

Problem 4 - SSD, ONNX model, Visualization, Inferencing 25 points

In this problem we will be inferencing SSD ONNX model using ONNX Runtime Server. You will follow the github repo and ONNX tutorials (links provided below). You will start with a pretrained Pytorch SSD model and retrain it for your target categories. Then you will convert this Pytorch model to ONNX and deploy it on ONNX runtime server for inferencing.

For part 1, 2, and 3, refer to the steps in the github repo. For part 4 and 5 refer to ONNX tutorial on inferencing and the lab. References

- Github repo. Shot MultiBox Detector Implementation in Pytorch. Available at <https://github.com/qfgaohao/pytorch-ssd>
- ONNX tutorial. Inferencing SSD ONNX model using ONNX Runtime Server. Available at <https://github.com/onnx/tutorials/blob/master/tutorials/OnnxRuntimeServerSSDModel.ipynb>
- Google. Open Images Dataset V5 + Extensions. Available at <https://storage.googleapis.com/openimages/web/index.html>
- The PASCAL Visual Object Classes Challenge 2007. Available at <http://host.robots.ox.ac.uk/pascal/VOC/voc2007/>

1. Download pretrained pytorch MobilenetV1 SSD and test it locally using Pascal VOC 2007 dataset. Show the test accuracy for the 20 classes. (4)

```
In [ ]: !git clone https://github.com/qfgaohao/pytorch-ssd

fatal: destination path 'pytorch-ssd' already exists and is not an empty directory.

In [ ]: !pip install onnx
! pip install onnxruntime
!pip install netron

Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting onnx
  Downloading onnx-1.13.0-cp38-cp38-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (13.5 MB)
    |████████████████████████████████████████| 13.5 MB 5.2 MB/s
Collecting protobuf<4,>=3.20.2
  Downloading protobuf-3.20.3-cp38-cp38-manylinux_2_5_x86_64.manylinux1_x86_64.whl (1.0 MB)
    |████████████████████████████████████████| 1.0 MB 37.5 MB/s
Requirement already satisfied: numpy>=1.16.6 in /usr/local/lib/python3.8/dist-packages (from onnx) (1.21.6)
Requirement already satisfied: typing-extensions>=3.6.2.1 in /usr/local/lib/python3.8/dist-packages (from onnx) (4.4.0)
Installing collected packages: protobuf, onnx
  Attempting uninstall: protobuf
    Found existing installation: protobuf 3.19.6
    Uninstalling protobuf-3.19.6:
      Successfully uninstalled protobuf-3.19.6
ERROR: pip's dependency resolver does not currently take into account all the packages that are installed. This behaviour is the source of the following dependency conflicts.
```



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ERROR: pip's dependency resolver does not currently take into account all the
packages that are installed. This behaviour is the source of the following dep
endency conflicts.
requests 2.23.0 requires urllib3!=1.25.0,!1.25.1,<1.26,>=1.21.1, but you have
urllib3 1.26.13 which is incompatible.
Successfully installed boto3-1.26.27 botocore-1.29.27 jmespath-1.0.1 s3transfe
r-0.6.0 urllib3-1.26.13
```

```
In [ ]: %cd pytorch-ssd
```

```
/content/pytorch-ssd
```

```
In [ ]: !wget -P models https://storage.googleapis.com/models-hao/voc-model-labels.tx
```

```
--2022-12-12 18:46:09-- https://storage.googleapis.com/models-hao/voc-model-l
abels.txt
Resolving storage.googleapis.com (storage.googleapis.com)... 172.217.203.128,
142.251.107.128, 74.125.196.128, ...
Connecting to storage.googleapis.com (storage.googleapis.com)|172.217.203.128
|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 145 [text/plain]
Saving to: 'models/voc-model-labels.txt.1'
```

```
voc-model-labels.tx 100%[=====>] 145 --.-KB/s in 0s
```

```
2022-12-12 18:46:09 (13.7 MB/s) - 'models/voc-model-labels.txt.1' saved [145/1
45]
```

```
In [ ]: !wget -P data http://host.robots.ox.ac.uk/pascal/VOC/voc2007/VOCtest_06-Nov-2
```

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--2022-12-12 18:46:12-- http://host.robots.ox.ac.uk/pascal/VOC/voc2007/VOCtes
t_06-Nov-2007.tar
Resolving host.robots.ox.ac.uk (host.robots.ox.ac.uk)... 129.67.94.152
Connecting to host.robots.ox.ac.uk (host.robots.ox.ac.uk)|129.67.94.152|:80...
connected.
HTTP request sent, awaiting response... 200 OK
Length: 451020800 (430M) [application/x-tar]
Saving to: 'data/VOCtest_06-Nov-2007.tar.1'
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VOCtest_06-Nov-2007 100%[=====>] 430.13M 30.9MB/s in 22s
```

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2022-12-12 18:46:35 (19.1 MB/s) - 'data/VOCtest_06-Nov-2007.tar.1' saved [4510
20800/451020800]
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In [ ]: !tar -xvf data/VOCtest_06-Nov-2007.tar -C data/
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Streaming output truncated to the last 5000 lines.

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 VOCdevkit/VOC2007/SegmentationObject/009899.png
 VOCdevkit/VOC2007/SegmentationObject/009901.png

```
In [ ]: !wget -P models https://storage.googleapis.com/models-hao/mobilenet-v1-ssd-mp-
--2022-12-12 18:48:46-- https://storage.googleapis.com/models-hao/mobilenet-v1-ssd-mp-0_675.pth
Resolving storage.googleapis.com (storage.googleapis.com)... 108.177.11.128, 108.177.12.128, 108.177.13.128, ...
Connecting to storage.googleapis.com (storage.googleapis.com)|108.177.11.128|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 37995286 (36M) [application/octet-stream]
Saving to: 'models/mobilenet-v1-ssd-mp-0_675.pth.1'

mobilenet-v1-ssd-mp 100%[=====>] 36.23M 122MB/s in 0.3s

2022-12-12 18:48:46 (122 MB/s) - 'models/mobilenet-v1-ssd-mp-0_675.pth.1' saved [37995286/37995286]
```

```
In [ ]: #Question 1 20 classes precision scores
!python eval_ssd.py --net mbl-ssd --dataset_type voc --dataset data/VOCdevkit
```

Streaming output truncated to the last 5000 lines.

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 Inference time: 0.10335755348205566
 Prediction: 0.107654 seconds.
 process image 3709
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process image 3885
Load Image: 0.004616 seconds.
Inference time: 0.10492682456970215
Prediction: 0.125078 seconds.
process image 3886
Load Image: 0.003917 seconds.
Inference time: 0.10555148124694824
Prediction: 0.133660 seconds.
process image 3887
Load Image: 0.004042 seconds.
Inference time: 0.10125136375427246
Prediction: 0.113917 seconds.
process image 3888
Load Image: 0.003834 seconds.
Inference time: 0.10975527763366699
Prediction: 0.126319 seconds.

process image 3889
Load Image: 0.004306 seconds.
Inference time: 0.1014094352722168
Prediction: 0.117610 seconds.
process image 3890
Load Image: 0.006778 seconds.
Inference time: 0.10641193389892578
Prediction: 0.129811 seconds.
process image 3891
Load Image: 0.005108 seconds.
Inference time: 0.10302400588989258
Prediction: 0.118206 seconds.
process image 3892
Load Image: 0.004363 seconds.
Inference time: 0.1028435230255127
Prediction: 0.119006 seconds.
process image 3893
Load Image: 0.003372 seconds.
Inference time: 0.11692953109741211
Prediction: 0.158036 seconds.
process image 3894
Load Image: 0.003582 seconds.
Inference time: 0.10301828384399414
Prediction: 0.118929 seconds.
process image 3895
Load Image: 0.004156 seconds.
Inference time: 0.10615181922912598
Prediction: 0.118048 seconds.
process image 3896
Load Image: 0.004127 seconds.
Inference time: 0.09970664978027344
Prediction: 0.115073 seconds.
process image 3897
Load Image: 0.004231 seconds.
Inference time: 0.10772013664245605
Prediction: 0.157002 seconds.
process image 3898
Load Image: 0.003757 seconds.
Inference time: 0.11630511283874512
Prediction: 0.123462 seconds.
process image 3899
Load Image: 0.003294 seconds.
Inference time: 0.10520410537719727
Prediction: 0.122664 seconds.
process image 3900
Load Image: 0.004563 seconds.
Inference time: 0.0990450382232666
Prediction: 0.130517 seconds.
process image 3901
Load Image: 0.004343 seconds.
Inference time: 0.11606502532958984
Prediction: 0.141453 seconds.
process image 3902
Load Image: 0.004577 seconds.
Inference time: 0.10033392906188965
Prediction: 0.107841 seconds.
process image 3903
Load Image: 0.003925 seconds.
Inference time: 0.1040499210357666
Prediction: 0.130462 seconds.
process image 3904
Load Image: 0.005923 seconds.
Inference time: 0.1030426025390625
Prediction: 0.124125 seconds.
process image 3905
Load Image: 0.004461 seconds.
Inference time: 0.10148978233337402
Prediction: 0.118600 seconds.
process image 3906

Load Image: 0.004847 seconds.
Inference time: 0.1125035285949707
Prediction: 0.117327 seconds.
process image 3907
Load Image: 0.004089 seconds.
Inference time: 0.10156011581420898
Prediction: 0.118098 seconds.
process image 3908
Load Image: 0.004144 seconds.
Inference time: 0.10691523551940918
Prediction: 0.113181 seconds.
process image 3909
Load Image: 0.003987 seconds.
Inference time: 0.10148477554321289
Prediction: 0.132412 seconds.
process image 3910
Load Image: 0.004208 seconds.
Inference time: 0.1001274585723877
Prediction: 0.125616 seconds.
process image 3911
Load Image: 0.003770 seconds.
Inference time: 0.10210752487182617
Prediction: 0.125128 seconds.
process image 3912
Load Image: 0.003823 seconds.
Inference time: 0.1031947135925293
Prediction: 0.116580 seconds.
process image 3913
Load Image: 0.003525 seconds.
Inference time: 0.11147856712341309
Prediction: 0.126178 seconds.
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Load Image: 0.004535 seconds.
Inference time: 0.10614132881164551
Prediction: 0.121963 seconds.
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Load Image: 0.005226 seconds.
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Prediction: 0.117959 seconds.
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Prediction: 0.107472 seconds.
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Prediction: 0.119535 seconds.
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Prediction: 0.124087 seconds.
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Load Image: 0.003804 seconds.
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Prediction: 0.113681 seconds.
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Load Image: 0.004301 seconds.
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Prediction: 0.146080 seconds.
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Load Image: 0.004453 seconds.
Inference time: 0.0983734130859375
Prediction: 0.115895 seconds.
process image 3922
Load Image: 0.003562 seconds.
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process image 3923
Load Image: 0.004183 seconds.

Inference time: 0.09881091117858887
Prediction: 0.129203 seconds.
process image 3924
Load Image: 0.004408 seconds.
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Prediction: 0.146835 seconds.
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Load Image: 0.003660 seconds.
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process image 3955
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Prediction: 0.114995 seconds.
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Prediction: 0.114961 seconds.
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process image 3975

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Load Image: 0.004184 seconds.
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Load Image: 0.004176 seconds.

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process image 4044

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Inference time: 0.098602294921875
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Inference time: 0.09333491325378418
Prediction: 0.113992 seconds.
process image 4053
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Inference time: 0.10028958320617676
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process image 4054
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process image 4057
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Inference time: 0.09920549392700195
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process image 4058
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Load Image: 0.002941 seconds.

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process image 4070
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Inference time: 0.09493517875671387
Prediction: 0.123507 seconds.
process image 4071
Load Image: 0.003957 seconds.
Inference time: 0.10262012481689453
Prediction: 0.139177 seconds.
process image 4072
Load Image: 0.003895 seconds.
Inference time: 0.09971261024475098
Prediction: 0.124392 seconds.
process image 4073
Load Image: 0.004221 seconds.
Inference time: 0.0957036018371582
Prediction: 0.114720 seconds.
process image 4074
Load Image: 0.001841 seconds.
Inference time: 0.10383081436157227
Prediction: 0.116649 seconds.
process image 4075
Load Image: 0.004667 seconds.
Inference time: 0.09297394752502441
Prediction: 0.108429 seconds.
process image 4076
Load Image: 0.004926 seconds.
Inference time: 0.09987568855285645
Prediction: 0.111919 seconds.
process image 4077
Load Image: 0.004069 seconds.
Inference time: 0.09389686584472656
Prediction: 0.123347 seconds.
process image 4078
Load Image: 0.004664 seconds.
Inference time: 0.09779572486877441

Prediction: 0.129931 seconds.
process image 4079
Load Image: 0.004569 seconds.
Inference time: 0.10005760192871094
Prediction: 0.111449 seconds.
process image 4080
Load Image: 0.006837 seconds.
Inference time: 0.10087108612060547
Prediction: 0.120959 seconds.
process image 4081
Load Image: 0.004323 seconds.
Inference time: 0.10061240196228027
Prediction: 0.141726 seconds.
process image 4082
Load Image: 0.004352 seconds.
Inference time: 0.09449410438537598
Prediction: 0.117218 seconds.
process image 4083
Load Image: 0.004449 seconds.
Inference time: 0.09939217567443848
Prediction: 0.121891 seconds.
process image 4084
Load Image: 0.003834 seconds.
Inference time: 0.09557580947875977
Prediction: 0.119754 seconds.
process image 4085
Load Image: 0.002760 seconds.
Inference time: 0.09471368789672852
Prediction: 0.101412 seconds.
process image 4086
Load Image: 0.004677 seconds.
Inference time: 0.10217666625976562
Prediction: 0.123234 seconds.
process image 4087
Load Image: 0.005656 seconds.
Inference time: 0.09388518333435059
Prediction: 0.125962 seconds.
process image 4088
Load Image: 0.004372 seconds.
Inference time: 0.1053621768951416
Prediction: 0.130758 seconds.
process image 4089
Load Image: 0.004639 seconds.
Inference time: 0.09314990043640137
Prediction: 0.122759 seconds.
process image 4090
Load Image: 0.002516 seconds.
Inference time: 0.09821748733520508
Prediction: 0.124340 seconds.
process image 4091
Load Image: 0.003865 seconds.
Inference time: 0.10148334503173828
Prediction: 0.134479 seconds.
process image 4092
Load Image: 0.004015 seconds.
Inference time: 0.1065518856048584
Prediction: 0.135789 seconds.
process image 4093
Load Image: 0.004301 seconds.
Inference time: 0.10366296768188477
Prediction: 0.136774 seconds.
process image 4094
Load Image: 0.004468 seconds.
Inference time: 0.0999298095703125
Prediction: 0.126314 seconds.
process image 4095
Load Image: 0.003660 seconds.
Inference time: 0.10764956474304199
Prediction: 0.114070 seconds.

