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```
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# =====
```



TensorFlow Hub Object Detection Colab

Welcome to the TensorFlow Hub Object Detection Colab! This notebook will take you through the steps of running an "out-of-the-box" object detection model on images.

More models

This collection contains TF2 object detection models that have been trained on the COCO 2017 dataset. Here you can find all object detection models that are currently hosted on [tfhub.dev](#).

Imports and Setup

Let's start with the base imports.

```
In [ ]: # This Colab requires a recent numpy version.  
!pip install numpy==1.24.3  
!pip install protobuf==3.20.3
```

```
Collecting numpy==1.24.3
  Downloading numpy-1.24.3-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (17.3 MB)
    ━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 17.3/17.3 MB 52.1 MB/s eta 0:00:00
Installing collected packages: numpy
  Attempting uninstall: numpy
    Found existing installation: numpy 1.23.5
    Uninstalling numpy-1.23.5:
      Successfully uninstalled numpy-1.23.5
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.
lida 0.0.10 requires fastapi, which is not installed.
lida 0.0.10 requires kaleido, which is not installed.
lida 0.0.10 requires python-multipart, which is not installed.
lida 0.0.10 requires uvicorn, which is not installed.
numba 0.56.4 requires numpy<1.24,>=1.18, but you have numpy 1.24.3 which is incompatible.
Successfully installed numpy-1.24.3
```

```
Requirement already satisfied: protobuf==3.20.3 in /usr/local/lib/python3.10/dist-packages (3.20.3)
Traceback (most recent call last):
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pkg_resources/__init__.py", line 3108, in _dep_map
    return self._dep_map
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pkg_resources/__init__.py", line 2901, in __getattr__
    raise AttributeError(attr)
AttributeError: _DistInfoDistribution__dep_map
```

During handling of the above exception, another exception occurred:

```
Traceback (most recent call last):
  File "/usr/local/lib/python3.10/dist-packages/pip/_internal/cli/base_command.py", line 169, in exc_logging_wrapper
    status = run_func(*args)
  File "/usr/local/lib/python3.10/dist-packages/pip/_internal/cli/req_command.py", line 242, in wrapper
    return func(self, options, args)
  File "/usr/local/lib/python3.10/dist-packages/pip/_internal/commands/install.py", line 441, in run
    conflicts = self._determine_conflicts(to_install)
  File "/usr/local/lib/python3.10/dist-packages/pip/_internal/commands/install.py", line 572, in _determine_conflicts
    return check_install_conflicts(to_install)
  File "/usr/local/lib/python3.10/dist-packages/pip/_internal/operations/check.py", line 101, in check_install_conflicts
    package_set, _ = create_package_set_from_installed()
  File "/usr/local/lib/python3.10/dist-packages/pip/_internal/operations/check.py", line 42, in create_package_set_from_installed
    dependencies = list(dist.iter_dependencies())
  File "/usr/local/lib/python3.10/dist-packages/pip/_internal/metadata/pkg_resources.py", line 216, in iter_dependencies
    return self._dist.requires(extras)
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pkg_resources/__init__.py", line 2821, in requires
    dm = self._dep_map
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pkg_resources/__init__.py", line 3110, in _dep_map
    self._dep_map = self._compute_dependencies()
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pkg_resources/__init__.py", line 3120, in _compute_dependencies
    reqs.extend(parse_requirements(req))
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pkg_resources/__init__.py", line 3173, in __init__
    super(Requirement, self).__init__(requirement_string)
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/packaging/requirements.py", line 102, in __init__
    req = REQUIREMENT.parseString(requirement_string)
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py", line 1131, in parse_string
    loc, tokens = self._parse(instring, 0)
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py", line 817, in _parseNoCache
    loc, tokens = self.parseImpl(instring, pre_loc, doActions)
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py", line 3886, in parseImpl
    loc, exptokens = e._parse(instring, loc, doActions)
```

