147521972656, 'postprocess': 1.8682479858398438},
 ultralytics.engine.results.Results object with attributes:

 boxes: ultralytics.engine.results.Boxes object
 keypoints: None
 masks: None
 names: {0: 'black-camel', 1: 'black-elephant', 2: 'black-horse', 3: 'black-king', 4: 'black-pawn', 5: 'black-quee
n', 6: 'white-camel', 7: 'white-elephant', 8: 'white-horse', 9: 'white-king', 10: 'white-pawn', 11: 'white-queen'}
 orig_img: array([[[37, 36, 38],
         [47, 46, 48],
         [48, 47, 49],
         ...,
         [58, 55, 51],
         [61, 58, 54],
         [61, 58, 54]],

        [[53, 52, 54],
         [61, 60, 62],
         [58, 57, 59],
         ...,
         [58, 55, 51],
```

```
         [59, 56, 52],
         [59, 56, 52]],

        [[53, 52, 54],
         [58, 57, 59],
         [53, 52, 54],
         ...,
         [52, 49, 45],
         [51, 48, 44],
         [50, 47, 43]],

        ...,

        [[65, 63, 55],
         [61, 59, 51],
         [57, 55, 47],
         ...,
         [31, 28, 23],
         [21, 18, 13],
         [25, 22, 17]],

        [[52, 50, 42],
         [52, 50, 42],
         [52, 50, 42],
         ...,
         [37, 34, 29],
         [33, 30, 25],
         [28, 25, 20]],

        [[54, 52, 44],
         [54, 52, 44],
         [53, 51, 43],
         ...,
         [41, 38, 33],
         [36, 33, 28],
         [28, 25, 20]]], dtype=uint8)
orig_shape: (640, 640)
path: '/content/test/images/20230315_194307_jpg.rf.20dcc57ba2dcfdd1ca6c921cd3fc6c14.jpg'
probs: None
save_dir: 'runs/detect/predict2'
speed: {'preprocess': 1.9292831420898438, 'inference': 10.974407196044922, 'postprocess': 1.6875267028808594},
```

```
 ultralytics.engine.results.Results object with attributes:

 boxes: ultralytics.engine.results.Boxes object
 keypoints: None
 masks: None
 names: {0: 'black-camel', 1: 'black-elephant', 2: 'black-horse', 3: 'black-king', 4: 'black-pawn', 5: 'black-quee
n', 6: 'white-camel', 7: 'white-elephant', 8: 'white-horse', 9: 'white-king', 10: 'white-pawn', 11: 'white-queen'}
 orig_img: array([[[14, 14, 14],
         [14, 14, 14],
         [14, 14, 14],
         ...,
         [21, 21, 21],
         [21, 21, 21],
         [21, 21, 21]],

        [[14, 14, 14],
         [14, 14, 14],
         [14, 14, 14],
         ...,
         [21, 21, 21],
         [21, 21, 21],
         [21, 21, 21]],

        [[14, 14, 14],
         [14, 14, 14],
         [14, 14, 14],
         ...,
         [21, 21, 21],
         [21, 21, 21],
         [21, 21, 21]],

        ...,

        [[33, 29, 24],
         [33, 29, 24],
         [37, 33, 28],
         ...,
         [30, 24, 13],
         [29, 23, 12],
         [27, 21, 10]],
```

```
        [[46, 42, 37],
         [39, 35, 30],
         [37, 33, 28],
         ...,
         [32, 26, 15],
         [30, 24, 13],
         [28, 22, 11]],

