Imports

[ ] ↳ *1 cellule masquée*

Download the Dataset

[ ] ↳ *3 cellules masquées*

Visualize Ground Truth Images

[ ] ↳ *4 cellules masquées*

Setup DarkNet

```
# Clone darknet repository.
if not os.path.exists('darknet'):
    !git clone https://github.com/AlexeyAB/darknet
```

```
Cloning into 'darknet'...
remote: Enumerating objects: 15833, done.
remote: Total 15833 (delta 0), reused 0 (delta 0), pack-reused 15833
Receiving objects: 100% (15833/15833), 14.35 MiB | 14.28 MiB/s, done.
Resolving deltas: 100% (10670/10670), done.
```

```
%cd darknet
```

```
/content/darknet
```

```
# Edit Makefile to enable OpenCV, CUDA, and cuDNN.
!sed -i 's/OPENCV=0/OPENCV=1/' Makefile
!sed -i 's/GPU=0/GPU=1/' Makefile
!sed -i 's/CUDNN=0/CUDNN=1/' Makefile
!sed -i 's/CUDNN_HALF=0/CUDNN_HALF=1/' Makefile
!sed -i 's/OPENCV=0/OPENCV=1/' Makefile
!sed -i 's/AVX=0/AVX=1/' Makefile
!sed -i 's/OPENMP=0/OPENMP=1/' Makefile
!sed -i 's/LIBSO=0/LIBSO=1/' Makefile
```

```
# Check CUDA version.
!/usr/local/cuda/bin/nvcc --version
```

```
nvcc: NVIDIA (R) Cuda compiler driver
Copyright (c) 2005-2021 NVIDIA Corporation
Built on Fri_Dec_17_18:16:03_PST_2021
Cuda compilation tools, release 11.6, V11.6.55
Build cuda_11.6.r11.6/compiler.30794723_0
```

```
# Build darknet using make command.
!make
```

```
  703 |     float avg_obj = 0;
      |           ^~~~~~~
./src/yolo_layer.c:702:11: warning: unused variable ‘avg_cat’ [-Wunused-variable]
  702 |     float avg_cat = 0;
      |           ^~~~~~~
./src/yolo_layer.c:701:11: warning: unused variable ‘recall75’ [-Wunused-variable]
  701 |     float recall75 = 0;
      |           ^~~~~~~~
./src/yolo_layer.c:700:11: warning: unused variable ‘recall’ [-Wunused-variable]
  700 |     float recall = 0;
      |           ^~~~~~
./src/yolo_layer.c:699:11: warning: unused variable ‘tot_ciou_loss’ [-Wunused-variable]
  699 |     float tot_ciou_loss = 0;
      |           ^~~~~~~~~~~~~
./src/yolo_layer.c:698:11: warning: unused variable ‘tot_diou_loss’ [-Wunused-variable]
  698 |     float tot_diou_loss = 0;
      |           ^~~~~~~~~~~~~
./src/yolo_layer.c:695:11: warning: unused variable ‘tot_ciou’ [-Wunused-variable]
  695 |     float tot_ciou = 0;
      |           ^~~~~~~~
./src/yolo_layer.c:694:11: warning: unused variable ‘tot_diou’ [-Wunused-variable]
  694 |     float tot_diou = 0;
      |           ^~~~~~~~
./src/yolo_layer.c:693:11: warning: unused variable ‘tot_giou’ [-Wunused-variable]
  693 |     float tot_giou = 0;
      |           ^~~~~~~~
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast -c ./src
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast -c ./src
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast -c ./src
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast -c ./src
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast -c ./src
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast -c ./src
g++ -std=c++11 -std=c++11 -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rd
```

Download the Pretrained Weights

[ ] ↳ *2 cellules masquées*

Prepare Text Files for Image Paths

[ ] ↳ *2 cellules masquées*

```
# Ce texte est au format code
```

Prepare the CFG Files

[ ] ↳ *4 cellules masquées*

Data Preparation

```
%%writefile build/darknet/x64/data/pothole.names
pothole
```

```
Writing build/darknet/x64/data/pothole.names
```

```
%%writefile build/darknet/x64/data/pothole_yolov4.data
classes = 1
train  = train.txt
valid  = valid.txt
names = build/darknet/x64/data/pothole.names
backup = backup_yolov4
```

```
Writing build/darknet/x64/data/pothole_yolov4.data
```

```
%%writefile build/darknet/x64/data/pothole_yolov4_tiny.data
classes = 1
train  = train.txt
valid  = valid.txt
names = build/darknet/x64/data/pothole.names
backup = backup_yolov4_tiny
```

```
Writing build/darknet/x64/data/pothole_yolov4_tiny.data
```

```
%%writefile build/darknet/x64/data/pothole_yolov4_tiny_multi_res.data
classes = 1
train  = train.txt
valid  = valid.txt
names = build/darknet/x64/data/pothole.names
backup = backup_yolov4_tiny_multi_res
```

```
     Writing build/darknet/x64/data/pothole_yolov4_tiny_multi_res.data
```

```
%%writefile build/darknet/x64/data/pothole_yolov4_fixed.data
classes = 1
train  = train.txt
valid  = valid.txt
names = build/darknet/x64/data/pothole.names
backup = backup_yolov4_fixed
```

```
     Writing build/darknet/x64/data/pothole_yolov4_fixed.data
```

```
%%writefile build/darknet/x64/data/pothole_test.data
classes = 1
train  = train.txt
valid  = test.txt
names = build/darknet/x64/data/pothole.names
backup = backup_test/
```

```
     Writing build/darknet/x64/data/pothole_test.data
```