process image 4096
Load Image: 0.004560 seconds.
Inference time: 0.09439826011657715
Prediction: 0.122297 seconds.
process image 4097
Load Image: 0.003180 seconds.
Inference time: 0.09849333763122559
Prediction: 0.131969 seconds.
process image 4098
Load Image: 0.003685 seconds.
Inference time: 0.0940392017364502
Prediction: 0.122403 seconds.
process image 4099
Load Image: 0.003456 seconds.
Inference time: 0.09367227554321289
Prediction: 0.116709 seconds.
process image 4100
Load Image: 0.004665 seconds.
Inference time: 0.10185432434082031
Prediction: 0.119688 seconds.
process image 4101
Load Image: 0.004832 seconds.
Inference time: 0.09424090385437012
Prediction: 0.114418 seconds.
process image 4102
Load Image: 0.002550 seconds.
Inference time: 0.09824395179748535
Prediction: 0.132071 seconds.
process image 4103
Load Image: 0.004736 seconds.
Inference time: 0.09276151657104492
Prediction: 0.121986 seconds.
process image 4104
Load Image: 0.004157 seconds.
Inference time: 0.09306526184082031
Prediction: 0.117633 seconds.
process image 4105
Load Image: 0.004139 seconds.
Inference time: 0.1028146743774414
Prediction: 0.118270 seconds.
process image 4106
Load Image: 0.004227 seconds.
Inference time: 0.09392023086547852
Prediction: 0.127327 seconds.
process image 4107
Load Image: 0.004522 seconds.
Inference time: 0.09960079193115234
Prediction: 0.126695 seconds.
process image 4108
Load Image: 0.005902 seconds.
Inference time: 0.09692645072937012
Prediction: 0.117798 seconds.
process image 4109
Load Image: 0.003575 seconds.
Inference time: 0.0977168083190918
Prediction: 0.143516 seconds.
process image 4110
Load Image: 0.003987 seconds.
Inference time: 0.09792590141296387
Prediction: 0.109608 seconds.
process image 4111
Load Image: 0.004102 seconds.
Inference time: 0.09339666366577148
Prediction: 0.117867 seconds.
process image 4112
Load Image: 0.004426 seconds.
Inference time: 0.09904599189758301
Prediction: 0.120596 seconds.
process image 4113

Load Image: 0.002921 seconds.
Inference time: 0.09249472618103027
Prediction: 0.124484 seconds.
process image 4114
Load Image: 0.005333 seconds.
Inference time: 0.0966942310333252
Prediction: 0.106292 seconds.
process image 4115
Load Image: 0.004305 seconds.
Inference time: 0.09942221641540527
Prediction: 0.117755 seconds.
process image 4116
Load Image: 0.005680 seconds.
Inference time: 0.09347105026245117
Prediction: 0.130018 seconds.
process image 4117
Load Image: 0.004329 seconds.
Inference time: 0.09876751899719238
Prediction: 0.124560 seconds.
process image 4118
Load Image: 0.004421 seconds.
Inference time: 0.09215211868286133
Prediction: 0.115168 seconds.
process image 4119
Load Image: 0.003767 seconds.
Inference time: 0.09814143180847168
Prediction: 0.108749 seconds.
process image 4120
Load Image: 0.004316 seconds.
Inference time: 0.09881448745727539
Prediction: 0.131192 seconds.
process image 4121
Load Image: 0.004579 seconds.
Inference time: 0.09368371963500977
Prediction: 0.137893 seconds.
process image 4122
Load Image: 0.003667 seconds.
Inference time: 0.09241580963134766
Prediction: 0.104133 seconds.
process image 4123
Load Image: 0.004323 seconds.
Inference time: 0.09250664710998535
Prediction: 0.110711 seconds.
process image 4124
Load Image: 0.004779 seconds.
Inference time: 0.10155844688415527
Prediction: 0.115558 seconds.
process image 4125
Load Image: 0.003819 seconds.
Inference time: 0.09358811378479004
Prediction: 0.099188 seconds.
process image 4126
Load Image: 0.003662 seconds.
Inference time: 0.0947866439819336
Prediction: 0.128181 seconds.
process image 4127
Load Image: 0.006378 seconds.
Inference time: 0.09315180778503418
Prediction: 0.112459 seconds.
process image 4128
Load Image: 0.003965 seconds.
Inference time: 0.10407900810241699
Prediction: 0.113806 seconds.
process image 4129
Load Image: 0.004009 seconds.
Inference time: 0.10294985771179199
Prediction: 0.126007 seconds.
process image 4130
Load Image: 0.004787 seconds.

Inference time: 0.09883713722229004
Prediction: 0.138167 seconds.
process image 4131
Load Image: 0.004316 seconds.
Inference time: 0.09886884689331055
Prediction: 0.115810 seconds.
process image 4132
Load Image: 0.004824 seconds.
Inference time: 0.09667062759399414
Prediction: 0.115858 seconds.
process image 4133
Load Image: 0.004165 seconds.
Inference time: 0.09401893615722656
Prediction: 0.119423 seconds.
process image 4134
Load Image: 0.004445 seconds.
Inference time: 0.09833574295043945
Prediction: 0.120168 seconds.
process image 4135
Load Image: 0.005094 seconds.
Inference time: 0.09737133979797363
Prediction: 0.105450 seconds.
process image 4136
Load Image: 0.002506 seconds.
Inference time: 0.09878325462341309
Prediction: 0.107095 seconds.
process image 4137
Load Image: 0.005734 seconds.
Inference time: 0.09805631637573242
Prediction: 0.121601 seconds.
process image 4138
Load Image: 0.004458 seconds.
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Prediction: 0.121189 seconds.
process image 4139
Load Image: 0.004361 seconds.
Inference time: 0.0982673168182373
Prediction: 0.106935 seconds.
process image 4140
Load Image: 0.003998 seconds.
Inference time: 0.0928950309753418
Prediction: 0.102438 seconds.
process image 4141
Load Image: 0.004348 seconds.
Inference time: 0.09199714660644531
Prediction: 0.114256 seconds.
process image 4142
Load Image: 0.007412 seconds.
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Prediction: 0.139274 seconds.
process image 4143
Load Image: 0.003694 seconds.
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Prediction: 0.106156 seconds.
process image 4144
Load Image: 0.004496 seconds.
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Prediction: 0.114587 seconds.
process image 4145
Load Image: 0.004176 seconds.
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Prediction: 0.117409 seconds.
process image 4146
Load Image: 0.005452 seconds.
Inference time: 0.09833741188049316
Prediction: 0.120901 seconds.
process image 4147
Load Image: 0.004803 seconds.
Inference time: 0.09452319145202637

Prediction: 0.108525 seconds.
process image 4148
Load Image: 0.004303 seconds.
Inference time: 0.09198737144470215
Prediction: 0.104375 seconds.
process image 4149
Load Image: 0.006322 seconds.
Inference time: 0.10049700736999512
Prediction: 0.125984 seconds.
process image 4150
Load Image: 0.004815 seconds.
Inference time: 0.09786653518676758
Prediction: 0.115062 seconds.
process image 4151
Load Image: 0.003790 seconds.
Inference time: 0.09427499771118164
Prediction: 0.100333 seconds.
process image 4152
Load Image: 0.005740 seconds.
Inference time: 0.0976102352142334
Prediction: 0.114099 seconds.
process image 4153
Load Image: 0.006185 seconds.
Inference time: 0.0950169563293457
Prediction: 0.123096 seconds.
process image 4154
Load Image: 0.004704 seconds.
Inference time: 0.10524821281433105
Prediction: 0.127196 seconds.
process image 4155
Load Image: 0.005588 seconds.
Inference time: 0.0947418212890625
Prediction: 0.122201 seconds.
process image 4156
Load Image: 0.004510 seconds.
Inference time: 0.09920358657836914
Prediction: 0.119944 seconds.
process image 4157
Load Image: 0.004839 seconds.
Inference time: 0.09723162651062012
Prediction: 0.107508 seconds.
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Load Image: 0.004227 seconds.
Inference time: 0.09584236145019531
Prediction: 0.110946 seconds.
process image 4159
Load Image: 0.004437 seconds.
Inference time: 0.10767364501953125
Prediction: 0.144984 seconds.
process image 4160
Load Image: 0.004133 seconds.
Inference time: 0.09603261947631836
Prediction: 0.112655 seconds.
process image 4161
Load Image: 0.004121 seconds.
Inference time: 0.10895824432373047
Prediction: 0.128649 seconds.
process image 4162
Load Image: 0.005043 seconds.
Inference time: 0.10718870162963867
Prediction: 0.122025 seconds.
process image 4163
Load Image: 0.003701 seconds.
Inference time: 0.0948324203491211
Prediction: 0.111872 seconds.
process image 4164
Load Image: 0.008216 seconds.
Inference time: 0.09681248664855957
Prediction: 0.148042 seconds.

process image 4165
Load Image: 0.005348 seconds.
Inference time: 0.09680700302124023
Prediction: 0.121652 seconds.
process image 4166
Load Image: 0.005070 seconds.
Inference time: 0.09971070289611816
Prediction: 0.125128 seconds.
process image 4167
Load Image: 0.004624 seconds.
Inference time: 0.093536376953125
Prediction: 0.115767 seconds.
process image 4168
Load Image: 0.005043 seconds.
Inference time: 0.10620808601379395
Prediction: 0.119592 seconds.
process image 4169
Load Image: 0.006094 seconds.
Inference time: 0.10368466377258301
Prediction: 0.112791 seconds.
process image 4170
Load Image: 0.005014 seconds.
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Prediction: 0.110632 seconds.
process image 4171
Load Image: 0.005112 seconds.
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Prediction: 0.116480 seconds.
process image 4172
Load Image: 0.005286 seconds.
Inference time: 0.0930633544921875
Prediction: 0.113548 seconds.
process image 4173
Load Image: 0.004201 seconds.
Inference time: 0.09907865524291992
Prediction: 0.115098 seconds.
process image 4174
Load Image: 0.004682 seconds.
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Prediction: 0.111682 seconds.
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Load Image: 0.004104 seconds.
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process image 4176
Load Image: 0.004150 seconds.
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Load Image: 0.004322 seconds.
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Prediction: 0.112447 seconds.
process image 4178
Load Image: 0.004792 seconds.
Inference time: 0.10906434059143066
Prediction: 0.137106 seconds.
process image 4179
Load Image: 0.005114 seconds.
Inference time: 0.09975385665893555
Prediction: 0.159642 seconds.
process image 4180
Load Image: 0.007444 seconds.
Inference time: 0.10849928855895996
Prediction: 0.129371 seconds.
process image 4181
Load Image: 0.003987 seconds.
Inference time: 0.09479761123657227
Prediction: 0.110539 seconds.
process image 4182

Load Image: 0.004215 seconds.
Inference time: 0.09955286979675293
Prediction: 0.114460 seconds.
process image 4183
Load Image: 0.004793 seconds.
Inference time: 0.09691381454467773
Prediction: 0.131460 seconds.
process image 4184
Load Image: 0.005336 seconds.
Inference time: 0.10120725631713867
Prediction: 0.135093 seconds.
process image 4185
Load Image: 0.004683 seconds.
Inference time: 0.10462522506713867
Prediction: 0.128476 seconds.
process image 4186
Load Image: 0.004218 seconds.
Inference time: 0.10342907905578613
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process image 4187
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Inference time: 0.09930896759033203
Prediction: 0.107243 seconds.
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Prediction: 0.102260 seconds.
process image 4189
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Load Image: 0.003555 seconds.
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process image 4191
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Load Image: 0.004187 seconds.
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Load Image: 0.004461 seconds.
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Prediction: 0.123702 seconds.
process image 4195
Load Image: 0.004660 seconds.
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process image 4196
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Prediction: 0.099594 seconds.
process image 4197
Load Image: 0.005404 seconds.
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Prediction: 0.124344 seconds.
process image 4198
Load Image: 0.005475 seconds.
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Prediction: 0.121839 seconds.
process image 4199
Load Image: 0.004937 seconds.

Inference time: 0.1002202033996582
Prediction: 0.151448 seconds.
process image 4200
Load Image: 0.004301 seconds.
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Prediction: 0.121955 seconds.
process image 4201
Load Image: 0.003763 seconds.
Inference time: 0.10213851928710938
Prediction: 0.127791 seconds.
process image 4202
Load Image: 0.003811 seconds.
Inference time: 0.10735058784484863
Prediction: 0.127556 seconds.
process image 4203
Load Image: 0.004196 seconds.
Inference time: 0.0938730239868164
Prediction: 0.121171 seconds.
process image 4204
Load Image: 0.004122 seconds.
Inference time: 0.10375022888183594
Prediction: 0.143510 seconds.
process image 4205
Load Image: 0.003663 seconds.
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Prediction: 0.112563 seconds.
process image 4206
Load Image: 0.004238 seconds.
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process image 4207
Load Image: 0.003681 seconds.
Inference time: 0.09423971176147461
Prediction: 0.141634 seconds.
process image 4208
Load Image: 0.003853 seconds.
Inference time: 0.09348630905151367
Prediction: 0.111305 seconds.
process image 4209
Load Image: 0.006172 seconds.
Inference time: 0.1057741641998291
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process image 4210
Load Image: 0.004250 seconds.
Inference time: 0.09980940818786621
Prediction: 0.108815 seconds.
process image 4211
Load Image: 0.004445 seconds.
Inference time: 0.10222935676574707
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process image 4212
Load Image: 0.006034 seconds.
Inference time: 0.09362673759460449
Prediction: 0.102810 seconds.
process image 4213
Load Image: 0.005168 seconds.
Inference time: 0.10319852828979492
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process image 4214
Load Image: 0.003804 seconds.
Inference time: 0.10350608825683594
Prediction: 0.124088 seconds.
process image 4215
Load Image: 0.004725 seconds.
Inference time: 0.10087299346923828
Prediction: 0.136889 seconds.
process image 4216
Load Image: 0.003785 seconds.
Inference time: 0.09717345237731934