```
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py", line
e 817, in _parseNoCache
    loc, tokens = self.parseImpl(instring, pre_loc, doActions)
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py", line
e 4114, in parseImpl
    return e._parse(
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py", line
e 817, in _parseNoCache
    loc, tokens = self.parseImpl(instring, pre_loc, doActions)
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py", line
e 3886, in parseImpl
    loc, exptokens = e._parse(instring, loc, doActions)
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py", line
e 817, in _parseNoCache
    loc, tokens = self.parseImpl(instring, pre_loc, doActions)
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py", line
e 4959, in parseImpl
    loc, tokens = self._expr_.parse(instring, loc, doActions, callPreParse=False)
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py", line
e 817, in _parseNoCache
    loc, tokens = self.parseImpl(instring, pre_loc, doActions)
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py", line
e 3886, in parseImpl
    loc, exptokens = e._parse(instring, loc, doActions)
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py", line
e 856, in _parseNoCache
    tokens = fn(instring, tokens_start, ret_tokens)
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py", line
e 291, in wrapper
    ret = func(*args[limit:])
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/packaging/requirement
s.py", line 71, in <lambda>
    lambda s, l, t: Marker(s[t._original_start : t._original_end])
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/packaging/markers.py",
line 278, in __init__
    self._markers = _coerce_parse_result(MARKER.parseString(marker))
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py", line
e 1131, in parse_string
    loc, tokens = self._parse(instring, 0)
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py", line
e 817, in _parseNoCache
    loc, tokens = self.parseImpl(instring, pre_loc, doActions)
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py", line
e 3886, in parseImpl
    loc, exptokens = e._parse(instring, loc, doActions)
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py", line
e 781, in _parseNoCache
    len_instring = len(instring)
KeyboardInterrupt
```

During handling of the above exception, another exception occurred:

```
Traceback (most recent call last):
  File "/usr/local/bin/pip3", line 8, in <module>
    sys.exit(main())
  File "/usr/local/lib/python3.10/dist-packages/pip/_internal/cli/main.py", line 79
, in main
    return command.main(cmd_args)
  File "/usr/local/lib/python3.10/dist-packages/pip/_internal/cli/base_command.py",

```

```
line 101, in main
    return self._main(args)
  File "/usr/local/lib/python3.10/dist-packages/pip/_internal/cli/base_command.py",
line 223, in _main
    return run(options, args)
  File "/usr/local/lib/python3.10/dist-packages/pip/_internal/cli/base_command.py",
line 206, in exc_logging_wrapper
    logger.critical("Operation cancelled by user")
  File "/usr/lib/python3.10/logging/__init__.py", line 1524, in critical
    self._log(CRITICAL, msg, args, **kwargs)
  File "/usr/lib/python3.10/logging/__init__.py", line 1624, in _log
    self.handle(record)
  File "/usr/lib/python3.10/logging/__init__.py", line 1634, in handle
    self.callHandlers(record)
  File "/usr/lib/python3.10/logging/__init__.py", line 1696, in callHandlers
    hdlr.handle(record)
  File "/usr/lib/python3.10/logging/__init__.py", line 968, in handle
    self.emit(record)
  File "/usr/local/lib/python3.10/dist-packages/pip/_internal/utils/logging.py", li
ne 169, in emit
    renderable = self.render_message(record, message)
  File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/rich/logging.py", line
174, in render_message
    def render_message(self, record: LogRecord, message: str) -> "ConsoleRenderabl
e":
KeyboardInterrupt
^C
```

```
In [ ]: import os
import pathlib

import matplotlib
import matplotlib.pyplot as plt

import io
import scipy.misc
import numpy as np
from six import BytesIO
from PIL import Image, ImageDraw, ImageFont
from six.moves.urllib.request import urlopen

import tensorflow as tf
import tensorflow_hub as hub

tf.get_logger().setLevel('ERROR')
```

Utilities

Run the following cell to create some utils that will be needed later:

- Helper method to load an image
- Map of Model Name to TF Hub handle
- List of tuples with Human Keypoints for the COCO 2017 dataset. This is needed for models with keypoints.

```
In [ ]: # @title Run this!!
```

```
def load_image_into_numpy_array(path):
    """Load an image from file into a numpy array.

    Puts image into numpy array to feed into tensorflow graph.
    Note that by convention we put it into a numpy array with shape
    (height, width, channels), where channels=3 for RGB.

    Args:
        path: the file path to the image

    Returns:
        uint8 numpy array with shape (img_height, img_width, 3)
    """
    image = None
    if(path.startswith('http')):
        response = urlopen(path)
        image_data = response.read()
        image_data = BytesIO(image_data)
        image = Image.open(image_data)
    else:
        image_data = tf.io.gfile.GFile(path, 'rb').read()
        image = Image.open(BytesIO(image_data))

    (im_width, im_height) = image.size
    return np.array(image.getdata()).reshape(
        (1, im_height, im_width, 3)).astype(np.uint8)