Train YOLOv4

```
models = ['YOLOv4', 'YOLOv4-Tiny', 'YOLOv4-Tiny-Multi-Res', 'YOLOv4-Fixed']
model_to_train = models[1] # models[0] or models[1] or models[2] or models[3]
print(model_to_train)
```

```
     YOLOv4-Tiny
```

```
import os
if model_to_train == 'YOLOv4-Tiny':
    os.makedirs('backup_yolov4_tiny', exist_ok=True)
    print('Backup directory created for YOLOv4-Tiny')

if model_to_train == 'YOLOv4-Tiny-Multi-Res':
    os.makedirs('backup_yolov4_tiny_multi_res', exist_ok=True)
    print('Backup directory created for YOLOv4-Tiny-Multi-Res')

if model_to_train == 'YOLOv4':
    os.makedirs('backup_yolov4', exist_ok=True)
    print('Backup directory created for YOLOv4')

if model_to_train == 'YOLOv4-Fixed':
    os.makedirs('backup_yolov4_fixed', exist_ok=True)
    print('Backup directory created for YOLOv4-Fixed')
```

```
     Backup directory created for YOLOv4-Tiny
```

```
if model_to_train == 'YOLOv4-Tiny':
    print('Training YOLOv4-Tiny model...')
    !./darknet detector train build/darknet/x64/data/pothole_yolov4_tiny.data cfg/yolov4-tiny-pothole.cfg yolov4-tiny.conv.29 -dont_show
    !./darknet detector map build/darknet/x64/data/pothole_test.data cfg/yolov4-tiny-pothole.cfg backup_yolov4_tiny/yolov4-tiny-pothole_f
    !./darknet detector map build/darknet/x64/data/pothole_test.data cfg/yolov4-tiny-pothole.cfg backup_yolov4_tiny/yolov4-tiny-pothole_f

if model_to_train == 'YOLOv4-Tiny-Multi-Res':
    print('Training YOLOv4-Tiny-Multi-Res model...')
    !./darknet detector train build/darknet/x64/data/pothole_yolov4_tiny_multi_res.data cfg/yolov4-tiny-multi-res-pothole.cfg yolov4-tiny
    !./darknet detector map build/darknet/x64/data/pothole_test.data cfg/yolov4-tiny-multi-res-pothole.cfg backup_yolov4_tiny_multi_res/y
    !./darknet detector map build/darknet/x64/data/pothole_test.data cfg/yolov4-tiny-multi-res-pothole.cfg backup_yolov4_tiny_multi_res/y

if model_to_train == 'YOLOv4':
    print('Training YOLOv4 model...')
    !./darknet detector train build/darknet/x64/data/pothole_yolov4.data cfg/yolov4-pothole.cfg yolov4.conv.137 -dont_show
    !./darknet detector map build/darknet/x64/data/pothole_test.data cfg/yolov4-pothole.cfg backup_yolov4/yolov4-pothole_final.weights
    !./darknet detector map build/darknet/x64/data/pothole_test.data cfg/yolov4-pothole.cfg backup_yolov4/yolov4-pothole_final.weights -i

if model_to_train == 'YOLOv4-Fixed':
    print('Training YOLOv4-Fixed model...')
    !./darknet detector train build/darknet/x64/data/pothole_yolov4_fixed.data cfg/yolov4-fixed-pothole.cfg yolov4.conv.137 -dont_show
    !./darknet detector map build/darknet/x64/data/pothole_test.data cfg/yolov4-fixed-pothole.cfg backup_yolov4_fixed/yolov4-fixed-pothol
    !./darknet detector map build/darknet/x64/data/pothole_test.data cfg/yolov4-fixed-pothole.cfg backup_yolov4_fixed/yolov4-fixed-pothol
```

```
  23 conv    256       1 x 1/ 1     26 x  26 x 256 ->   26 x  26 x 256 0.089 BF
  24 route  18 23                                ->   26 x  26 x 512
  25 max                2x 2/ 2     26 x  26 x 512 ->   13 x  13 x 512 0.000 BF
  26 conv    512       3 x 3/ 1     13 x  13 x 512 ->   13 x  13 x 512 0.797 BF
  27 conv    256       1 x 1/ 1     13 x  13 x 512 ->   13 x  13 x 256 0.044 BF
  28 conv    512       3 x 3/ 1     13 x  13 x 256 ->   13 x  13 x 512 0.399 BF
  29 conv     18       1 x 1/ 1     13 x  13 x 512 ->   13 x  13 x  18 0.003 BF
  30 yolo
[yolo] params: iou loss: ciou (4), iou_norm: 0.07, obj_norm: 1.00, cls_norm: 1.00, delta_norm: 1.00, scale_x_y: 1.05
nms_kind: greedynms (1), beta = 0.600000
  31 route  27                                   ->   13 x  13 x 256
  32 conv    128       1 x 1/ 1     13 x  13 x 256 ->   13 x  13 x 128 0.011 BF