Prediction: 0.121664 seconds.
process image 4217
Load Image: 0.003972 seconds.
Inference time: 0.09653830528259277
Prediction: 0.133297 seconds.
process image 4218
Load Image: 0.004591 seconds.
Inference time: 0.10845232009887695
Prediction: 0.141430 seconds.
process image 4219
Load Image: 0.004279 seconds.
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Prediction: 0.124748 seconds.
process image 4220
Load Image: 0.005535 seconds.
Inference time: 0.14795589447021484
Prediction: 0.206717 seconds.
process image 4221
Load Image: 0.007823 seconds.
Inference time: 0.14628267288208008
Prediction: 0.170002 seconds.
process image 4222
Load Image: 0.006972 seconds.
Inference time: 0.151611328125
Prediction: 0.175183 seconds.
process image 4223
Load Image: 0.006969 seconds.
Inference time: 0.1481180191040039
Prediction: 0.177128 seconds.
process image 4224
Load Image: 0.005772 seconds.
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Prediction: 0.172529 seconds.
process image 4225
Load Image: 0.003391 seconds.
Inference time: 0.15685677528381348
Prediction: 0.176993 seconds.
process image 4226
Load Image: 0.008638 seconds.
Inference time: 0.15789079666137695
Prediction: 0.228529 seconds.
process image 4227
Load Image: 0.006806 seconds.
Inference time: 0.15499210357666016
Prediction: 0.184254 seconds.
process image 4228
Load Image: 0.006443 seconds.
Inference time: 0.15895867347717285
Prediction: 0.193571 seconds.
process image 4229
Load Image: 0.007485 seconds.
Inference time: 0.1496572494506836
Prediction: 0.162321 seconds.
process image 4230
Load Image: 0.006649 seconds.
Inference time: 0.15607929229736328
Prediction: 0.163892 seconds.
process image 4231
Load Image: 0.005734 seconds.
Inference time: 0.1571342945098877
Prediction: 0.177879 seconds.
process image 4232
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Prediction: 0.162190 seconds.
process image 4233
Load Image: 0.008601 seconds.
Inference time: 0.15078234672546387
Prediction: 0.224277 seconds.

process image 4234
Load Image: 0.006789 seconds.
Inference time: 0.14635443687438965
Prediction: 0.162287 seconds.
process image 4235
Load Image: 0.008113 seconds.
Inference time: 0.1486830711364746
Prediction: 0.199018 seconds.
process image 4236
Load Image: 0.006929 seconds.
Inference time: 0.15468263626098633
Prediction: 0.193743 seconds.
process image 4237
Load Image: 0.008123 seconds.
Inference time: 0.1632671356201172
Prediction: 0.192535 seconds.
process image 4238
Load Image: 0.007554 seconds.
Inference time: 0.14561939239501953
Prediction: 0.197320 seconds.
process image 4239
Load Image: 0.004411 seconds.
Inference time: 0.1018214225769043
Prediction: 0.123941 seconds.
process image 4240
Load Image: 0.003601 seconds.
Inference time: 0.09451913833618164
Prediction: 0.098685 seconds.
process image 4241
Load Image: 0.004142 seconds.
Inference time: 0.11758255958557129
Prediction: 0.143089 seconds.
process image 4242
Load Image: 0.004104 seconds.
Inference time: 0.10140037536621094
Prediction: 0.113633 seconds.
process image 4243
Load Image: 0.004194 seconds.
Inference time: 0.0967862606048584
Prediction: 0.108585 seconds.
process image 4244
Load Image: 0.003788 seconds.
Inference time: 0.10382890701293945
Prediction: 0.121820 seconds.
process image 4245
Load Image: 0.004260 seconds.
Inference time: 0.09626913070678711
Prediction: 0.134602 seconds.
process image 4246
Load Image: 0.003927 seconds.
Inference time: 0.09836602210998535
Prediction: 0.111361 seconds.
process image 4247
Load Image: 0.004615 seconds.
Inference time: 0.10258769989013672
Prediction: 0.116201 seconds.
process image 4248
Load Image: 0.003917 seconds.
Inference time: 0.09519052505493164
Prediction: 0.109464 seconds.
process image 4249
Load Image: 0.003844 seconds.
Inference time: 0.11081337928771973
Prediction: 0.129013 seconds.
process image 4250
Load Image: 0.004372 seconds.
Inference time: 0.10373902320861816
Prediction: 0.124194 seconds.
process image 4251

Load Image: 0.004868 seconds.
Inference time: 0.0987389087677002
Prediction: 0.107790 seconds.
process image 4252
Load Image: 0.004214 seconds.
Inference time: 0.10754084587097168
Prediction: 0.122439 seconds.
process image 4253
Load Image: 0.003687 seconds.
Inference time: 0.10550975799560547
Prediction: 0.124103 seconds.
process image 4254
Load Image: 0.004864 seconds.
Inference time: 0.11148524284362793
Prediction: 0.140029 seconds.
process image 4255
Load Image: 0.004285 seconds.
Inference time: 0.10146951675415039
Prediction: 0.153993 seconds.
process image 4256
Load Image: 0.004805 seconds.
Inference time: 0.10115528106689453
Prediction: 0.120381 seconds.
process image 4257
Load Image: 0.005487 seconds.
Inference time: 0.10545682907104492
Prediction: 0.138158 seconds.
process image 4258
Load Image: 0.005784 seconds.
Inference time: 0.09474587440490723
Prediction: 0.103928 seconds.
process image 4259
Load Image: 0.004368 seconds.
Inference time: 0.09409189224243164
Prediction: 0.118829 seconds.
process image 4260
Load Image: 0.004453 seconds.
Inference time: 0.10099911689758301
Prediction: 0.115190 seconds.
process image 4261
Load Image: 0.005157 seconds.
Inference time: 0.10084104537963867
Prediction: 0.117859 seconds.
process image 4262
Load Image: 0.003626 seconds.
Inference time: 0.09522771835327148
Prediction: 0.111516 seconds.
process image 4263
Load Image: 0.001657 seconds.
Inference time: 0.09801006317138672
Prediction: 0.108479 seconds.
process image 4264
Load Image: 0.003523 seconds.
Inference time: 0.09472489356994629
Prediction: 0.122651 seconds.
process image 4265
Load Image: 0.004201 seconds.
Inference time: 0.11411666870117188
Prediction: 0.120318 seconds.
process image 4266
Load Image: 0.004863 seconds.
Inference time: 0.09516215324401855
Prediction: 0.116235 seconds.
process image 4267
Load Image: 0.004534 seconds.
Inference time: 0.10029315948486328
Prediction: 0.128502 seconds.
process image 4268
Load Image: 0.005500 seconds.

Inference time: 0.09206032752990723
Prediction: 0.134833 seconds.
process image 4269
Load Image: 0.004642 seconds.
Inference time: 0.1070091724395752
Prediction: 0.140213 seconds.
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Load Image: 0.004456 seconds.
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Prediction: 0.120360 seconds.
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Load Image: 0.003471 seconds.
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process image 4272
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Prediction: 0.144312 seconds.
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Load Image: 0.004148 seconds.
Inference time: 0.0947725772857666
Prediction: 0.110394 seconds.
process image 4275
Load Image: 0.004339 seconds.
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process image 4276
Load Image: 0.004690 seconds.
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Load Image: 0.004351 seconds.
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Prediction: 0.116443 seconds.
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Load Image: 0.004364 seconds.
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Prediction: 0.106519 seconds.
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process image 4283
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Prediction: 0.137141 seconds.
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Inference time: 0.10398244857788086

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process image 4288
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Load Image: 0.005054 seconds.
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Load Image: 0.004503 seconds.
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process image 4302
Load Image: 0.004208 seconds.
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Prediction: 0.107785 seconds.

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process image 4303
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process image 4304
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Prediction: 0.127128 seconds.
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Prediction: 0.116109 seconds.
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Prediction: 0.113591 seconds.
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Prediction: 0.096819 seconds.
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Load Image: 0.004463 seconds.
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Prediction: 0.120215 seconds.
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Prediction: 0.115873 seconds.
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Prediction: 0.115100 seconds.
process image 4319
Load Image: 0.004742 seconds.
Inference time: 0.0975944995880127
Prediction: 0.119868 seconds.
process image 4320
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Load Image: 0.004778 seconds.
Inference time: 0.10032439231872559
Prediction: 0.152197 seconds.
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Load Image: 0.005543 seconds.
Inference time: 0.10401368141174316
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process image 4442
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Prediction: 0.126847 seconds.
process image 4443
Load Image: 0.004497 seconds.
Inference time: 0.09446597099304199
Prediction: 0.102352 seconds.
process image 4444
Load Image: 0.001913 seconds.
Inference time: 0.09492206573486328
Prediction: 0.124169 seconds.
process image 4445
Load Image: 0.007457 seconds.
Inference time: 0.10200166702270508
Prediction: 0.117380 seconds.
process image 4446
Load Image: 0.003994 seconds.
Inference time: 0.0967566967010498
Prediction: 0.128017 seconds.
process image 4447
Load Image: 0.003979 seconds.
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Prediction: 0.121904 seconds.
process image 4448
Load Image: 0.004247 seconds.
Inference time: 0.09282517433166504
Prediction: 0.108368 seconds.
process image 4449
Load Image: 0.004594 seconds.
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Prediction: 0.145334 seconds.
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Load Image: 0.004619 seconds.
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Prediction: 0.099103 seconds.
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Load Image: 0.003469 seconds.
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Prediction: 0.127035 seconds.
process image 4452
Load Image: 0.004596 seconds.
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Prediction: 0.134735 seconds.
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Load Image: 0.003362 seconds.
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Prediction: 0.109881 seconds.
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Prediction: 0.101547 seconds.
process image 4455
Load Image: 0.004012 seconds.
Inference time: 0.09700202941894531
Prediction: 0.115852 seconds.
process image 4456
Load Image: 0.003716 seconds.
Inference time: 0.09679222106933594
Prediction: 0.105734 seconds.
process image 4457
Load Image: 0.004797 seconds.
Inference time: 0.09535384178161621
Prediction: 0.125561 seconds.
process image 4458
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Load Image: 0.003737 seconds.
Inference time: 0.10035967826843262
Prediction: 0.134528 seconds.
process image 4459
Load Image: 0.003144 seconds.
Inference time: 0.11312985420227051
Prediction: 0.131280 seconds.
process image 4460
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process image 4473
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Load Image: 0.004866 seconds.

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process image 4507
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process image 4508
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process image 4527

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process image 4596

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Inference time: 0.09502339363098145
Prediction: 0.109951 seconds.
process image 4629
Load Image: 0.003731 seconds.
Inference time: 0.09200668334960938
Prediction: 0.109231 seconds.
process image 4630
Load Image: 0.004471 seconds.
Inference time: 0.09236526489257812

Prediction: 0.132630 seconds.
process image 4631
Load Image: 0.004888 seconds.
Inference time: 0.09867405891418457
Prediction: 0.121986 seconds.
process image 4632
Load Image: 0.002841 seconds.
Inference time: 0.09261012077331543
Prediction: 0.106368 seconds.
process image 4633
Load Image: 0.004381 seconds.
Inference time: 0.1104893684387207
Prediction: 0.125983 seconds.
process image 4634
Load Image: 0.003675 seconds.
Inference time: 0.09985113143920898
Prediction: 0.129012 seconds.
process image 4635
Load Image: 0.004650 seconds.
Inference time: 0.09360837936401367
Prediction: 0.120256 seconds.
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Load Image: 0.003830 seconds.
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Prediction: 0.122023 seconds.
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process image 4638
Load Image: 0.003874 seconds.
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Prediction: 0.115344 seconds.
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Load Image: 0.004748 seconds.
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Load Image: 0.004034 seconds.
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process image 4665

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Load Image: 0.004411 seconds.
Inference time: 0.09216713905334473
Prediction: 0.126334 seconds.
process image 4815
Load Image: 0.004096 seconds.
Inference time: 0.10132050514221191
Prediction: 0.128966 seconds.
process image 4816
Load Image: 0.004575 seconds.
Inference time: 0.09549927711486816
Prediction: 0.109010 seconds.
process image 4817
Load Image: 0.004563 seconds.
Inference time: 0.10206222534179688
Prediction: 0.127917 seconds.
process image 4818
Load Image: 0.003649 seconds.
Inference time: 0.09324026107788086
Prediction: 0.109808 seconds.
process image 4819
Load Image: 0.003559 seconds.
Inference time: 0.09902501106262207
Prediction: 0.124821 seconds.
process image 4820
Load Image: 0.003706 seconds.

Inference time: 0.10569381713867188
Prediction: 0.118513 seconds.
process image 4821
Load Image: 0.003870 seconds.
Inference time: 0.09448409080505371
Prediction: 0.116189 seconds.
process image 4822
Load Image: 0.003986 seconds.
Inference time: 0.09576153755187988
Prediction: 0.132306 seconds.
process image 4823
Load Image: 0.003681 seconds.
Inference time: 0.09536361694335938
Prediction: 0.128042 seconds.
process image 4824
Load Image: 0.004509 seconds.
Inference time: 0.10025978088378906
Prediction: 0.129048 seconds.
process image 4825
Load Image: 0.004651 seconds.
Inference time: 0.09633421897888184
Prediction: 0.118324 seconds.
process image 4826
Load Image: 0.003239 seconds.
Inference time: 0.09325766563415527
Prediction: 0.122773 seconds.
process image 4827
Load Image: 0.004612 seconds.
Inference time: 0.09703421592712402
Prediction: 0.118485 seconds.
process image 4828
Load Image: 0.004067 seconds.
Inference time: 0.10111021995544434
Prediction: 0.108687 seconds.
process image 4829
Load Image: 0.003938 seconds.
Inference time: 0.09284830093383789
Prediction: 0.099772 seconds.
process image 4830
Load Image: 0.004309 seconds.
Inference time: 0.09318137168884277
Prediction: 0.119856 seconds.
process image 4831
Load Image: 0.004463 seconds.
Inference time: 0.09281682968139648
Prediction: 0.117876 seconds.
process image 4832
Load Image: 0.004065 seconds.
Inference time: 0.10396623611450195
Prediction: 0.123380 seconds.
process image 4833
Load Image: 0.004398 seconds.
Inference time: 0.09562826156616211
Prediction: 0.144406 seconds.
process image 4834
Load Image: 0.003835 seconds.
Inference time: 0.10055327415466309
Prediction: 0.130621 seconds.
process image 4835
Load Image: 0.004378 seconds.
Inference time: 0.09317541122436523
Prediction: 0.118399 seconds.
process image 4836
Load Image: 0.004529 seconds.
Inference time: 0.10739731788635254
Prediction: 0.124739 seconds.
process image 4837
Load Image: 0.004104 seconds.
Inference time: 0.09778213500976562