ALL_MODELS = {
    'CenterNet HourGlass104 512x512' : 'https://tfhub.dev/tensorflow/centernet/hourglass104/5',
    'CenterNet HourGlass104 Keypoints 512x512' : 'https://tfhub.dev/tensorflow/centernet/hourglass104/5/with_kp',
    'CenterNet HourGlass104 1024x1024' : 'https://tfhub.dev/tensorflow/centernet/hourglass104/1024x1024/5',
    'CenterNet HourGlass104 Keypoints 1024x1024' : 'https://tfhub.dev/tensorflow/centernet/hourglass104/1024x1024/5/with_kp',
    'CenterNet Resnet50 V1 FPN 512x512' : 'https://tfhub.dev/tensorflow/centernet/resnet50v1/5',
    'CenterNet Resnet50 V1 FPN Keypoints 512x512' : 'https://tfhub.dev/tensorflow/centernet/resnet50v1/5/with_kp',
    'CenterNet Resnet101 V1 FPN 512x512' : 'https://tfhub.dev/tensorflow/centernet/resnet101v1/5',
    'CenterNet Resnet50 V2 512x512' : 'https://tfhub.dev/tensorflow/centernet/resnet50v2/5',
    'CenterNet Resnet50 V2 Keypoints 512x512' : 'https://tfhub.dev/tensorflow/centernet/resnet50v2/5/with_kp',
    'EfficientDet D0 512x512' : 'https://tfhub.dev/tensorflow/efficientdet/d0/1',
    'EfficientDet D1 640x640' : 'https://tfhub.dev/tensorflow/efficientdet/d1/1',
    'EfficientDet D2 768x768' : 'https://tfhub.dev/tensorflow/efficientdet/d2/1',
    'EfficientDet D3 896x896' : 'https://tfhub.dev/tensorflow/efficientdet/d3/1',
    'EfficientDet D4 1024x1024' : 'https://tfhub.dev/tensorflow/efficientdet/d4/1',
    'EfficientDet D5 1280x1280' : 'https://tfhub.dev/tensorflow/efficientdet/d5/1',
    'EfficientDet D6 1280x1280' : 'https://tfhub.dev/tensorflow/efficientdet/d6/1',
    'EfficientDet D7 1536x1536' : 'https://tfhub.dev/tensorflow/efficientdet/d7/1',
    'SSD MobileNet v2 320x320' : 'https://tfhub.dev/tensorflow/ssd_mobilenet_v2/2',
    'SSD MobileNet V1 FPN 640x640' : 'https://tfhub.dev/tensorflow/ssd_mobilenet_v1/fpn/2',
    'SSD MobileNet V2 FPNLite 320x320' : 'https://tfhub.dev/tensorflow/ssd_mobilenet_v2/2',
    'SSD MobileNet V2 FPNLite 640x640' : 'https://tfhub.dev/tensorflow/ssd_mobilenet_v2/2',
    'SSD ResNet50 V1 FPN 640x640 (RetinaNet50)' : 'https://tfhub.dev/tensorflow/retinanet/5',
    'SSD ResNet50 V1 FPN 1024x1024 (RetinaNet50)' : 'https://tfhub.dev/tensorflow/retinanet/5/1024x1024',
    'SSD ResNet101 V1 FPN 640x640 (RetinaNet101)' : 'https://tfhub.dev/tensorflow/retinanet/101',
    'SSD ResNet101 V1 FPN 1024x1024 (RetinaNet101)' : 'https://tfhub.dev/tensorflow/retinanet/101/1024x1024',
    'SSD ResNet152 V1 FPN 640x640 (RetinaNet152)' : 'https://tfhub.dev/tensorflow/retinanet/152',
    'SSD ResNet152 V1 FPN 1024x1024 (RetinaNet152)' : 'https://tfhub.dev/tensorflow/retinanet/152/1024x1024'}
```

```
faster_rcnn_resnet50_v1_640x640' : 'https://tfhub.dev/tensorflow/faster_rcnn/resnet50_v1_640x640/1',
'Faster R-CNN ResNet50 V1 1024x1024' : 'https://tfhub.dev/tensorflow/faster_rcnn/resnet50_v1_1024x1024/1',
'Faster R-CNN ResNet50 V1 800x1333' : 'https://tfhub.dev/tensorflow/faster_rcnn/resnet50_v1_800x1333/1',
'Faster R-CNN ResNet101 V1 640x640' : 'https://tfhub.dev/tensorflow/faster_rcnn/resnet101_v1_640x640/1',
'Faster R-CNN ResNet101 V1 1024x1024' : 'https://tfhub.dev/tensorflow/faster_rcnn/resnet101_v1_1024x1024/1',
'Faster R-CNN ResNet101 V1 800x1333' : 'https://tfhub.dev/tensorflow/faster_rcnn/resnet101_v1_800x1333/1',
'Faster R-CNN ResNet152 V1 640x640' : 'https://tfhub.dev/tensorflow/faster_rcnn/resnet152_v1_640x640/1',
'Faster R-CNN ResNet152 V1 1024x1024' : 'https://tfhub.dev/tensorflow/faster_rcnn/resnet152_v1_1024x1024/1',
'Faster R-CNN ResNet152 V1 800x1333' : 'https://tfhub.dev/tensorflow/faster_rcnn/resnet152_v1_800x1333/1',
'Faster R-CNN Inception ResNet V2 640x640' : 'https://tfhub.dev/tensorflow/faster_rcnn/inception_resnet_v2_640x640/1',
'Faster R-CNN Inception ResNet V2 1024x1024' : 'https://tfhub.dev/tensorflow/faster_rcnn/inception_resnet_v2_1024x1024/1',
'Mask R-CNN Inception ResNet V2 1024x1024' : 'https://tfhub.dev/tensorflow/mask_rcnn/inception_resnet_v2_1024x1024/1'