        [[39, 35, 30],
         [30, 26, 21],
         [28, 24, 19],
         ...,
         [33, 27, 16],
         [31, 25, 14],
         [29, 23, 12]]], dtype=uint8)
 orig_shape: (640, 640)
 path: '/content/test/images/20230315_195331_jpg.rf.d4e8d549a869a7b3cf03aa58b18ecb85.jpg'
 probs: None
 save_dir: 'runs/detect/predict2'
 speed: {'preprocess': 1.3680458068847656, 'inference': 10.47658920288086, 'postprocess': 1.2540817260742188},
 ultralytics.engine.results.Results object with attributes:

 boxes: ultralytics.engine.results.Boxes object
 keypoints: None
 masks: None
 names: {0: 'black-camel', 1: 'black-elephant', 2: 'black-horse', 3: 'black-king', 4: 'black-pawn', 5: 'black-quee
n', 6: 'white-camel', 7: 'white-elephant', 8: 'white-horse', 9: 'white-king', 10: 'white-pawn', 11: 'white-queen'}
 orig_img: array([[[25, 25, 25],
         [24, 24, 24],
         [25, 25, 25],
         ...,
         [26, 26, 26],
         [30, 30, 30],
         [33, 33, 33]],

        [[25, 25, 25],
         [25, 25, 25],
         [26, 26, 26],
         ...,
         [27, 27, 27],
         [31, 31, 31],
```

```
         [33, 33, 33]],

        [[25, 25, 25],
         [25, 25, 25],
         [27, 27, 27],
         ...,
         [29, 29, 29],
         [32, 32, 32],
         [33, 33, 33]],

        ...,

        [[40, 37, 32],
         [35, 32, 27],
         [33, 30, 25],
         ...,
         [43, 37, 32],
         [47, 41, 36],
         [49, 43, 38]],

        [[51, 48, 43],
         [44, 41, 36],
         [38, 35, 30],
         ...,
         [49, 43, 38],
         [52, 46, 41],
         [51, 45, 40]],

        [[36, 33, 28],
         [31, 28, 23],
         [27, 24, 19],
         ...,
         [51, 45, 40],
         [52, 46, 41],
         [49, 43, 38]]], dtype=uint8)
orig_shape: (640, 640)
path: '/content/test/images/20230315_195425_jpg.rf.ade863ff45e600f66303e669849b0ff9.jpg'
probs: None
save_dir: 'runs/detect/predict2'
speed: {'preprocess': 1.3494491577148438, 'inference': 10.445117950439453, 'postprocess': 1.233816146850586},
ultralytics.engine.results.Results object with attributes:
```

```
 boxes: ultralytics.engine.results.Boxes object
 keypoints: None
 masks: None
 names: {0: 'black-camel', 1: 'black-elephant', 2: 'black-horse', 3: 'black-king', 4: 'black-pawn', 5: 'black-quee
n', 6: 'white-camel', 7: 'white-elephant', 8: 'white-horse', 9: 'white-king', 10: 'white-pawn', 11: 'white-queen'}
 orig_img: array([[[ 40,  28,  22],
         [ 42,  30,  24],
         [ 45,  33,  29],
         ...,
         [ 87, 158, 192],
         [ 87, 158, 192],
         [ 87, 158, 192]],

        [[ 47,  35,  29],
         [ 49,  37,  31],
         [ 51,  39,  33],
         ...,
         [ 87, 158, 192],
         [ 87, 158, 192],
         [ 87, 158, 192]],

        [[ 59,  46,  38],
         [ 60,  47,  39],
         [ 62,  49,  41],
         ...,
         [ 87, 158, 192],
         [ 87, 158, 192],
         [ 87, 158, 192]],

        ...,

        [[105, 184, 225],
         [105, 184, 225],
         [105, 184, 225],
         ...,
         [ 40,  95, 138],
         [ 41,  96, 139],
         [ 42,  97, 140]],