Prediction: 0.104473 seconds.
process image 4838
Load Image: 0.004239 seconds.
Inference time: 0.09283232688903809
Prediction: 0.106545 seconds.
process image 4839
Load Image: 0.004124 seconds.
Inference time: 0.10521221160888672
Prediction: 0.118134 seconds.
process image 4840
Load Image: 0.004612 seconds.
Inference time: 0.09494566917419434
Prediction: 0.126161 seconds.
process image 4841
Load Image: 0.004769 seconds.
Inference time: 0.09358811378479004
Prediction: 0.124573 seconds.
process image 4842
Load Image: 0.005515 seconds.
Inference time: 0.09669375419616699
Prediction: 0.111526 seconds.
process image 4843
Load Image: 0.004567 seconds.
Inference time: 0.09818100929260254
Prediction: 0.130826 seconds.
process image 4844
Load Image: 0.004214 seconds.
Inference time: 0.09378886222839355
Prediction: 0.129426 seconds.
process image 4845
Load Image: 0.004430 seconds.
Inference time: 0.09578824043273926
Prediction: 0.105708 seconds.
process image 4846
Load Image: 0.004956 seconds.
Inference time: 0.09358668327331543
Prediction: 0.112512 seconds.
process image 4847
Load Image: 0.004263 seconds.
Inference time: 0.09322047233581543
Prediction: 0.109745 seconds.
process image 4848
Load Image: 0.003646 seconds.
Inference time: 0.10319256782531738
Prediction: 0.109299 seconds.
process image 4849
Load Image: 0.004789 seconds.
Inference time: 0.09360551834106445
Prediction: 0.101610 seconds.
process image 4850
Load Image: 0.003730 seconds.
Inference time: 0.09483146667480469
Prediction: 0.106644 seconds.
process image 4851
Load Image: 0.005045 seconds.
Inference time: 0.0996708869934082
Prediction: 0.120787 seconds.
process image 4852
Load Image: 0.004787 seconds.
Inference time: 0.09411478042602539
Prediction: 0.120205 seconds.
process image 4853
Load Image: 0.003294 seconds.
Inference time: 0.10826468467712402
Prediction: 0.115538 seconds.
process image 4854
Load Image: 0.004381 seconds.
Inference time: 0.09583187103271484
Prediction: 0.117810 seconds.

process image 4855
Load Image: 0.004393 seconds.
Inference time: 0.09222817420959473
Prediction: 0.121743 seconds.
process image 4856
Load Image: 0.002271 seconds.
Inference time: 0.10336780548095703
Prediction: 0.120131 seconds.
process image 4857
Load Image: 0.005344 seconds.
Inference time: 0.09459972381591797
Prediction: 0.138422 seconds.
process image 4858
Load Image: 0.004382 seconds.
Inference time: 0.10111737251281738
Prediction: 0.123715 seconds.
process image 4859
Load Image: 0.004670 seconds.
Inference time: 0.10812234878540039
Prediction: 0.153611 seconds.
process image 4860
Load Image: 0.003737 seconds.
Inference time: 0.1030123233795166
Prediction: 0.118733 seconds.
process image 4861
Load Image: 0.004125 seconds.
Inference time: 0.10050797462463379
Prediction: 0.124221 seconds.
process image 4862
Load Image: 0.004272 seconds.
Inference time: 0.09158945083618164
Prediction: 0.112686 seconds.
process image 4863
Load Image: 0.003923 seconds.
Inference time: 0.09886431694030762
Prediction: 0.127402 seconds.
process image 4864
Load Image: 0.004300 seconds.
Inference time: 0.09961175918579102
Prediction: 0.125012 seconds.
process image 4865
Load Image: 0.004453 seconds.
Inference time: 0.09830617904663086
Prediction: 0.123479 seconds.
process image 4866
Load Image: 0.004472 seconds.
Inference time: 0.0945134162902832
Prediction: 0.117447 seconds.
process image 4867
Load Image: 0.005392 seconds.
Inference time: 0.09404110908508301
Prediction: 0.133222 seconds.
process image 4868
Load Image: 0.004517 seconds.
Inference time: 0.09335875511169434
Prediction: 0.134428 seconds.
process image 4869
Load Image: 0.004174 seconds.
Inference time: 0.11224532127380371
Prediction: 0.127001 seconds.
process image 4870
Load Image: 0.004318 seconds.
Inference time: 0.09816741943359375
Prediction: 0.115306 seconds.
process image 4871
Load Image: 0.003863 seconds.
Inference time: 0.09762430191040039
Prediction: 0.110919 seconds.
process image 4872

Load Image: 0.004686 seconds.
Inference time: 0.09482336044311523
Prediction: 0.141565 seconds.
process image 4873
Load Image: 0.003972 seconds.
Inference time: 0.10539793968200684
Prediction: 0.137339 seconds.
process image 4874
Load Image: 0.004328 seconds.
Inference time: 0.0992586612701416
Prediction: 0.130399 seconds.
process image 4875
Load Image: 0.003723 seconds.
Inference time: 0.0991511344909668
Prediction: 0.123570 seconds.
process image 4876
Load Image: 0.004539 seconds.
Inference time: 0.0924220085144043
Prediction: 0.104656 seconds.
process image 4877
Load Image: 0.003579 seconds.
Inference time: 0.10698103904724121
Prediction: 0.141227 seconds.
process image 4878
Load Image: 0.004439 seconds.
Inference time: 0.09372758865356445
Prediction: 0.147381 seconds.
process image 4879
Load Image: 0.004015 seconds.
Inference time: 0.09452033042907715
Prediction: 0.154050 seconds.
process image 4880
Load Image: 0.004272 seconds.
Inference time: 0.09224939346313477
Prediction: 0.096980 seconds.
process image 4881
Load Image: 0.003156 seconds.
Inference time: 0.09305882453918457
Prediction: 0.120228 seconds.
process image 4882
Load Image: 0.003450 seconds.
Inference time: 0.11312317848205566
Prediction: 0.128969 seconds.
process image 4883
Load Image: 0.004497 seconds.
Inference time: 0.09308624267578125
Prediction: 0.098109 seconds.
process image 4884
Load Image: 0.004431 seconds.
Inference time: 0.0922384262084961
Prediction: 0.129905 seconds.
process image 4885
Load Image: 0.004220 seconds.
Inference time: 0.10577154159545898
Prediction: 0.152147 seconds.
process image 4886
Load Image: 0.005630 seconds.
Inference time: 0.09776759147644043
Prediction: 0.139699 seconds.
process image 4887
Load Image: 0.004313 seconds.
Inference time: 0.10157656669616699
Prediction: 0.127752 seconds.
process image 4888
Load Image: 0.003950 seconds.
Inference time: 0.09426641464233398
Prediction: 0.110237 seconds.
process image 4889
Load Image: 0.004190 seconds.

Inference time: 0.09750151634216309
Prediction: 0.123719 seconds.
process image 4890
Load Image: 0.004810 seconds.
Inference time: 0.09700298309326172
Prediction: 0.120227 seconds.
process image 4891
Load Image: 0.004321 seconds.
Inference time: 0.09693694114685059
Prediction: 0.118042 seconds.
process image 4892
Load Image: 0.004089 seconds.
Inference time: 0.09185218811035156
Prediction: 0.106162 seconds.
process image 4893
Load Image: 0.004100 seconds.
Inference time: 0.10245728492736816
Prediction: 0.122488 seconds.
process image 4894
Load Image: 0.004491 seconds.
Inference time: 0.09602594375610352
Prediction: 0.114607 seconds.
process image 4895
Load Image: 0.003912 seconds.
Inference time: 0.09827709197998047
Prediction: 0.137116 seconds.
process image 4896
Load Image: 0.004318 seconds.
Inference time: 0.09980487823486328
Prediction: 0.134402 seconds.
process image 4897
Load Image: 0.003980 seconds.
Inference time: 0.09278154373168945
Prediction: 0.120559 seconds.
process image 4898
Load Image: 0.003582 seconds.
Inference time: 0.09501123428344727
Prediction: 0.130517 seconds.
process image 4899
Load Image: 0.003469 seconds.
Inference time: 0.09815502166748047
Prediction: 0.115954 seconds.
process image 4900
Load Image: 0.004360 seconds.
Inference time: 0.0967569351196289
Prediction: 0.114394 seconds.
process image 4901
Load Image: 0.004406 seconds.
Inference time: 0.1080787181854248
Prediction: 0.152582 seconds.
process image 4902
Load Image: 0.004348 seconds.
Inference time: 0.09972333908081055
Prediction: 0.106800 seconds.
process image 4903
Load Image: 0.004714 seconds.
Inference time: 0.10077881813049316
Prediction: 0.130851 seconds.
process image 4904
Load Image: 0.003948 seconds.
Inference time: 0.09915971755981445
Prediction: 0.111438 seconds.
process image 4905
Load Image: 0.004312 seconds.
Inference time: 0.09244084358215332
Prediction: 0.144235 seconds.
process image 4906
Load Image: 0.003054 seconds.
Inference time: 0.09298205375671387

Prediction: 0.098029 seconds.
process image 4907
Load Image: 0.004407 seconds.
Inference time: 0.09570932388305664
Prediction: 0.111254 seconds.
process image 4908
Load Image: 0.004039 seconds.
Inference time: 0.09723138809204102
Prediction: 0.123032 seconds.
process image 4909
Load Image: 0.003632 seconds.
Inference time: 0.10330557823181152
Prediction: 0.122691 seconds.
process image 4910
Load Image: 0.004359 seconds.
Inference time: 0.0983879566192627
Prediction: 0.114033 seconds.
process image 4911
Load Image: 0.003836 seconds.
Inference time: 0.09290719032287598
Prediction: 0.102575 seconds.
process image 4912
Load Image: 0.003807 seconds.
Inference time: 0.09152817726135254
Prediction: 0.126654 seconds.
process image 4913
Load Image: 0.003540 seconds.
Inference time: 0.10052204132080078
Prediction: 0.106031 seconds.
process image 4914
Load Image: 0.003857 seconds.
Inference time: 0.09238171577453613
Prediction: 0.105914 seconds.
process image 4915
Load Image: 0.003892 seconds.
Inference time: 0.09204220771789551
Prediction: 0.116045 seconds.
process image 4916
Load Image: 0.006692 seconds.
Inference time: 0.10251402854919434
Prediction: 0.108243 seconds.
process image 4917
Load Image: 0.004083 seconds.
Inference time: 0.0920562744140625
Prediction: 0.127095 seconds.
process image 4918
Load Image: 0.006141 seconds.
Inference time: 0.10410308837890625
Prediction: 0.120078 seconds.
process image 4919
Load Image: 0.004672 seconds.
Inference time: 0.09582209587097168
Prediction: 0.117222 seconds.
process image 4920
Load Image: 0.003883 seconds.
Inference time: 0.0990755558013916
Prediction: 0.114210 seconds.
process image 4921
Load Image: 0.005235 seconds.
Inference time: 0.09454751014709473
Prediction: 0.102617 seconds.
process image 4922
Load Image: 0.003969 seconds.
Inference time: 0.09592199325561523
Prediction: 0.120579 seconds.
process image 4923
Load Image: 0.004822 seconds.
Inference time: 0.09758853912353516
Prediction: 0.111633 seconds.

process image 4924
Load Image: 0.004103 seconds.
Inference time: 0.09402298927307129
Prediction: 0.120228 seconds.
process image 4925
Load Image: 0.005855 seconds.
Inference time: 0.09596014022827148
Prediction: 0.116415 seconds.
process image 4926
Load Image: 0.007216 seconds.
Inference time: 0.1018071174621582
Prediction: 0.135598 seconds.
process image 4927
Load Image: 0.003756 seconds.
Inference time: 0.09287595748901367
Prediction: 0.122362 seconds.
process image 4928
Load Image: 0.005673 seconds.
Inference time: 0.09834551811218262
Prediction: 0.112932 seconds.
process image 4929
Load Image: 0.004337 seconds.
Inference time: 0.09848189353942871
Prediction: 0.103171 seconds.
process image 4930
Load Image: 0.004488 seconds.
Inference time: 0.09265708923339844
Prediction: 0.126937 seconds.
process image 4931
Load Image: 0.003907 seconds.
Inference time: 0.09234428405761719
Prediction: 0.111688 seconds.
process image 4932
Load Image: 0.003564 seconds.
Inference time: 0.09379982948303223
Prediction: 0.115707 seconds.
process image 4933
Load Image: 0.004069 seconds.
Inference time: 0.09581351280212402
Prediction: 0.115918 seconds.
process image 4934
Load Image: 0.004486 seconds.
Inference time: 0.1056663990020752
Prediction: 0.124995 seconds.
process image 4935
Load Image: 0.004304 seconds.
Inference time: 0.10336923599243164
Prediction: 0.131006 seconds.
process image 4936
Load Image: 0.003471 seconds.
Inference time: 0.0953061580657959
Prediction: 0.115077 seconds.
process image 4937
Load Image: 0.004308 seconds.
Inference time: 0.10180330276489258
Prediction: 0.106788 seconds.
process image 4938
Load Image: 0.003571 seconds.
Inference time: 0.098876953125
Prediction: 0.109475 seconds.
process image 4939
Load Image: 0.004062 seconds.
Inference time: 0.09617996215820312
Prediction: 0.142232 seconds.
process image 4940
Load Image: 0.004149 seconds.
Inference time: 0.09706687927246094
Prediction: 0.111729 seconds.
process image 4941

Load Image: 0.001777 seconds.
Inference time: 0.09239411354064941
Prediction: 0.107301 seconds.
process image 4942
Load Image: 0.003534 seconds.
Inference time: 0.09206748008728027
Prediction: 0.130980 seconds.
process image 4943
Load Image: 0.005559 seconds.
Inference time: 0.1026616096496582
Prediction: 0.122771 seconds.
process image 4944
Load Image: 0.006520 seconds.
Inference time: 0.09514355659484863
Prediction: 0.126322 seconds.
process image 4945
Load Image: 0.005133 seconds.
Inference time: 0.09631967544555664
Prediction: 0.103294 seconds.
process image 4946
Load Image: 0.004468 seconds.
Inference time: 0.09767341613769531
Prediction: 0.106878 seconds.
process image 4947
Load Image: 0.005366 seconds.
Inference time: 0.09570479393005371
Prediction: 0.102150 seconds.
process image 4948
Load Image: 0.003798 seconds.
Inference time: 0.09274601936340332
Prediction: 0.107634 seconds.
process image 4949
Load Image: 0.003757 seconds.
Inference time: 0.09831619262695312
Prediction: 0.109030 seconds.
process image 4950
Load Image: 0.004745 seconds.
Inference time: 0.09562969207763672
Prediction: 0.121657 seconds.
process image 4951
Load Image: 0.004447 seconds.
Inference time: 0.11101579666137695
Prediction: 0.139219 seconds.