}

IMAGES_FOR_TEST = {
    'Beach' : 'models/research/object_detection/test_images/image2.jpg',
    'Dogs' : 'models/research/object_detection/test_images/image1.jpg',
    # By Heiko Gorski, Source: https://commons.wikimedia.org/wiki/File:Naxos_Taverna.jpg
    'Naxos Taverna' : 'https://upload.wikimedia.org/wikipedia/commons/6/60/Naxos_Taverna.jpg',
    # Source: https://commons.wikimedia.org/wiki/File:The_Coleoptera_of_the_British_islands_(1897)_part_1_01b.jpg
    'Beatles' : 'https://upload.wikimedia.org/wikipedia/commons/1/1b/The_Coleoptera_of_the_British_islands_(1897)_part_1_01b.jpg',
    # By Américo Toledo, Source: https://commons.wikimedia.org/wiki/File:Biblioteca_Municipal_de_Santos.jpg
    'Phones' : 'https://upload.wikimedia.org/wikipedia/commons/thumb/0/0d/Biblioteca_Municipal_de_Santos.jpg',
    # Source: https://commons.wikimedia.org/wiki/File:The_smaller_British_birds_(8053).jpg
    'Birds' : 'https://upload.wikimedia.org/wikipedia/commons/0/09/The_smaller_Britisches_Vogelbuch_(1909)_Cover.jpg',
    'Zevent' : 'custom/zevent.jpg',
    'Bouchon' : 'custom/bouchon.jpg',
    'Bouchon mais chiant' : 'custom/fourviere.jpg',
    'Bouchon mais pire' : 'custom/bouchon2.jpg',
    'Savane' : 'custom/zebra.jpg',
    'Elevage' : 'custom/elevage.jpg',
    'Lycee' : 'custom/lycee.jpg'
}

COCO17_HUMAN_POSE_KEYPOINTS = [(0, 1),
(0, 2),
(1, 3),
(2, 4),
(0, 5),
(0, 6),
(5, 7),
(7, 9),
(6, 8),
(8, 10),
(5, 6),
(5, 11),
(6, 12),
(11, 12),
(11, 13),
(13, 15),
(12, 14),
(14, 16)]
```

Visualization tools

To visualize the images with the proper detected boxes, keypoints and segmentation, we will use the TensorFlow Object Detection API. To install it we will clone the repo.

```
In [ ]: # Clone the tensorflow models repository  
!git clone --depth 1 https://github.com/tensorflow/models  
  
Cloning into 'models'...  
remote: Enumerating objects: 3996, done.  
remote: Counting objects: 100% (3996/3996), done.  
remote: Compressing objects: 100% (3029/3029), done.  
remote: Total 3996 (delta 1176), reused 2743 (delta 910), pack-reused 0  
Receiving objects: 100% (3996/3996), 53.29 MiB | 25.04 MiB/s, done.  
Resolving deltas: 100% (1176/1176), done.
```

Intalling the Object Detection API

```
In [ ]: %%bash  
sudo apt install -y protobuf-compiler  
cd models/research/  
protoc object_detection/protos/*.proto --python_out=.  
cp object_detection/packages/tf2/setup.py .  
python -m pip install .
```