        [[105, 184, 225],
```

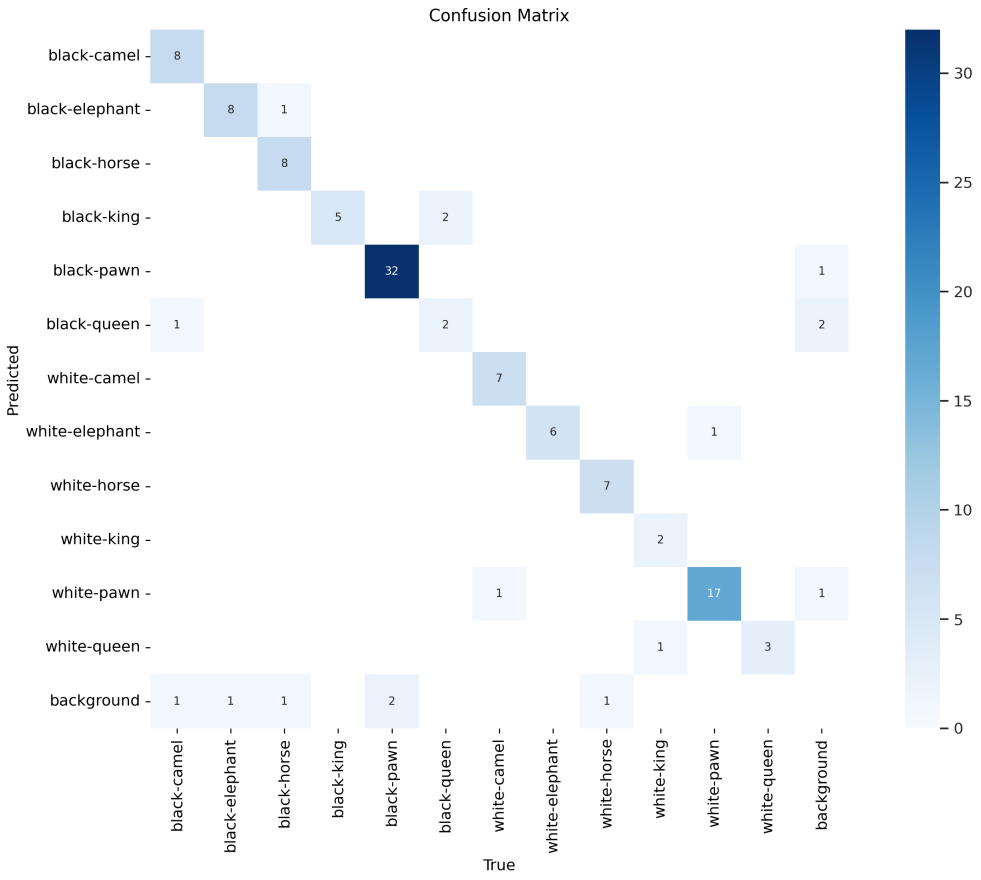
```
         [105, 184, 225],
         [105, 184, 225],
         ...,
         [ 42,  95, 138],
         [ 44,  97, 140],
         [ 45,  98, 141]],