  33 upsample                 2x    13 x  13 x 128 ->   26 x  26 x 128
  34 route  33 23                                ->   26 x  26 x 384
  35 conv    256       3 x 3/ 1     26 x  26 x 384 ->   26 x  26 x 256 1.196 BF
  36 conv     18       1 x 1/ 1     26 x  26 x 256 ->   26 x  26 x  18 0.006 BF
  37 yolo
[yolo] params: iou loss: ciou (4), iou_norm: 0.07, obj_norm: 1.00, cls_norm: 1.00, delta_norm: 1.00, scale_x_y: 1.05
nms_kind: greedynms (1), beta = 0.600000
Total BFLOPS 6.787
avg_outputs = 299663
Loading weights from yolov4-tiny.conv.29...
 seen 64, trained: 0 K-images (0 Kilo-batches_64)
Done! Loaded 29 layers from weights-file
saveweights: Using default '1000'
savelast: Using default '100'
Weights are saved after: 1000 iterations. Last weights (*_last.weight) are stored every 100 iterations.
Learning Rate: 0.00261, Momentum: 0.9, Decay: 0.0005
 Detection layer: 30 - type = 28
 Detection layer: 37 - type = 28
 Create 64 permanent cpu-threads
Loaded: 14.551797 seconds
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 30 Avg (IOU: 0.294593), count: 14, class_loss = 146.719833, iou
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 37 Avg (IOU: 0.319026), count: 29, class_loss = 503.247864, iou
 total_bbox = 43, rewritten_bbox = 0.000000 %
H1/8000: loss=325.0 hours left=-1.0
 1: 324.985352, 324.985352 avg loss, 0.000000 rate, 168.927704 seconds, 32 images, -1.000000 hours left
Loaded: 0.000092 seconds
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 30 Avg (IOU: 0.298112), count: 11, class_loss = 146.786728, iou
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 37 Avg (IOU: 0.341301), count: 24, class_loss = 502.834045, iou
 total_bbox = 78, rewritten_bbox = 0.000000 %
H2/8000: loss=324.8 hours left=407.7
 2: 324.811890, 324.968018 avg loss, 0.000000 rate, 170.071321 seconds, 64 images, 407.681356 hours left
Loaded: 0.000099 seconds
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 30 Avg (IOU: 0.288366), count: 17, class_loss = 147.335526, iou
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 37 Avg (IOU: 0.306763), count: 35, class_loss = 503.331573, iou
 total_bbox = 130, rewritten_bbox = 0.000000 %
H3/8000: loss=325.3 hours left=407.4
 3: 325.335083, 325.004730 avg loss, 0.000000 rate, 161.461590 seconds, 96 images, 407.382965 hours left
Loaded: 0.000080 seconds
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 30 Avg (IOU: 0.253817), count: 15, class_loss = 147.197327, iou
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 37 Avg (IOU: 0.310909), count: 35, class_loss = 502.838165, iou
 total_bbox = 180, rewritten_bbox = 0.000000 %
H4/8000: loss=325.0 hours left=406.9
 4: 325.019318, 325.006195 avg loss, 0.000000 rate, 156.639240 seconds, 128 images, 406.895827 hours left
Loaded: 0.000086 seconds
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 30 Avg (IOU: 0.296184), count: 14, class_loss = 147.097351, iou
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 37 Avg (IOU: 0.331063), count: 22, class_loss = 502.699921, iou
```

In case you are running this on a cloud Jupyter environment, zipping the backup folder will make it much easier to download them.

```
if model_to_train == 'YOLOv4-Tiny':
    !zip -r /content/darknet/backup_yolov4_tiny backup_yolov4_tiny

if model_to_train == 'YOLOv4-Tiny-Multi-Res':
    !zip -r /content/darknet/backup_yolov4_tiny_multi_res backup_yolov4_tiny_multi_res

if model_to_train == 'YOLOv4':
    !zip -r /content/darknet/backup_yolov4 backup_yolov4

if model_to_train == 'YOLOv4-Fixed':
    !zip -r /content/darknet/backup_yolov4_fixed backup_yolov4_fixed
```

```
  adding: backup_yolov4/ (stored 0%)
  adding: backup_yolov4/yolov4-pothole_last.weights (deflated 8%)
```