```
Reading package lists...
Building dependency tree...
Reading state information...
protobuf-compiler is already the newest version (3.12.4-1ubuntu7.22.04.1).
0 upgraded, 0 newly installed, 0 to remove and 19 not upgraded.
Processing /content/models/research
    Preparing metadata (setup.py): started
    Preparing metadata (setup.py): finished with status 'done'
Collecting avro-python3 (from object-detection==0.1)
    Downloading avro-python3-1.10.2.tar.gz (38 kB)
    Preparing metadata (setup.py): started
    Preparing metadata (setup.py): finished with status 'done'
Collecting apache-beam (from object-detection==0.1)
    Downloading apache_beam-2.51.0-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x8
6_64.whl (14.7 MB)
    14.7/14.7 MB 31.2 MB/s eta 0:00:00
Requirement already satisfied: pillow in /usr/local/lib/python3.10/dist-packages (f
rom object-detection==0.1) (9.4.0)
Requirement already satisfied: lxml in /usr/local/lib/python3.10/dist-packages (fro
m object-detection==0.1) (4.9.3)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.10/dist-package
s (from object-detection==0.1) (3.7.1)
Requirement already satisfied: Cython in /usr/local/lib/python3.10/dist-packages (f
rom object-detection==0.1) (3.0.4)
Requirement already satisfied: contextlib2 in /usr/local/lib/python3.10/dist-package
es (from object-detection==0.1) (21.6.0)
Requirement already satisfied: tf-slim in /usr/local/lib/python3.10/dist-packages
(from object-detection==0.1) (1.1.0)
Requirement already satisfied: six in /usr/local/lib/python3.10/dist-packages (from
object-detection==0.1) (1.16.0)
Requirement already satisfied: pycocotools in /usr/local/lib/python3.10/dist-package
es (from object-detection==0.1) (2.0.7)
Collecting lvis (from object-detection==0.1)
    Downloading lvis-0.5.3-py3-none-any.whl (14 kB)
Requirement already satisfied: scipy in /usr/local/lib/python3.10/dist-packages (fr
om object-detection==0.1) (1.11.3)
Requirement already satisfied: pandas in /usr/local/lib/python3.10/dist-packages (f
rom object-detection==0.1) (1.5.3)
Collecting tf-models-official>=2.5.1 (from object-detection==0.1)
    Downloading tf_models_official-2.14.2-py2.py3-none-any.whl (2.7 MB)
    2.7/2.7 MB 46.7 MB/s eta 0:00:00
Collecting tensorflow_io (from object-detection==0.1)
    Downloading tensorflow_io-0.34.0-cp310-cp310-manylinux_2_12_x86_64.manylinux2010_
x86_64.whl (28.8 MB)
    28.8/28.8 MB 52.9 MB/s eta 0:00:00
Requirement already satisfied: keras in /usr/local/lib/python3.10/dist-packages (fr
om object-detection==0.1) (2.14.0)
Collecting pyparsing==2.4.7 (from object-detection==0.1)
    Downloading pyparsing-2.4.7-py2.py3-none-any.whl (67 kB)
    67.8/67.8 kB 8.0 MB/s eta 0:00:00
Collecting sacrebleu<=2.2.0 (from object-detection==0.1)
    Downloading sacrebleu-2.2.0-py3-none-any.whl (116 kB)
    116.6/116.6 kB 12.8 MB/s eta 0:00:00
Collecting portalocker (from sacrebleu<=2.2.0->object-detection==0.1)
    Downloading portalocker-2.8.2-py3-none-any.whl (17 kB)
Requirement already satisfied: regex in /usr/local/lib/python3.10/dist-packages (fr
om sacrebleu<=2.2.0->object-detection==0.1) (2023.6.3)
Requirement already satisfied: tabulate>=0.8.9 in /usr/local/lib/python3.10/dist-pa
ckages (from sacrebleu<=2.2.0->object-detection==0.1) (0.9.0)
```