        [[105, 184, 225],
         [105, 184, 225],
         [105, 184, 225],
         ...,
         [ 43,  96, 139],
         [ 44,  97, 140],
         [ 45,  98, 141]]], dtype=uint8)
 orig_shape: (958, 1280)
 path: '/content/test/images/photo_2023-03-07-12-31-27_jpeg.rf.f0e8a63e3376386e3163dd79d7499054.jpg'
 probs: None
 save_dir: 'runs/detect/predict2'
 speed: {'preprocess': 1.2297630310058594, 'inference': 71.10810279846191, 'postprocess': 1.3577938079833984}]
```

In [ ]:

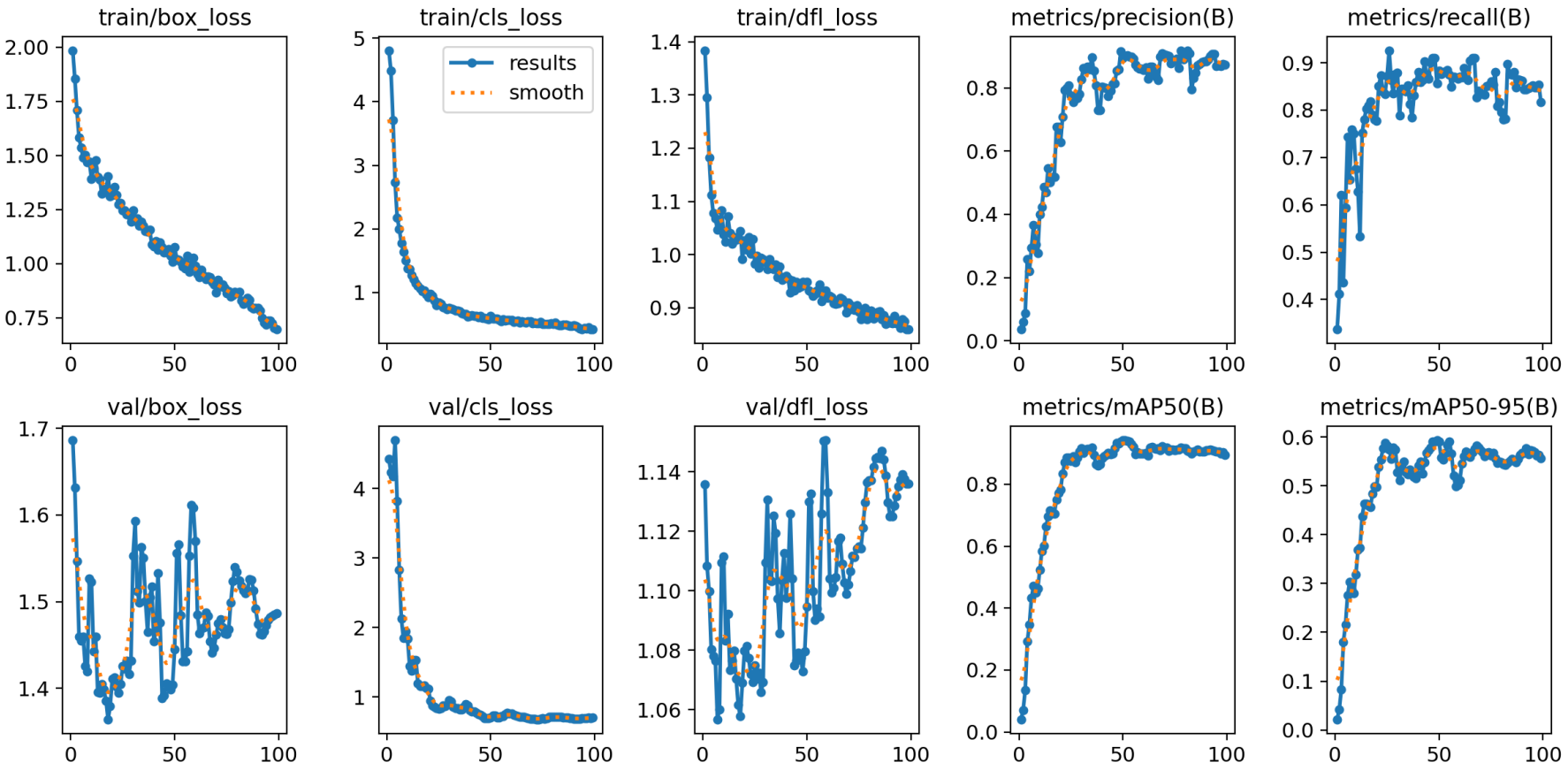
```
# Confusion matrix
from IPython.display import display,Image
Image(filename="/content/runs/detect/train/confusion_matrix.png",width=600)
```

Out[ ]:



In [ ]:
```
Image(filename="/content/runs/detect/train/results.png")