Average Precision Per-class:
aeroplane: 0.6843271224059599
bicycle: 0.7911140237662206
bird: 0.6171819168583986
boat: 0.5612220055063379
bottle: 0.3485216621466003
bus: 0.7677814849265677
car: 0.7280986468467315
cat: 0.8369208203985581
chair: 0.5169138632991064
cow: 0.6238697603075337
diningtable: 0.7062172972736019
dog: 0.7872868219961326
horse: 0.819446325939355
motorbike: 0.7918539457195842
person: 0.702363739134837
pottedplant: 0.39852951468542563
sheep: 0.6066678298227772
sofa: 0.7573083661544429
train: 0.8262441264750008
tvmonitor: 0.6461898726506375

Average Precision Across All Classes:0.6759029573156905

Average Precision Per-class:

aeroplane: 0.6843271224059599

bicycle: 0.7911140237662206

bird: 0.6171819168583986

boat: 0.5612220055063379

bottle: 0.3485216621466003

bus: 0.7677814849265677

car: 0.7280986468467315

cat: 0.8369208203985581

chair: 0.5169138632991064

cow: 0.6238697603075337

diningtable: 0.7062172972736019

dog: 0.7872868219961326

horse: 0.819446325939355

motorbike: 0.7918539457195842

person: 0.702363739134837

pottedplant: 0.39852951468542563

sheep: 0.6066678298227772

sofa: 0.7573083661544429

train: 0.8262441264750008

tvmonitor: 0.6461898726506375

Average Precision Across All Classes:0.6759029573156905

2. Select any two related categories from Google Open Images dataset and finetune the pretrained SSD model. Examples include, Aircraft and Aeroplane, Handgun and Shotgun. You can use open_images_downloader.py script provided at the github to download the data. For finetuning you can use the same parameters as in the tutorial below. Compute the accuracy of the test data for these categories before and after finetuning. (4+4)

```
In [ ]: !wget -P models https://storage.googleapis.com/models-hao/open-images-model-1.
--2022-12-12 19:06:25-- https://storage.googleapis.com/models-hao/open-images
-model-labels.txt
Resolving storage.googleapis.com (storage.googleapis.com)... 173.194.215.128,
173.194.216.128, 173.194.217.128, ...
Connecting to storage.googleapis.com (storage.googleapis.com)|173.194.215.128
```

```
|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 26 [text/plain]
Saving to: 'models/open-images-model-labels.txt'
```

```
open-images-model-l 100%[=====] 26 --.-KB/s in 0s
```

```
2022-12-12 19:06:25 (3.69 MB/s) - 'models/open-images-model-labels.txt' saved
[26/26]
```

```
In [ ]: !python open_images_downloader.py --root data/open_images --retry 2 --class_n
```

```
2022-12-12 19:07:29,757 - root - Download https://storage.googleapis.com/openi
mages/2018_04/class-descriptions-boxable.csv.
2022-12-12 19:07:29,881 - root - Download https://storage.googleapis.com/openi
mages/2018_04/train/train-annotations-bbox.csv.
2022-12-12 19:07:40,161 - root - Read annotation file data/open_images/train-a
nnotations-bbox.csv
2022-12-12 19:08:00,834 - root - train bounding boxes size: 1307
2022-12-12 19:08:00,834 - root - Approximate Image Stats:
2022-12-12 19:08:00,839 - root - Handgun: 561/990 = 0.57.
2022-12-12 19:08:00,839 - root - Shotgun: 429/990 = 0.43.
2022-12-12 19:08:00,839 - root - Label distribution:
2022-12-12 19:08:00,839 - root - Handgun: 727/1307 = 0.56.
2022-12-12 19:08:00,839 - root - Shotgun: 580/1307 = 0.44.
2022-12-12 19:08:00,840 - root - Shuffle dataset.
2022-12-12 19:08:00,840 - root - Save train data to data/open_images/sub-train
-annotations-bbox.csv.
2022-12-12 19:08:00,854 - root - Download https://storage.googleapis.com/openi
mages/2018_04/validation/validation-annotations-bbox.csv.
2022-12-12 19:08:01,063 - root - Read annotation file data/open_images/validat
ion-annotations-bbox.csv
2022-12-12 19:08:01,329 - root - validation bounding boxes size: 50
2022-12-12 19:08:01,329 - root - Approximate Image Stats:
2022-12-12 19:08:01,331 - root - Handgun: 20/39 = 0.51.
2022-12-12 19:08:01,331 - root - Shotgun: 19/39 = 0.49.
2022-12-12 19:08:01,331 - root - Label distribution:
2022-12-12 19:08:01,332 - root - Shotgun: 26/50 = 0.52.
2022-12-12 19:08:01,332 - root - Handgun: 24/50 = 0.48.
2022-12-12 19:08:01,332 - root - Shuffle dataset.
2022-12-12 19:08:01,332 - root - Save validation data to data/open_images/sub-
validation-annotations-bbox.csv.
2022-12-12 19:08:01,333 - root - Download https://storage.googleapis.com/openi
mages/2018_04/test/test-annotations-bbox.csv.
2022-12-12 19:08:01,989 - root - Read annotation file data/open_images/test-an
notations-bbox.csv
2022-12-12 19:08:02,765 - root - test bounding boxes size: 147
2022-12-12 19:08:02,766 - root - Approximate Image Stats:
2022-12-12 19:08:02,768 - root - Handgun: 72/130 = 0.55.
2022-12-12 19:08:02,768 - root - Shotgun: 58/130 = 0.45.
2022-12-12 19:08:02,768 - root - Label distribution:
2022-12-12 19:08:02,769 - root - Handgun: 81/147 = 0.55.
2022-12-12 19:08:02,769 - root - Shotgun: 66/147 = 0.45.
2022-12-12 19:08:02,769 - root - Shuffle dataset.
2022-12-12 19:08:02,769 - root - Save test data to data/open_images/sub-test-a
nnotations-bbox.csv.
2022-12-12 19:08:02,771 - root - Start downloading 1121 images.
2022-12-12 19:08:04,634 - root - Downloaded 100 images.
2022-12-12 19:08:05,847 - root - Downloaded 200 images.
2022-12-12 19:08:07,032 - root - Downloaded 300 images.
2022-12-12 19:08:08,230 - root - Downloaded 400 images.
2022-12-12 19:08:09,540 - root - Downloaded 500 images.
2022-12-12 19:08:10,853 - root - Downloaded 600 images.
2022-12-12 19:08:12,128 - root - Downloaded 700 images.
2022-12-12 19:08:13,354 - root - Downloaded 800 images.
2022-12-12 19:08:14,537 - root - Downloaded 900 images.
2022-12-12 19:08:16,038 - root - Downloaded 1000 images.
```

2022-12-12 19:08:17,512 - root - Downloaded 1100 images.
 2022-12-12 19:08:18,287 - root - Task Done.

In []: `%cd /content/pytorch-ssd`

`/content/pytorch-ssd`

In []: `!python train_ssd.py --dataset_type open_images --num_workers 0 --datasets da`

`/usr/local/lib/python3.8/dist-packages/requests/__init__.py:89: RequestsDependencyWarning: urllib3 (1.26.13) or chardet (3.0.4) doesn't match a supported version!`

`warnings.warn("urllib3 ({} or chardet ({} doesn't match a supported "`
 2022-12-12 19:09:47,121 - root - INFO - Namespace(balance_data=False, base_net=None, base_net_lr=0.001, batch_size=5, checkpoint_folder='models/', dataset_type='open_images', datasets=['data/open_images'], debug_steps=100, extra_layers_lr=None, freeze_base_net=False, freeze_net=False, gamma=0.1, lr=0.01, mb2_width_mult=1.0, milestones='80,100', momentum=0.9, net='mb1-ssd', num_epochs=2, num_workers=0, pretrained_ssd='models/mobilenet-v1-ssd-mp-0_675.pth', resume=None, scheduler='cosine', t_max=100.0, use_cuda=True, validation_dataset=None, validation_epochs=1, weight_decay=0.0005)

2022-12-12 19:09:47,122 - root - INFO - Prepare training datasets.

2022-12-12 19:09:47,654 - root - INFO - Dataset Summary: Number of Images: 961
 Minimum Number of Images for a Class: -1

Label Distribution:

Handgun: 727

Shotgun: 580

2022-12-12 19:09:47,655 - root - INFO - Stored labels into file models/open-images-model-labels.txt.

2022-12-12 19:09:47,655 - root - INFO - Train dataset size: 961

2022-12-12 19:09:47,655 - root - INFO - Prepare Validation datasets.

2022-12-12 19:09:47,727 - root - INFO - Dataset Summary: Number of Images: 123
 Minimum Number of Images for a Class: -1

Label Distribution:

Handgun: 81

Shotgun: 66

2022-12-12 19:09:47,727 - root - INFO - validation dataset size: 123

2022-12-12 19:09:47,728 - root - INFO - Build network.

2022-12-12 19:09:47,804 - root - INFO - Init from pretrained ssd models/mobilenet-v1-ssd-mp-0_675.pth

2022-12-12 19:09:47,859 - root - INFO - Took 0.05 seconds to load the model.

2022-12-12 19:09:47,861 - root - INFO - Learning rate: 0.01, Base net learning rate: 0.001, Extra Layers learning rate: 0.01.

2022-12-12 19:09:47,861 - root - INFO - Uses CosineAnnealingLR scheduler.

2022-12-12 19:09:47,861 - root - INFO - Start training from epoch 0.

`/usr/local/lib/python3.8/dist-packages/torch/optim/lr_scheduler.py:138: UserWarning: Detected call of `lr_scheduler.step()` before `optimizer.step()`. In PyTorch 1.1.0 and later, you should call them in the opposite order: `optimizer.step()` before `lr_scheduler.step()`. Failure to do this will result in PyTorch skipping the first value of the learning rate schedule. See more details at https://pytorch.org/docs/stable/optim.html#how-to-adjust-learning-rate`

`warnings.warn("Detected call of `lr_scheduler.step()` before `optimizer.step()`. "`

`/content/pytorch-ssd/vision/transforms/transforms.py:247: VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths or shapes) is deprecated. If you meant to do this, you must specify 'dtype=object' when creating the ndarray.`

`mode = random.choice(self.sample_options)`

`/usr/local/lib/python3.8/dist-packages/torch/nn/_reduction.py:42: UserWarning: size_average and reduce args will be deprecated, please use reduction='sum' instead.`

`warnings.warn(warning.format(ret))`

2022-12-12 19:12:57,022 - root - INFO - Epoch: 0, Step: 100, Average Loss: 5.6664, Average Regression Loss 2.2437, Average Classification Loss: 3.4227

2022-12-12 19:15:49,897 - root - INFO - Epoch: 0, Validation Loss: 3.8250, Validation Regression Loss 1.3816, Validation Classification Loss: 2.4434

2022-12-12 19:15:49,946 - root - INFO - Saved model models/mb1-ssd-Epoch-0-Loss-3.8250466537475587.pth

2022-12-12 19:18:51,219 - root - INFO - Epoch: 1, Step: 100, Average Loss: 4.3

584, Average Regression Loss 1.6124, Average Classification Loss: 2.7460
 2022-12-12 19:21:47,728 - root - INFO - Epoch: 1, Validation Loss: 3.5291, Validation Regression Loss 1.2304, Validation Classification Loss: 2.2986
 2022-12-12 19:21:47,772 - root - INFO - Saved model models/mb1-ssd-Epoch-1-Loss-3.5290506076812744.pth

```
In [ ]: #Pre Training
!python eval_ssd.py --net mb1-ssd --dataset_type open_images --dataset data/

#Pre training precision per class

/usr/local/lib/python3.8/dist-packages/requests/__init__.py:89: RequestsDependencyWarning: urllib3 (1.26.13) or chardet (3.0.4) doesn't match a supported version!
  warnings.warn("urllib3 ({}), or chardet ({}), doesn't match a supported version".format(urllib3.__version__, chardet.__version__), RequestsDependencyWarning)

eval_ssd.py:69: UserWarning: To copy construct from a tensor, it is recommended to use sourceTensor.clone().detach() or sourceTensor.clone().detach().requires_grad_(True), rather than torch.tensor(sourceTensor).
  all_gt_boxes[class_index][image_id] = torch.tensor(all_gt_boxes[class_index][image_id])

It took 0.04267072677612305 seconds to load the model.
process image 0
Load Image: 0.022537 seconds.
Inference time: 0.13198637962341309
Prediction: 0.148028 seconds.
process image 1
Load Image: 0.010336 seconds.
Inference time: 0.08928203582763672
Prediction: 0.100380 seconds.
process image 2
Load Image: 0.009272 seconds.
Inference time: 0.08698916435241699
Prediction: 0.101871 seconds.
process image 3
Load Image: 0.014777 seconds.
Inference time: 0.08714509010314941
Prediction: 0.104056 seconds.
process image 4
Load Image: 0.019027 seconds.
Inference time: 0.08803415298461914
Prediction: 0.102346 seconds.
process image 5
Load Image: 0.012134 seconds.
Inference time: 0.09016084671020508
Prediction: 0.102662 seconds.
process image 6
Load Image: 0.010605 seconds.
Inference time: 0.09569931030273438
Prediction: 0.109349 seconds.
process image 7
Load Image: 0.014143 seconds.
Inference time: 0.08812355995178223
Prediction: 0.101361 seconds.
process image 8
Load Image: 0.014986 seconds.
Inference time: 0.08304762840270996
Prediction: 0.098905 seconds.
process image 9
Load Image: 0.017291 seconds.
Inference time: 0.09193682670593262
Prediction: 0.106487 seconds.
process image 10
Load Image: 0.018095 seconds.
Inference time: 0.08589434623718262
Prediction: 0.103168 seconds.
process image 11
Load Image: 0.005245 seconds.
Inference time: 0.08354425430297852
Prediction: 0.100883 seconds.
```


process image 12
Load Image: 0.010213 seconds.
Inference time: 0.09005045890808105
Prediction: 0.104948 seconds.
process image 13
Load Image: 0.010807 seconds.
Inference time: 0.0893552303314209
Prediction: 0.107348 seconds.
process image 14
Load Image: 0.018023 seconds.
Inference time: 0.08375048637390137
Prediction: 0.098173 seconds.
process image 15
Load Image: 0.017131 seconds.
Inference time: 0.0932154655456543
Prediction: 0.108182 seconds.
process image 16
Load Image: 0.018036 seconds.
Inference time: 0.08440995216369629
Prediction: 0.099674 seconds.
process image 17
Load Image: 0.017291 seconds.
Inference time: 0.08527302742004395
Prediction: 0.107128 seconds.
process image 18
Load Image: 0.018148 seconds.
Inference time: 0.09422564506530762
Prediction: 0.107036 seconds.
process image 19
Load Image: 0.009659 seconds.
Inference time: 0.0942080020904541
Prediction: 0.119222 seconds.
process image 20
Load Image: 0.014414 seconds.
Inference time: 0.08646583557128906
Prediction: 0.110143 seconds.
process image 21
Load Image: 0.008673 seconds.
Inference time: 0.08524155616760254
Prediction: 0.099021 seconds.
process image 22
Load Image: 0.013958 seconds.
Inference time: 0.0875551700592041
Prediction: 0.100960 seconds.
process image 23
Load Image: 0.011475 seconds.
Inference time: 0.09349775314331055
Prediction: 0.114823 seconds.
process image 24
Load Image: 0.028289 seconds.
Inference time: 0.08377575874328613
Prediction: 0.099938 seconds.
process image 25
Load Image: 0.020124 seconds.
Inference time: 0.08385968208312988
Prediction: 0.095536 seconds.
process image 26
Load Image: 0.013227 seconds.
Inference time: 0.08819890022277832
Prediction: 0.104390 seconds.
process image 27
Load Image: 0.012861 seconds.
Inference time: 0.08658051490783691
Prediction: 0.107573 seconds.
process image 28
Load Image: 0.016261 seconds.
Inference time: 0.08846092224121094
Prediction: 0.105676 seconds.
process image 29