```
Requirement already satisfied: numpy>=1.17 in /usr/local/lib/python3.10/dist-packages (from sacrebleu<=2.2.0->object-detection==0.1) (1.24.3)
Collecting colorama (from sacrebleu<=2.2.0->object-detection==0.1)
    Downloading colorama-0.4.6-py2.py3-none-any.whl (25 kB)
Requirement already satisfied: gin-config in /usr/local/lib/python3.10/dist-packages (from tf-models-official>=2.5.1->object-detection==0.1) (0.5.0)
Requirement already satisfied: google-api-python-client>=1.6.7 in /usr/local/lib/python3.10/dist-packages (from tf-models-official>=2.5.1->object-detection==0.1) (2.8.4.0)
Collecting immutabledict (from tf-models-official>=2.5.1->object-detection==0.1)
    Downloading immutabledict-3.0.0-py3-none-any.whl (4.0 kB)
Requirement already satisfied: kaggle>=1.3.9 in /usr/local/lib/python3.10/dist-packages (from tf-models-official>=2.5.1->object-detection==0.1) (1.5.16)
Requirement already satisfied: oauth2client in /usr/local/lib/python3.10/dist-packages (from tf-models-official>=2.5.1->object-detection==0.1) (4.1.3)
Requirement already satisfied: opencv-python-headless in /usr/local/lib/python3.10/dist-packages (from tf-models-official>=2.5.1->object-detection==0.1) (4.8.1.78)
Requirement already satisfied: psutil>=5.4.3 in /usr/local/lib/python3.10/dist-packages (from tf-models-official>=2.5.1->object-detection==0.1) (5.9.5)
Requirement already satisfied: py-cpuinfo>=3.3.0 in /usr/local/lib/python3.10/dist-packages (from tf-models-official>=2.5.1->object-detection==0.1) (9.0.0)
Requirement already satisfied: pyyaml>=6.0.0 in /usr/local/lib/python3.10/dist-packages (from tf-models-official>=2.5.1->object-detection==0.1) (6.0.1)
Collecting sentencepiece (from tf-models-official>=2.5.1->object-detection==0.1)
    Downloading sentencepiece-0.1.99-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (1.3 MB)
    ━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.3/1.3 MB 75.6 MB/s eta 0:00:00
Collecting seqeval (from tf-models-official>=2.5.1->object-detection==0.1)
    Downloading seqeval-1.2.2.tar.gz (43 kB)
    ━━━━━━━━━━━━━━━━━━━━━━━━ 43.6/43.6 kB 4.9 MB/s eta 0:00:00
    Preparing metadata (setup.py): started
    Preparing metadata (setup.py): finished with status 'done'
Requirement already satisfied: tensorflow-datasets in /usr/local/lib/python3.10/dist-packages (from tf-models-official>=2.5.1->object-detection==0.1) (4.9.3)
Requirement already satisfied: tensorflow-hub>=0.6.0 in /usr/local/lib/python3.10/dist-packages (from tf-models-official>=2.5.1->object-detection==0.1) (0.15.0)
Collecting tensorflow-model-optimization>=0.4.1 (from tf-models-official>=2.5.1->object-detection==0.1)
    Downloading tensorflow_model_optimization-0.7.5-py2.py3-none-any.whl (241 kB)
    ━━━━━━━━━━━━━━━━━━━━━━━━ 241.2/241.2 kB 27.8 MB/s eta 0:00:00
Collecting tensorflow-text~2.14.0 (from tf-models-official>=2.5.1->object-detection==0.1)
    Downloading tensorflow_text-2.14.0-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (6.5 MB)
    ━━━━━━━━━━━━━━━━━━━━━━ 6.5/6.5 MB 95.5 MB/s eta 0:00:00
Requirement already satisfied: tensorflow~2.14.0 in /usr/local/lib/python3.10/dist-packages (from tf-models-official>=2.5.1->object-detection==0.1) (2.14.0)
Requirement already satisfied: python-dateutil>=2.8.1 in /usr/local/lib/python3.10/dist-packages (from pandas->object-detection==0.1) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas->object-detection==0.1) (2023.3.post1)
Requirement already satisfied: absl-py>=0.2.2 in /usr/local/lib/python3.10/dist-packages (from tf-slim->object-detection==0.1) (1.4.0)
Collecting crcmod<2.0,>=1.7 (from apache-beam->object-detection==0.1)
    Downloading crcmod-1.7.tar.gz (89 kB)
    ━━━━━━━━━━━━━━━━━━━━━━ 89.7/89.7 kB 11.3 MB/s eta 0:00:00
    Preparing metadata (setup.py): started
    Preparing metadata (setup.py): finished with status 'done'
Collecting orjson<4,>=3.9.7 (from apache-beam->object-detection==0.1)
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  Downloading orjson-3.9.10-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_6
4.whl (138 kB)                                                 138.7/138.7 kB 1.0 MB/s eta 0:00:00