```

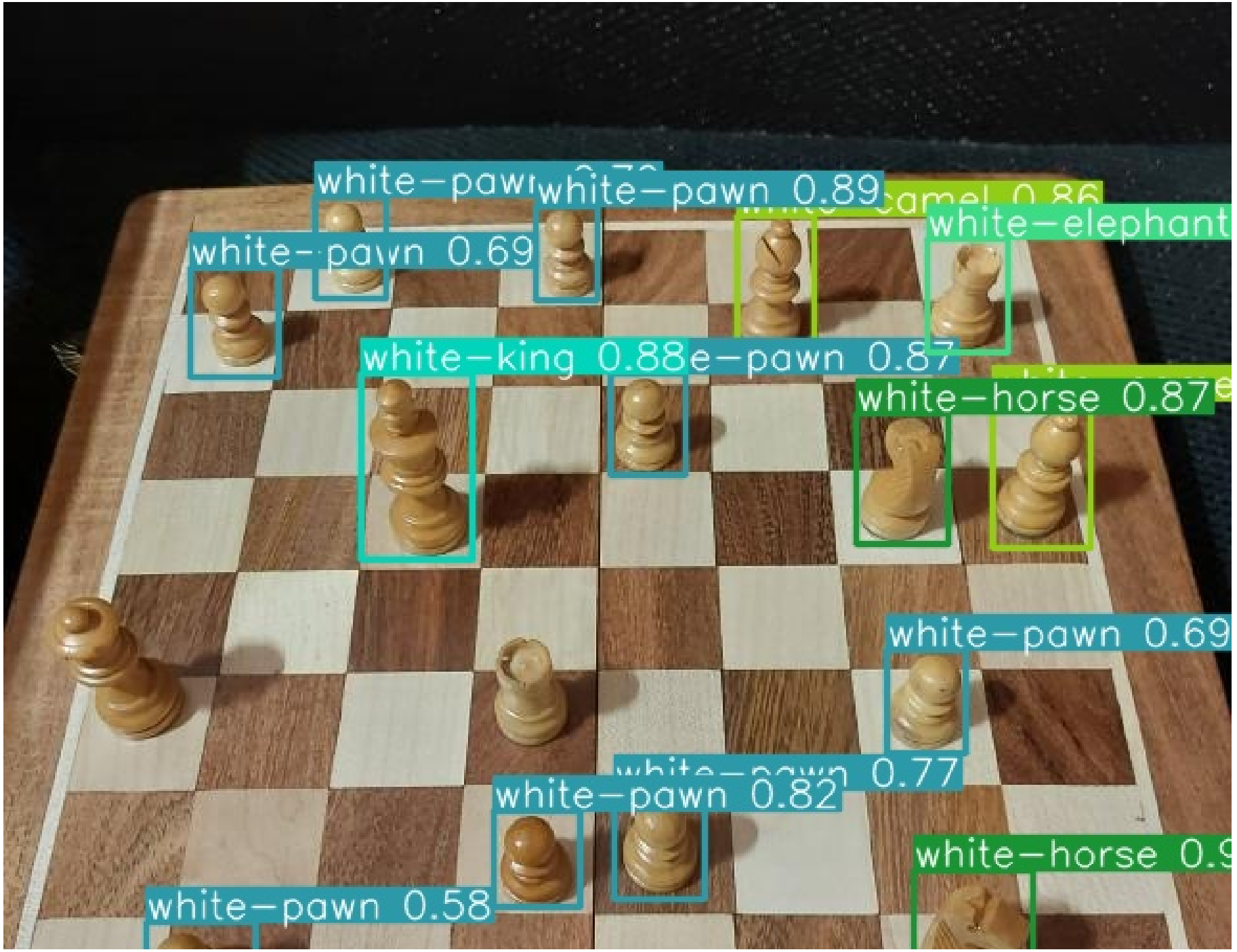
Out[ ]:



Predicted Image 1

In [ ]:
```
Image(filename="/content/runs/detect/predict2/20230315_193509_jpg.rf.6a788bb87d85fc2661fdec5a6f4c0a6b.jpg",width=100
```

Out[ ]:


white-pawn 0.89
white-pawn 0.69
white-elephant
white-king 0.88
e-pawn 0.87
white-horse 0.87
white-pawn 0.69
white-pawn 0.77
white-pawn 0.82
white-horse
white-pawn 0.58

Predicted Image 2

In [ ]:
```
Image(filename="/content/runs/detect/predict2/20230315_194307_jpg.rf.20dcc57ba2dcfdd1ca6c921cd3fc6c14.jpg",width=10(
```

Out[ ]:


white-king 0.58
black-pawn 0.84
black-elephant 0.70
white-horse 0.88
white-elephant
black-king 0.84
black-horse 0.91
white-elephant 0.92
black-pawn 0.84
white-camel 0.86
white-horse 0.96