Load Image: 0.007850 seconds.
Inference time: 0.08334946632385254
Prediction: 0.098203 seconds.
process image 30
Load Image: 0.027206 seconds.
Inference time: 0.08344030380249023
Prediction: 0.100114 seconds.
process image 31
Load Image: 0.009714 seconds.
Inference time: 0.08416485786437988
Prediction: 0.100611 seconds.
process image 32
Load Image: 0.013481 seconds.
Inference time: 0.10687589645385742
Prediction: 0.127990 seconds.
process image 33
Load Image: 0.021411 seconds.
Inference time: 0.08501195907592773
Prediction: 0.099761 seconds.
process image 34
Load Image: 0.013035 seconds.
Inference time: 0.08460283279418945
Prediction: 0.098546 seconds.
process image 35
Load Image: 0.011770 seconds.
Inference time: 0.08715939521789551
Prediction: 0.103153 seconds.
process image 36
Load Image: 0.022769 seconds.
Inference time: 0.08703804016113281
Prediction: 0.100337 seconds.
process image 37
Load Image: 0.010912 seconds.
Inference time: 0.09051275253295898
Prediction: 0.103607 seconds.
process image 38
Load Image: 0.017200 seconds.
Inference time: 0.08960103988647461
Prediction: 0.104183 seconds.
process image 39
Load Image: 0.014100 seconds.
Inference time: 0.08491849899291992
Prediction: 0.096315 seconds.
process image 40
Load Image: 0.012150 seconds.
Inference time: 0.08624148368835449
Prediction: 0.105990 seconds.
process image 41
Load Image: 0.029027 seconds.
Inference time: 0.08412742614746094
Prediction: 0.097815 seconds.
process image 42
Load Image: 0.010533 seconds.
Inference time: 0.08657050132751465
Prediction: 0.099845 seconds.
process image 43
Load Image: 0.020067 seconds.
Inference time: 0.08435320854187012
Prediction: 0.098515 seconds.
process image 44
Load Image: 0.025420 seconds.
Inference time: 0.08438539505004883
Prediction: 0.098879 seconds.
process image 45
Load Image: 0.014080 seconds.
Inference time: 0.08956646919250488
Prediction: 0.102209 seconds.
process image 46
Load Image: 0.006127 seconds.

Inference time: 0.0888972282409668
Prediction: 0.106529 seconds.
process image 47
Load Image: 0.029310 seconds.
Inference time: 0.08682894706726074
Prediction: 0.100192 seconds.
process image 48
Load Image: 0.011423 seconds.
Inference time: 0.08597660064697266
Prediction: 0.100228 seconds.
process image 49
Load Image: 0.016916 seconds.
Inference time: 0.09209227561950684
Prediction: 0.105939 seconds.
process image 50
Load Image: 0.015915 seconds.
Inference time: 0.08608102798461914
Prediction: 0.103110 seconds.
process image 51
Load Image: 0.009455 seconds.
Inference time: 0.08981919288635254
Prediction: 0.105746 seconds.
process image 52
Load Image: 0.006185 seconds.
Inference time: 0.08857226371765137
Prediction: 0.109067 seconds.
process image 53
Load Image: 0.016581 seconds.
Inference time: 0.0867013931274414
Prediction: 0.104649 seconds.
process image 54
Load Image: 0.010860 seconds.
Inference time: 0.08436441421508789
Prediction: 0.098453 seconds.
process image 55
Load Image: 0.011266 seconds.
Inference time: 0.08817267417907715
Prediction: 0.101933 seconds.
process image 56
Load Image: 0.013646 seconds.
Inference time: 0.09542179107666016
Prediction: 0.110026 seconds.
process image 57
Load Image: 0.027849 seconds.
Inference time: 0.09293961524963379
Prediction: 0.107325 seconds.
process image 58
Load Image: 0.017696 seconds.
Inference time: 0.0959627628326416
Prediction: 0.116474 seconds.
process image 59
Load Image: 0.014106 seconds.
Inference time: 0.12659740447998047
Prediction: 0.155370 seconds.
process image 60
Load Image: 0.018886 seconds.
Inference time: 0.1266036033630371
Prediction: 0.153208 seconds.
process image 61
Load Image: 0.026561 seconds.
Inference time: 0.13624262809753418
Prediction: 0.161769 seconds.
process image 62
Load Image: 0.035157 seconds.
Inference time: 0.12920713424682617
Prediction: 0.150811 seconds.
process image 63
Load Image: 0.045916 seconds.
Inference time: 0.12793588638305664

Prediction: 0.151849 seconds.
process image 64
Load Image: 0.023300 seconds.
Inference time: 0.13313555717468262
Prediction: 0.157026 seconds.
process image 65
Load Image: 0.025663 seconds.
Inference time: 0.1372363567352295
Prediction: 0.161111 seconds.
process image 66
Load Image: 0.025103 seconds.
Inference time: 0.13691425323486328
Prediction: 0.164433 seconds.
process image 67
Load Image: 0.027779 seconds.
Inference time: 0.12533330917358398
Prediction: 0.144239 seconds.
process image 68
Load Image: 0.024650 seconds.
Inference time: 0.12902569770812988
Prediction: 0.148508 seconds.
process image 69
Load Image: 0.015830 seconds.
Inference time: 0.13371944427490234
Prediction: 0.165799 seconds.
process image 70
Load Image: 0.009410 seconds.
Inference time: 0.12659287452697754
Prediction: 0.143786 seconds.
process image 71
Load Image: 0.017254 seconds.
Inference time: 0.12590980529785156
Prediction: 0.147644 seconds.
process image 72
Load Image: 0.023736 seconds.
Inference time: 0.13612627983093262
Prediction: 0.165505 seconds.
process image 73
Load Image: 0.012703 seconds.
Inference time: 0.13263416290283203
Prediction: 0.154041 seconds.
process image 74
Load Image: 0.018621 seconds.
Inference time: 0.12595057487487793
Prediction: 0.148653 seconds.
process image 75
Load Image: 0.018807 seconds.
Inference time: 0.12652897834777832
Prediction: 0.151534 seconds.
process image 76
Load Image: 0.024910 seconds.
Inference time: 0.1282806396484375
Prediction: 0.151650 seconds.
process image 77
Load Image: 0.023252 seconds.
Inference time: 0.1293344497680664
Prediction: 0.154125 seconds.
process image 78
Load Image: 0.023801 seconds.
Inference time: 0.1233525276184082
Prediction: 0.148013 seconds.
process image 79
Load Image: 0.030123 seconds.
Inference time: 0.12574315071105957
Prediction: 0.153087 seconds.
process image 80
Load Image: 0.015578 seconds.
Inference time: 0.0843191146850586
Prediction: 0.100817 seconds.

process image 81
Load Image: 0.011041 seconds.
Inference time: 0.08564639091491699
Prediction: 0.099457 seconds.
process image 82
Load Image: 0.014225 seconds.
Inference time: 0.10002613067626953
Prediction: 0.115444 seconds.
process image 83
Load Image: 0.010370 seconds.
Inference time: 0.08752942085266113
Prediction: 0.100637 seconds.
process image 84
Load Image: 0.018499 seconds.
Inference time: 0.08204507827758789
Prediction: 0.094293 seconds.
process image 85
Load Image: 0.013351 seconds.
Inference time: 0.0879666805267334
Prediction: 0.106542 seconds.
process image 86
Load Image: 0.016782 seconds.
Inference time: 0.09087991714477539
Prediction: 0.110537 seconds.
process image 87
Load Image: 0.014094 seconds.
Inference time: 0.08652019500732422
Prediction: 0.100890 seconds.
process image 88
Load Image: 0.016205 seconds.
Inference time: 0.08910489082336426
Prediction: 0.109193 seconds.
process image 89
Load Image: 0.015105 seconds.
Inference time: 0.0865473747253418
Prediction: 0.102942 seconds.
process image 90
Load Image: 0.012738 seconds.
Inference time: 0.0829315185546875
Prediction: 0.098264 seconds.
process image 91
Load Image: 0.013903 seconds.
Inference time: 0.09564423561096191
Prediction: 0.108729 seconds.
process image 92
Load Image: 0.016797 seconds.
Inference time: 0.08381319046020508
Prediction: 0.100166 seconds.
process image 93
Load Image: 0.008261 seconds.
Inference time: 0.0837547779083252
Prediction: 0.107072 seconds.
process image 94
Load Image: 0.012872 seconds.
Inference time: 0.08321714401245117
Prediction: 0.101364 seconds.
process image 95
Load Image: 0.017921 seconds.
Inference time: 0.08884000778198242
Prediction: 0.104635 seconds.
process image 96
Load Image: 0.010840 seconds.
Inference time: 0.09812045097351074
Prediction: 0.114836 seconds.
process image 97
Load Image: 0.009557 seconds.
Inference time: 0.08530902862548828
Prediction: 0.100635 seconds.
process image 98

Load Image: 0.017666 seconds.
Inference time: 0.09703254699707031
Prediction: 0.113153 seconds.
process image 99
Load Image: 0.011718 seconds.
Inference time: 0.09170246124267578
Prediction: 0.119281 seconds.
process image 100
Load Image: 0.035549 seconds.
Inference time: 0.08873605728149414
Prediction: 0.102371 seconds.
process image 101
Load Image: 0.017390 seconds.
Inference time: 0.08701014518737793
Prediction: 0.106684 seconds.
process image 102
Load Image: 0.024504 seconds.
Inference time: 0.0992882251739502
Prediction: 0.115700 seconds.
process image 103
Load Image: 0.009945 seconds.
Inference time: 0.08754277229309082
Prediction: 0.101151 seconds.
process image 104
Load Image: 0.012257 seconds.
Inference time: 0.08621001243591309
Prediction: 0.100870 seconds.
process image 105
Load Image: 0.015049 seconds.
Inference time: 0.09241819381713867
Prediction: 0.106017 seconds.
process image 106
Load Image: 0.021196 seconds.
Inference time: 0.0903923511505127
Prediction: 0.105163 seconds.
process image 107
Load Image: 0.012801 seconds.
Inference time: 0.10823798179626465
Prediction: 0.123395 seconds.
process image 108
Load Image: 0.013747 seconds.
Inference time: 0.08874297142028809
Prediction: 0.102417 seconds.
process image 109
Load Image: 0.015889 seconds.
Inference time: 0.0841062068939209
Prediction: 0.099704 seconds.
process image 110
Load Image: 0.016214 seconds.
Inference time: 0.08617091178894043
Prediction: 0.102204 seconds.
process image 111
Load Image: 0.015540 seconds.
Inference time: 0.08363461494445801
Prediction: 0.097448 seconds.
process image 112
Load Image: 0.014157 seconds.
Inference time: 0.08716988563537598
Prediction: 0.102013 seconds.
process image 113
Load Image: 0.013718 seconds.
Inference time: 0.08657050132751465
Prediction: 0.107425 seconds.
process image 114
Load Image: 0.006032 seconds.
Inference time: 0.08669781684875488
Prediction: 0.101118 seconds.
process image 115
Load Image: 0.031315 seconds.

```

Inference time: 0.08883476257324219
Prediction: 0.102818 seconds.
process image 116
Load Image: 0.018844 seconds.
Inference time: 0.09568643569946289
Prediction: 0.113334 seconds.
process image 117
Load Image: 0.019373 seconds.
Inference time: 0.08827018737792969
Prediction: 0.105889 seconds.
process image 118
Load Image: 0.018232 seconds.
Inference time: 0.08641886711120605
Prediction: 0.100293 seconds.
process image 119
Load Image: 0.007848 seconds.
Inference time: 0.08877158164978027
Prediction: 0.104705 seconds.
process image 120
Load Image: 0.028964 seconds.
Inference time: 0.08583426475524902
Prediction: 0.101496 seconds.
process image 121
Load Image: 0.033685 seconds.
Inference time: 0.08378744125366211
Prediction: 0.098486 seconds.
process image 122
Load Image: 0.017631 seconds.
Inference time: 0.0877385139465332
Prediction: 0.105090 seconds.

```

Average Precision Per-class:

Handgun: 0.7707385024601339

Shotgun: 0.414184897302562

Average Precision Across All Classes:0.5924616998813479

```

In [ ]: #Post Training
!python eval_ssd.py --net mbl-ssd --dataset_type open_images --dataset data/

#post training precision

/usr/local/lib/python3.8/dist-packages/requests/__init__.py:89: RequestsDependencyWarning: urllib3 (1.26.13) or chardet (3.0.4) doesn't match a supported version!
  warnings.warn("urllib3 ({}), or chardet ({}), doesn't match a supported version".format(urllib3.__version__, chardet.__version__), RequestsDependencyWarning)
eval_ssd.py:69: UserWarning: To copy construct from a tensor, it is recommended to use sourceTensor.clone().detach() or sourceTensor.clone().detach().requires_grad_(True), rather than torch.tensor(sourceTensor).
  all_gt_boxes[class_index][image_id] = torch.tensor(all_gt_boxes[class_index][image_id])
It took 0.041754722595214844 seconds to load the model.
process image 0
Load Image: 0.023102 seconds.
Inference time: 0.09867477416992188
Prediction: 0.113857 seconds.
process image 1
Load Image: 0.010207 seconds.
Inference time: 0.09036827087402344
Prediction: 0.105100 seconds.
process image 2
Load Image: 0.009313 seconds.
Inference time: 0.08774280548095703
Prediction: 0.101868 seconds.
process image 3
Load Image: 0.012305 seconds.
Inference time: 0.08848977088928223

```

Prediction: 0.105222 seconds.
process image 4
Load Image: 0.017234 seconds.
Inference time: 0.0906682014465332
Prediction: 0.104562 seconds.
process image 5
Load Image: 0.011671 seconds.
Inference time: 0.08504438400268555
Prediction: 0.096990 seconds.
process image 6
Load Image: 0.011103 seconds.
Inference time: 0.08886027336120605
Prediction: 0.102368 seconds.
process image 7
Load Image: 0.019882 seconds.
Inference time: 0.0891118049621582
Prediction: 0.102431 seconds.
process image 8
Load Image: 0.015564 seconds.
Inference time: 0.08348226547241211
Prediction: 0.102903 seconds.
process image 9
Load Image: 0.018339 seconds.
Inference time: 0.0880732536315918
Prediction: 0.102448 seconds.
process image 10
Load Image: 0.018178 seconds.
Inference time: 0.08424234390258789
Prediction: 0.098944 seconds.
process image 11
Load Image: 0.007384 seconds.
Inference time: 0.0902860164642334
Prediction: 0.108195 seconds.
process image 12
Load Image: 0.010602 seconds.
Inference time: 0.08563923835754395
Prediction: 0.100236 seconds.
process image 13
Load Image: 0.011475 seconds.
Inference time: 0.08372950553894043
Prediction: 0.099321 seconds.
process image 14
Load Image: 0.021825 seconds.
Inference time: 0.08312773704528809
Prediction: 0.100262 seconds.
process image 15
Load Image: 0.016147 seconds.
Inference time: 0.09183883666992188
Prediction: 0.106763 seconds.
process image 16
Load Image: 0.016785 seconds.
Inference time: 0.08806324005126953
Prediction: 0.104542 seconds.
process image 17
Load Image: 0.017339 seconds.
Inference time: 0.09044861793518066
Prediction: 0.113874 seconds.
process image 18
Load Image: 0.019114 seconds.
Inference time: 0.08442020416259766
Prediction: 0.096633 seconds.
process image 19
Load Image: 0.011789 seconds.
Inference time: 0.09063005447387695
Prediction: 0.117954 seconds.
process image 20
Load Image: 0.014774 seconds.
Inference time: 0.08432841300964355
Prediction: 0.102481 seconds.