Collecting dill<0.3.2,>=0.3.1.1 (from apache-beam->object-detection==0.1)
  Downloading dill-0.3.1.1.tar.gz (151 kB)                      152.0/152.0 kB 18.4 MB/s eta 0:00:00
    Preparing metadata (setup.py): started
    Preparing metadata (setup.py): finished with status 'done'
Requirement already satisfied: cloudpickle~=2.2.1 in /usr/local/lib/python3.10/dist-packages (from apache-beam->object-detection==0.1) (2.2.1)
Collecting fastavro<2,>=0.23.6 (from apache-beam->object-detection==0.1)
  Downloading fastavro-1.9.0-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_6
4.whl (3.1 MB)                                                 3.1/3.1 MB 70.2 MB/s eta 0:00:00
Collecting fasteners<1.0,>=0.3 (from apache-beam->object-detection==0.1)
  Downloading fasteners-0.19-py3-none-any.whl (18 kB)
Requirement already satisfied: grpcio!=1.48.0,<2,>=1.33.1 in /usr/local/lib/python3.10/dist-packages (from apache-beam->object-detection==0.1) (1.59.0)
Collecting hdfs<3.0.0,>=2.1.0 (from apache-beam->object-detection==0.1)
  Downloading hdfs-2.7.3.tar.gz (43 kB)                         43.5/43.5 kB 4.7 MB/s eta 0:00:00
    Preparing metadata (setup.py): started
    Preparing metadata (setup.py): finished with status 'done'
Requirement already satisfied: httplib2<0.23.0,>=0.8 in /usr/local/lib/python3.10/dist-packages (from apache-beam->object-detection==0.1) (0.22.0)
Collecting js2py<1,>=0.74 (from apache-beam->object-detection==0.1)
  Downloading Js2Py-0.74-py3-none-any.whl (1.0 MB)              1.0/1.0 MB 51.7 MB/s eta 0:00:00
Collecting objsize<0.7.0,>=0.6.1 (from apache-beam->object-detection==0.1)
  Downloading objsize-0.6.1-py3-none-any.whl (9.3 kB)
Requirement already satisfied: packaging>=22.0 in /usr/local/lib/python3.10/dist-packages (from apache-beam->object-detection==0.1) (23.2)
Collecting pymongo<5.0.0,>=3.8.0 (from apache-beam->object-detection==0.1)
  Downloading pymongo-4.6.0-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_6
4.whl (677 kB)                                                 677.1/677.1 kB 26.4 MB/s eta 0:00:00
Requirement already satisfied: proto-plus<2,>=1.7.1 in /usr/local/lib/python3.10/dist-packages (from apache-beam->object-detection==0.1) (1.22.3)
Requirement already satisfied: protobuf!=4.0.*,!=4.21.*,!=4.22.0,!=4.23.*,!=4.2
4.0,!=4.24.1,!=4.24.2,<4.25.0,>=3.20.3 in /usr/local/lib/python3.10/dist-packages (from apache-beam->object-detection==0.1) (3.20.3)
Requirement already satisfied: pydot<2,>=1.2.0 in /usr/local/lib/python3.10/dist-packages (from apache-beam->object-detection==0.1) (1.4.2)
Requirement already satisfied: requests<3.0.0,>=2.24.0 in /usr/local/lib/python3.1
0/dist-packages (from apache-beam->object-detection==0.1) (2.31.0)
Requirement already satisfied: typing-extensions>=3.7.0 in /usr/local/lib/python3.1
0/dist-packages (from apache-beam->object-detection==0.1) (4.5.0)
Collecting zstandard<1,>=0.18.0 (from apache-beam->object-detection==0.1)
  Downloading zstandard-0.22.0-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_
64.whl (5.4 MB)                                              5.4/5.4 MB 64.5 MB/s eta 0:00:00
Requirement already satisfied: pyarrow<12.0.0,>=3.0.0 in /usr/local/lib/python3.10/
dist-packages (from apache-beam->object-detection==0.1) (9.0.0)
Requirement already satisfied: cycler>=0.10.0 in /usr/local/lib/python3.10/dist-pac
kages (from lvis->object-detection==0.1) (0.12.1)
Requirement already satisfied: kiwisolver>=1.1.0 in /usr/local/lib/python3.10/dist-
packages (from lvis->object-detection==0.1) (1.4.5)
Requirement already satisfied: opencv-python>=4.1.0.25 in /usr/local/lib/python3.1
0/dist-packages (from lvis->object-detection==0.1) (4.8.0.76)
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Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-p
ackages (from matplotlib->object-detection==0.1) (1.1.1)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-
packages (from matplotlib->object-detection==0.1) (4.43.1)
Requirement already satisfied: tensorflow-io-gcs-filesystem==0.34.0 in /usr/local/l
ib/python3.10/dist-packages (from tensorflow_io->object-detection==0.1) (0.34.0)
Requirement already satisfied: google-auth<3.0.0dev,>=1.19.0 in /usr/local/lib/pyth