process image 21
Load Image: 0.010413 seconds.
Inference time: 0.08886456489562988
Prediction: 0.102924 seconds.
process image 22
Load Image: 0.014621 seconds.
Inference time: 0.08870077133178711
Prediction: 0.102467 seconds.
process image 23
Load Image: 0.011518 seconds.
Inference time: 0.0860910415649414
Prediction: 0.099435 seconds.
process image 24
Load Image: 0.040225 seconds.
Inference time: 0.10202383995056152
Prediction: 0.117971 seconds.
process image 25
Load Image: 0.020578 seconds.
Inference time: 0.10055255889892578
Prediction: 0.112444 seconds.
process image 26
Load Image: 0.014277 seconds.
Inference time: 0.08662581443786621
Prediction: 0.104469 seconds.
process image 27
Load Image: 0.013469 seconds.
Inference time: 0.0846261978149414
Prediction: 0.107802 seconds.
process image 28
Load Image: 0.016711 seconds.
Inference time: 0.08991074562072754
Prediction: 0.105871 seconds.
process image 29
Load Image: 0.008885 seconds.
Inference time: 0.08573508262634277
Prediction: 0.101022 seconds.
process image 30
Load Image: 0.024720 seconds.
Inference time: 0.08613801002502441
Prediction: 0.099370 seconds.
process image 31
Load Image: 0.009371 seconds.
Inference time: 0.0931708812713623
Prediction: 0.113749 seconds.
process image 32
Load Image: 0.014039 seconds.
Inference time: 0.09232807159423828
Prediction: 0.106908 seconds.
process image 33
Load Image: 0.021882 seconds.
Inference time: 0.08664131164550781
Prediction: 0.102023 seconds.
process image 34
Load Image: 0.012882 seconds.
Inference time: 0.0912480354309082
Prediction: 0.103521 seconds.
process image 35
Load Image: 0.010200 seconds.
Inference time: 0.08360576629638672
Prediction: 0.099645 seconds.
process image 36
Load Image: 0.023060 seconds.
Inference time: 0.08866071701049805
Prediction: 0.101808 seconds.
process image 37
Load Image: 0.011729 seconds.
Inference time: 0.08751082420349121
Prediction: 0.100750 seconds.
process image 38

Load Image: 0.018556 seconds.
Inference time: 0.09065580368041992
Prediction: 0.108546 seconds.
process image 39
Load Image: 0.013856 seconds.
Inference time: 0.08681035041809082
Prediction: 0.101846 seconds.
process image 40
Load Image: 0.012824 seconds.
Inference time: 0.08573055267333984
Prediction: 0.102933 seconds.
process image 41
Load Image: 0.020724 seconds.
Inference time: 0.08759474754333496
Prediction: 0.102009 seconds.
process image 42
Load Image: 0.010838 seconds.
Inference time: 0.08997583389282227
Prediction: 0.103364 seconds.
process image 43
Load Image: 0.020129 seconds.
Inference time: 0.1104423999786377
Prediction: 0.125921 seconds.
process image 44
Load Image: 0.026068 seconds.
Inference time: 0.08582067489624023
Prediction: 0.101686 seconds.
process image 45
Load Image: 0.014790 seconds.
Inference time: 0.08631110191345215
Prediction: 0.099223 seconds.
process image 46
Load Image: 0.005600 seconds.
Inference time: 0.08813071250915527
Prediction: 0.104650 seconds.
process image 47
Load Image: 0.030391 seconds.
Inference time: 0.0844120979309082
Prediction: 0.098781 seconds.
process image 48
Load Image: 0.011626 seconds.
Inference time: 0.08762192726135254
Prediction: 0.102076 seconds.
process image 49
Load Image: 0.017559 seconds.
Inference time: 0.09818720817565918
Prediction: 0.111880 seconds.
process image 50
Load Image: 0.016139 seconds.
Inference time: 0.08709073066711426
Prediction: 0.105728 seconds.
process image 51
Load Image: 0.009719 seconds.
Inference time: 0.09632611274719238
Prediction: 0.111667 seconds.
process image 52
Load Image: 0.006273 seconds.
Inference time: 0.09031200408935547
Prediction: 0.107772 seconds.
process image 53
Load Image: 0.016722 seconds.
Inference time: 0.09112071990966797
Prediction: 0.106647 seconds.
process image 54
Load Image: 0.011138 seconds.
Inference time: 0.09235548973083496
Prediction: 0.106638 seconds.
process image 55
Load Image: 0.012051 seconds.

Inference time: 0.0865027904510498
Prediction: 0.099271 seconds.
process image 56
Load Image: 0.013623 seconds.
Inference time: 0.08819150924682617
Prediction: 0.102268 seconds.
process image 57
Load Image: 0.027325 seconds.
Inference time: 0.09552907943725586
Prediction: 0.110000 seconds.
process image 58
Load Image: 0.016783 seconds.
Inference time: 0.08807110786437988
Prediction: 0.108588 seconds.
process image 59
Load Image: 0.009690 seconds.
Inference time: 0.0924367904663086
Prediction: 0.113837 seconds.
process image 60
Load Image: 0.016509 seconds.
Inference time: 0.08723640441894531
Prediction: 0.105946 seconds.
process image 61
Load Image: 0.015581 seconds.
Inference time: 0.08881473541259766
Prediction: 0.107523 seconds.
process image 62
Load Image: 0.021809 seconds.
Inference time: 0.08928179740905762
Prediction: 0.105924 seconds.
process image 63
Load Image: 0.023290 seconds.
Inference time: 0.08979225158691406
Prediction: 0.104390 seconds.
process image 64
Load Image: 0.012168 seconds.
Inference time: 0.0874185562133789
Prediction: 0.102983 seconds.
process image 65
Load Image: 0.014283 seconds.
Inference time: 0.08555173873901367
Prediction: 0.101278 seconds.
process image 66
Load Image: 0.023304 seconds.
Inference time: 0.08829689025878906
Prediction: 0.104536 seconds.
process image 67
Load Image: 0.017772 seconds.
Inference time: 0.0943305492401123
Prediction: 0.107922 seconds.
process image 68
Load Image: 0.016154 seconds.
Inference time: 0.09350180625915527
Prediction: 0.107405 seconds.
process image 69
Load Image: 0.009476 seconds.
Inference time: 0.08476972579956055
Prediction: 0.102153 seconds.
process image 70
Load Image: 0.006039 seconds.
Inference time: 0.09177184104919434
Prediction: 0.103381 seconds.
process image 71
Load Image: 0.010569 seconds.
Inference time: 0.0906686782836914
Prediction: 0.105054 seconds.
process image 72
Load Image: 0.016324 seconds.
Inference time: 0.08726000785827637

Prediction: 0.107675 seconds.
process image 73
Load Image: 0.006905 seconds.
Inference time: 0.08753228187561035
Prediction: 0.101233 seconds.
process image 74
Load Image: 0.009555 seconds.
Inference time: 0.09682154655456543
Prediction: 0.110988 seconds.
process image 75
Load Image: 0.011080 seconds.
Inference time: 0.0843665599822998
Prediction: 0.099115 seconds.
process image 76
Load Image: 0.013939 seconds.
Inference time: 0.08978557586669922
Prediction: 0.103770 seconds.
process image 77
Load Image: 0.015579 seconds.
Inference time: 0.08969759941101074
Prediction: 0.104994 seconds.
process image 78
Load Image: 0.016512 seconds.
Inference time: 0.08470439910888672
Prediction: 0.104422 seconds.
process image 79
Load Image: 0.016597 seconds.
Inference time: 0.09171485900878906
Prediction: 0.110041 seconds.
process image 80
Load Image: 0.011656 seconds.
Inference time: 0.08372092247009277
Prediction: 0.098741 seconds.
process image 81
Load Image: 0.010885 seconds.
Inference time: 0.08575868606567383
Prediction: 0.100115 seconds.
process image 82
Load Image: 0.012912 seconds.
Inference time: 0.08297371864318848
Prediction: 0.095861 seconds.
process image 83
Load Image: 0.010081 seconds.
Inference time: 0.09760451316833496
Prediction: 0.110981 seconds.
process image 84
Load Image: 0.021447 seconds.
Inference time: 0.08500480651855469
Prediction: 0.097337 seconds.
process image 85
Load Image: 0.013463 seconds.
Inference time: 0.08276820182800293
Prediction: 0.100983 seconds.
process image 86
Load Image: 0.016443 seconds.
Inference time: 0.08704090118408203
Prediction: 0.105749 seconds.
process image 87
Load Image: 0.013552 seconds.
Inference time: 0.08813905715942383
Prediction: 0.102470 seconds.
process image 88
Load Image: 0.016486 seconds.
Inference time: 0.09245777130126953
Prediction: 0.112752 seconds.
process image 89
Load Image: 0.017644 seconds.
Inference time: 0.08992385864257812
Prediction: 0.106481 seconds.

```
process image 90
Load Image: 0.012800 seconds.
Inference time: 0.08436346054077148
Prediction: 0.099878 seconds.
process image 91
Load Image: 0.013885 seconds.
Inference time: 0.09096169471740723
Prediction: 0.104199 seconds.
process image 92
Load Image: 0.026103 seconds.
Inference time: 0.08300542831420898
Prediction: 0.099773 seconds.
process image 93
Load Image: 0.007876 seconds.
Inference time: 0.08433151245117188
Prediction: 0.102805 seconds.
process image 94
Load Image: 0.012367 seconds.
Inference time: 0.08649015426635742
Prediction: 0.104597 seconds.
process image 95
Load Image: 0.018018 seconds.
Inference time: 0.08860111236572266
Prediction: 0.108449 seconds.
process image 96
Load Image: 0.010926 seconds.
Inference time: 0.08470535278320312
Prediction: 0.102657 seconds.
process image 97
Load Image: 0.008779 seconds.
Inference time: 0.08925056457519531
Prediction: 0.104831 seconds.
process image 98
Load Image: 0.017480 seconds.
Inference time: 0.09355568885803223
Prediction: 0.109052 seconds.
process image 99
Load Image: 0.012075 seconds.
Inference time: 0.08907723426818848
Prediction: 0.103450 seconds.
process image 100
Load Image: 0.019172 seconds.
Inference time: 0.09123730659484863
Prediction: 0.107472 seconds.
process image 101
Load Image: 0.017163 seconds.
Inference time: 0.0837411880493164
Prediction: 0.103490 seconds.
process image 102
Load Image: 0.026579 seconds.
Inference time: 0.08820581436157227
Prediction: 0.105362 seconds.
process image 103
Load Image: 0.009814 seconds.
Inference time: 0.08654379844665527
Prediction: 0.100472 seconds.
process image 104
Load Image: 0.013605 seconds.
Inference time: 0.08457303047180176
Prediction: 0.099865 seconds.
process image 105
Load Image: 0.014074 seconds.
Inference time: 0.08416628837585449
Prediction: 0.098588 seconds.
process image 106
Load Image: 0.025225 seconds.
Inference time: 0.08395552635192871
Prediction: 0.098509 seconds.
process image 107
```

Load Image: 0.012557 seconds.
Inference time: 0.09137296676635742
Prediction: 0.106681 seconds.
process image 108
Load Image: 0.010866 seconds.
Inference time: 0.08680868148803711
Prediction: 0.100288 seconds.
process image 109
Load Image: 0.015942 seconds.
Inference time: 0.09586787223815918
Prediction: 0.111554 seconds.
process image 110
Load Image: 0.015454 seconds.
Inference time: 0.08402276039123535
Prediction: 0.099240 seconds.
process image 111
Load Image: 0.016155 seconds.
Inference time: 0.08313846588134766
Prediction: 0.097594 seconds.
process image 112
Load Image: 0.015828 seconds.
Inference time: 0.08718276023864746
Prediction: 0.101408 seconds.
process image 113
Load Image: 0.013739 seconds.
Inference time: 0.08725714683532715
Prediction: 0.103196 seconds.
process image 114
Load Image: 0.005788 seconds.
Inference time: 0.08873867988586426
Prediction: 0.103656 seconds.
process image 115
Load Image: 0.030972 seconds.
Inference time: 0.0828709602355957
Prediction: 0.096752 seconds.
process image 116
Load Image: 0.018532 seconds.
Inference time: 0.08558154106140137
Prediction: 0.102262 seconds.
process image 117
Load Image: 0.018214 seconds.
Inference time: 0.09326767921447754
Prediction: 0.110672 seconds.
process image 118
Load Image: 0.017492 seconds.
Inference time: 0.08777713775634766
Prediction: 0.101924 seconds.
process image 119
Load Image: 0.007817 seconds.
Inference time: 0.08599734306335449
Prediction: 0.108898 seconds.
process image 120
Load Image: 0.032087 seconds.
Inference time: 0.08525490760803223
Prediction: 0.099228 seconds.
process image 121
Load Image: 0.032301 seconds.
Inference time: 0.08866262435913086
Prediction: 0.103764 seconds.
process image 122
Load Image: 0.017449 seconds.
Inference time: 0.08255791664123535
Prediction: 0.100032 seconds.

Average Precision Per-class:
Handgun: 0.7707385024601339
Shotgun: 0.414184897302562

Average Precision Across All Classes:0.5924616998813479

3. Convert the Pytorch model to ONNX format and save it. (4)

```
In [ ]: import torch
```

```
In [ ]: label_file = 'models/open-images-model-labels.txt'
path = ('/content/pytorch-ssd/models/mb1-ssd-Epoch-1-Loss-3.5290506076812744.')
class_names = [name.strip() for name in open(label_file).readlines()]
```

```
In [ ]: model = torch.load(path)
```

```
In [ ]: from vision.ssd.mobilenetv1_ssd import create_mobilenetv1_ssd, create_mobilenetv1_ssd
net = create_mobilenetv1_ssd(len(class_names), is_test=True)
type(net)
net.load(path)
net.eval()
```

```
Out[ ]: SSD(
  (base_net): Sequential(
    (0): Sequential(
      (0): Conv2d(3, 32, kernel_size=(3, 3), stride=(2, 2), padding=(1, 1), bias=False)
      (1): BatchNorm2d(32, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
      (2): ReLU(inplace=True)
    )
    (1): Sequential(
      (0): Conv2d(32, 32, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1), groups=32, bias=False)
      (1): BatchNorm2d(32, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
      (2): ReLU(inplace=True)
      (3): Conv2d(32, 64, kernel_size=(1, 1), stride=(1, 1), bias=False)
      (4): BatchNorm2d(64, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
      (5): ReLU(inplace=True)
    )
    (2): Sequential(
      (0): Conv2d(64, 64, kernel_size=(3, 3), stride=(2, 2), padding=(1, 1), groups=64, bias=False)
      (1): BatchNorm2d(64, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
      (2): ReLU(inplace=True)
      (3): Conv2d(64, 128, kernel_size=(1, 1), stride=(1, 1), bias=False)
      (4): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
      (5): ReLU(inplace=True)
    )
    (3): Sequential(
      (0): Conv2d(128, 128, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1), groups=128, bias=False)
      (1): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
      (2): ReLU(inplace=True)
      (3): Conv2d(128, 128, kernel_size=(1, 1), stride=(1, 1), bias=False)
      (4): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
      (5): ReLU(inplace=True)
    )
    (4): Sequential(
      (0): Conv2d(128, 128, kernel_size=(3, 3), stride=(2, 2), padding=(1, 1), groups=128, bias=False)
      (1): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
```

```

        (2): ReLU(inplace=True)
        (3): Conv2d(128, 256, kernel_size=(1, 1), stride=(1, 1), bias=False)
        (4): BatchNorm2d(256, eps=1e-05, momentum=0.1, affine=True, track_runnin
g_stats=True)
        (5): ReLU(inplace=True)
    )
    (5): Sequential(
      (0): Conv2d(256, 256, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1),
groups=256, bias=False)
      (1): BatchNorm2d(256, eps=1e-05, momentum=0.1, affine=True, track_runnin
g_stats=True)
      (2): ReLU(inplace=True)
      (3): Conv2d(256, 256, kernel_size=(1, 1), stride=(1, 1), bias=False)
      (4): BatchNorm2d(256, eps=1e-05, momentum=0.1, affine=True, track_runnin
g_stats=True)
      (5): ReLU(inplace=True)
    )
    (6): Sequential(
      (0): Conv2d(256, 256, kernel_size=(3, 3), stride=(2, 2), padding=(1, 1),
groups=256, bias=False)
      (1): BatchNorm2d(256, eps=1e-05, momentum=0.1, affine=True, track_runnin
g_stats=True)
      (2): ReLU(inplace=True)
      (3): Conv2d(256, 512, kernel_size=(1, 1), stride=(1, 1), bias=False)
      (4): BatchNorm2d(512, eps=1e-05, momentum=0.1, affine=True, track_runnin
g_stats=True)
      (5): ReLU(inplace=True)
    )
    (7): Sequential(
      (0): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1),
groups=512, bias=False)
      (1): BatchNorm2d(512, eps=1e-05, momentum=0.1, affine=True, track_runnin
g_stats=True)
      (2): ReLU(inplace=True)
      (3): Conv2d(512, 512, kernel_size=(1, 1), stride=(1, 1), bias=False)
      (4): BatchNorm2d(512, eps=1e-05, momentum=0.1, affine=True, track_runnin
g_stats=True)
      (5): ReLU(inplace=True)
    )
    (8): Sequential(
      (0): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1),
groups=512, bias=False)
      (1): BatchNorm2d(512, eps=1e-05, momentum=0.1, affine=True, track_runnin
g_stats=True)
      (2): ReLU(inplace=True)
      (3): Conv2d(512, 512, kernel_size=(1, 1), stride=(1, 1), bias=False)
      (4): BatchNorm2d(512, eps=1e-05, momentum=0.1, affine=True, track_runnin
g_stats=True)
      (5): ReLU(inplace=True)
    )
    (9): Sequential(
      (0): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1),
groups=512, bias=False)
      (1): BatchNorm2d(512, eps=1e-05, momentum=0.1, affine=True, track_runnin
g_stats=True)
      (2): ReLU(inplace=True)
      (3): Conv2d(512, 512, kernel_size=(1, 1), stride=(1, 1), bias=False)
      (4): BatchNorm2d(512, eps=1e-05, momentum=0.1, affine=True, track_runnin
g_stats=True)
      (5): ReLU(inplace=True)
    )
    (10): Sequential(
      (0): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1),
groups=512, bias=False)
      (1): BatchNorm2d(512, eps=1e-05, momentum=0.1, affine=True, track_runnin
g_stats=True)
      (2): ReLU(inplace=True)
      (3): Conv2d(512, 512, kernel_size=(1, 1), stride=(1, 1), bias=False)
      (4): BatchNorm2d(512, eps=1e-05, momentum=0.1, affine=True, track_runnin

```



```

g_stats=True)
    (5): ReLU(inplace=True)
    )
    (11): Sequential(
      (0): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1),
groups=512, bias=False)
      (1): BatchNorm2d(512, eps=1e-05, momentum=0.1, affine=True, track_runnin
g_stats=True)
      (2): ReLU(inplace=True)
      (3): Conv2d(512, 512, kernel_size=(1, 1), stride=(1, 1), bias=False)
      (4): BatchNorm2d(512, eps=1e-05, momentum=0.1, affine=True, track_runnin
g_stats=True)
      (5): ReLU(inplace=True)
    )
    (12): Sequential(
      (0): Conv2d(512, 512, kernel_size=(3, 3), stride=(2, 2), padding=(1, 1),
groups=512, bias=False)
      (1): BatchNorm2d(512, eps=1e-05, momentum=0.1, affine=True, track_runnin
g_stats=True)
      (2): ReLU(inplace=True)
      (3): Conv2d(512, 1024, kernel_size=(1, 1), stride=(1, 1), bias=False)
      (4): BatchNorm2d(1024, eps=1e-05, momentum=0.1, affine=True, track_runni
ng_stats=True)
      (5): ReLU(inplace=True)
    )
    (13): Sequential(
      (0): Conv2d(1024, 1024, kernel_size=(3, 3), stride=(1, 1), padding=(1,
1), groups=1024, bias=False)
      (1): BatchNorm2d(1024, eps=1e-05, momentum=0.1, affine=True, track_runni
ng_stats=True)
      (2): ReLU(inplace=True)
      (3): Conv2d(1024, 1024, kernel_size=(1, 1), stride=(1, 1), bias=False)
      (4): BatchNorm2d(1024, eps=1e-05, momentum=0.1, affine=True, track_runni
ng_stats=True)
      (5): ReLU(inplace=True)
    )
  )
  (extras): ModuleList(
    (0): Sequential(
      (0): Conv2d(1024, 256, kernel_size=(1, 1), stride=(1, 1))
      (1): ReLU()
      (2): Conv2d(256, 512, kernel_size=(3, 3), stride=(2, 2), padding=(1, 1))
      (3): ReLU()
    )
    (1): Sequential(
      (0): Conv2d(512, 128, kernel_size=(1, 1), stride=(1, 1))
      (1): ReLU()
      (2): Conv2d(128, 256, kernel_size=(3, 3), stride=(2, 2), padding=(1, 1))
      (3): ReLU()
    )
    (2): Sequential(
      (0): Conv2d(256, 128, kernel_size=(1, 1), stride=(1, 1))
      (1): ReLU()
      (2): Conv2d(128, 256, kernel_size=(3, 3), stride=(2, 2), padding=(1, 1))
      (3): ReLU()
    )
    (3): Sequential(
      (0): Conv2d(256, 128, kernel_size=(1, 1), stride=(1, 1))
      (1): ReLU()
      (2): Conv2d(128, 256, kernel_size=(3, 3), stride=(2, 2), padding=(1, 1))
      (3): ReLU()
    )
  )
  (classification_headers): ModuleList(
    (0): Conv2d(512, 18, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (1): Conv2d(1024, 18, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (2): Conv2d(512, 18, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (3): Conv2d(256, 18, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (4): Conv2d(256, 18, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  )

```

```

(5): Conv2d(256, 18, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
)
(regression_headers): ModuleList(
  (0): Conv2d(512, 24, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (1): Conv2d(1024, 24, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (2): Conv2d(512, 24, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (3): Conv2d(256, 24, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (4): Conv2d(256, 24, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (5): Conv2d(256, 24, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
)
(source_layer_add_ons): ModuleList()
)

```

```

In [ ]: import torch.onnx

def Convert_ONNX():

    model.eval()

    dummy_input = torch.randn(1, input_size, requires_grad=True)

    torch.onnx.export(model,
        dummy_input,
        "ImageClassifier.onnx",
        export_params=True,
        opset_version=10,
        do_constant_folding=True,
        input_names = ['modelInput'],
        output_names = ['modelOutput'],
        dynamic_axes={'modelInput' : {0 : 'batch_size'},
                      'modelOutput' : {0 : 'batch_size'}})

    print(" ")
    print('Model has been converted to ONNX')

```

```

In [ ]: #converting to model.onnx

import torch.onnx
import torchvision
import torch

dummy_input = torch.randn(1, 3, 300, 300)
state_dict = torch.load(path)
torch.onnx.export(net, dummy_input, "model.onnx", verbose=False, output_names=

```

4. Deploy the ONNX model on ONNX runtime (ORT) server. You can refer to the lab for instructions on how to do this. Test the inferencing set-up using 1 image from each of the two selected categories. (5)

```

In [ ]: import io
import numpy as np
from torch import nn
import torch.utils.model_zoo as model_zoo
import torch.onnx

```

```

In [ ]: !pip install onnx
!pip install onnxruntime
!pip install netron

```

Looking in indexes: <https://pypi.org/simple>, <https://us-python.pkg.dev/colab-wheels/public/simple/>
 Requirement already satisfied: onnx in /usr/local/lib/python3.8/dist-packages (1.12.0)

```

Requirement already satisfied: protobuf<=3.20.1,>=3.12.2 in /usr/local/lib/python3.8/dist-packages (from onnx) (3.19.6)
Requirement already satisfied: typing-extensions>=3.6.2.1 in /usr/local/lib/python3.8/dist-packages (from onnx) (4.4.0)
Requirement already satisfied: numpy>=1.16.6 in /usr/local/lib/python3.8/dist-packages (from onnx) (1.21.6)
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting onnxruntime
  Downloading onnxruntime-1.13.1-cp38-cp38-manylinux_2_27_x86_64.whl (4.5 MB)
    |████████████████████████████████████████| 4.5 MB 4.7 MB/s
Requirement already satisfied: flatbuffers in /usr/local/lib/python3.8/dist-packages (from onnxruntime) (1.12)
Requirement already satisfied: packaging in /usr/local/lib/python3.8/dist-packages (from onnxruntime) (21.3)
Requirement already satisfied: sympy in /usr/local/lib/python3.8/dist-packages (from onnxruntime) (1.7.1)
Requirement already satisfied: numpy>=1.21.6 in /usr/local/lib/python3.8/dist-packages (from onnxruntime) (1.21.6)
Requirement already satisfied: protobuf in /usr/local/lib/python3.8/dist-packages (from onnxruntime) (3.19.6)
Collecting coloredlogs
  Downloading coloredlogs-15.0.1-py2.py3-none-any.whl (46 kB)
    |████████████████████████████████████████| 46 kB 3.7 MB/s
Collecting humanfriendly>=9.1
  Downloading humanfriendly-10.0-py2.py3-none-any.whl (86 kB)
    |████████████████████████████████████████| 86 kB 5.7 MB/s
Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in /usr/local/lib/python3.8/dist-packages (from packaging->onnxruntime) (3.0.9)
Requirement already satisfied: mpmath>=0.19 in /usr/local/lib/python3.8/dist-packages (from sympy->onnxruntime) (1.2.1)
Installing collected packages: humanfriendly, coloredlogs, onnxruntime
Successfully installed coloredlogs-15.0.1 humanfriendly-10.0 onnxruntime-1.13.1

```

```
In [ ]: import onnx
```

```

onnx_model = onnx.load("model.onnx")
onnx.checker.check_model(onnx_model)

```

```

In [ ]: import onnxruntime
x = dummy_input
torch_out = net(x)
ort_session = onnxruntime.InferenceSession("model.onnx")

def to_numpy(tensor):
    return tensor.detach().cpu().numpy() if tensor.requires_grad else tensor.cpu().numpy()

ort_inputs = {ort_session.get_inputs()[0].name: x.numpy()}
ort_outs = ort_session.run(None, ort_inputs)

np.testing.assert_allclose(to_numpy(torch_out[0]), ort_outs[0], rtol=1e-03, atol=1e-05)

print("Exported model has been tested with ONNXRuntime, and the result looks good!")

```

Exported model has been tested with ONNXRuntime, and the result looks good!

```
In [ ]: !pip install netron
```

```

Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting netron
  Downloading netron-6.2.5-py3-none-any.whl (1.5 MB)
    |████████████████████████████████████████| 1.5 MB 5.2 MB/s
Installing collected packages: netron
Successfully installed netron-6.2.5

```

In []: `import netron`

```
import netron
netron.start('/content/pytorch-ssd/model.onnx', browse=True)
```

Serving '/content/pytorch-ssd/model.onnx' at http://localhost:22968

Out[]: ('localhost', 22968)

```
In [ ]: import torchvision.transforms as transforms
from PIL import Image, ImageDraw
img = Image.open("/content/pytorch-ssd/data/open_images/test/04abf880fdee279d

transform = transforms.Compose([
    transforms.Resize([300, 300]),
    transforms.PILToTensor()])

img_tensor = transform(img).to(torch.float32).unsqueeze(0)

torch_out = net(img_tensor)
ort_session = onnxruntime.InferenceSession("model.onnx")

ort_inputs = {ort_session.get_inputs()[0].name: to_numpy(img_tensor)}
ort_outs = ort_session.run(None, ort_inputs)

np.testing.assert_allclose(to_numpy(torch_out[0]), ort_outs[0], rtol=1e-03, a
print("Exported model has been tested with ONNXRuntime, and the result looks o
```

Exported model has been tested with ONNXRuntime, and the result looks good!

```
In [ ]: import torchvision.transforms as transforms
img = Image.open("data/open_images/test/46d91202d0431329.jpg")

transform = transforms.Compose([
    transforms.Resize([300, 300]),
    transforms.PILToTensor()])

img_tensor = transform(img).to(torch.float32).unsqueeze(0)

torch_out = net(img_tensor)
ort_session = onnxruntime.InferenceSession("model.onnx")

ort_inputs = {ort_session.get_inputs()[0].name: to_numpy(img_tensor)}
ort_outs = ort_session.run(None, ort_inputs)

np.testing.assert_allclose(to_numpy(torch_out[0]), ort_outs[0], rtol=1e-03, a
print("Exported model has been tested with ONNXRuntime, and the result looks o
```

Exported model has been tested with ONNXRuntime, and the result looks good!