on3.10/dist-packages (from google-api-python-client>=1.6.7->tf-models-official>=
2.5.1->object-detection==0.1) (2.17.3)
Requirement already satisfied: google-auth-httplib2>=0.1.0 in /usr/local/lib/python
3.10/dist-packages (from google-api-python-client>=1.6.7->tf-models-official>=
2.5.1->object-detection==0.1) (0.1.1)
Requirement already satisfied: google-api-core!=2.0.*,!>=2.1.*,!>=2.2.*,!>=2.3.0,<
3.0.0dev,>=1.31.5 in /usr/local/lib/python3.10/dist-packages (from google-api-pytho
n-client>=1.6.7->tf-models-official>=2.5.1->object-detection==0.1) (2.11.1)
Requirement already satisfied: uritemplate<5,>=3.0.1 in /usr/local/lib/python3.10/di
st-packages (from google-api-python-client>=1.6.7->tf-models-official>=2.5.1->obje
ct-detection==0.1) (4.1.1)
Collecting docopt (from hdfs<3.0.0,>=2.1.0->apache-beam->object-detection==0.1)
    Downloading docopt-0.6.2.tar.gz (25 kB)
    Preparing metadata (setup.py): started
        Preparing metadata (setup.py): finished with status 'done'
Requirement already satisfied: tzlocal>=1.2 in /usr/local/lib/python3.10/dist-packa
ges (from js2py<1,>=0.74->apache-beam->object-detection==0.1) (5.2)
Collecting pyjsparser>=2.5.1 (from js2py<1,>=0.74->apache-beam->object-detection==
0.1)
    Downloading pyjsparser-2.7.1.tar.gz (24 kB)
    Preparing metadata (setup.py): started
        Preparing metadata (setup.py): finished with status 'done'
Requirement already satisfied: certifi in /usr/local/lib/python3.10/dist-packages
    (from kaggle>=1.3.9->tf-models-official>=2.5.1->object-detection==0.1) (2023.7.22)
Requirement already satisfied: tqdm in /usr/local/lib/python3.10/dist-packages (fro
m kaggle>=1.3.9->tf-models-official>=2.5.1->object-detection==0.1) (4.66.1)
Requirement already satisfied: python-slugify in /usr/local/lib/python3.10/dist-pac
kages (from kaggle>=1.3.9->tf-models-official>=2.5.1->object-detection==0.1)
(8.0.1)
Requirement already satisfied: urllib3 in /usr/local/lib/python3.10/dist-packages
    (from kaggle>=1.3.9->tf-models-official>=2.5.1->object-detection==0.1) (2.0.7)
Requirement already satisfied: bleach in /usr/local/lib/python3.10/dist-packages (f
rom kaggle>=1.3.9->tf-models-official>=2.5.1->object-detection==0.1) (6.1.0)
Collecting dnspython<3.0.0,>=1.16.0 (from pymongo<5.0.0,>=3.8.0->apache-beam->objec
t-detection==0.1)
    Downloading dnspython-2.4.2-py3-none-any.whl (300 kB)
    300.4/300.4 kB 29.6 MB/s eta 0:00:00
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.1
0/dist-packages (from requests<3.0.0,>=2.24.0->apache-beam->object-detection==0.1)
(3.3.1)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packa
ges (from requests<3.0.0,>=2.24.0->apache-beam->object-detection==0.1) (3.4)
Requirement already satisfied: astunparse>=1.6.0 in /usr/local/lib/python3.10/dist-
packages (from tensorflow~2.14.0->tf-models-official>=2.5.1->object-detection==
0.1) (1.6.3)
Requirement already satisfied: flatbuffers>=23.5.26 in /usr/local/lib/python3.10/di
st-packages (from tensorflow~2.14.0->tf-models-official>=2.5.1->object-detection==
0.1) (23.5.26)
Requirement already satisfied: gast!=0.5.0,!>=0.5.1,!>=0.5.2,>=0.2.1 in /usr/local/li
b/python3.10/dist-packages (from tensorflow~2.14.0->tf-models-official>=2.5.1->obj
ect-detection==0.1) (0.5.4)
Requirement already satisfied: google-pasta>=0.1.1 in /usr/local/lib/python3.10/dis
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t-packages (from tensorflow~=2.14.0->tf-models-official>=2.5.1->object-detection==0.1) (0.2.0)
Requirement already satisfied: h5py>=2.9.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow~=2.14.0->tf-models-official>=2.5.1->object-detection==0.1) (3.9.0)
Requirement already satisfied: libclang>=13.0.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow~=2.14.0->tf-models-official>=2.5.1->object-detection==0.1) (16.0.6)
Requirement already satisfied: ml-dtypes==0.2.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow~=2.14.0->tf-models-official>=2.5.1->object-detection==0.1) (0.2.0)
Requirement already satisfied: opt-einsum>=2.3.2 in /usr/local/lib/python3.10/dist-packages (from tensorflow~=2.14.0->tf-models-official>=2.5.1->object-detection==0.1) (3.3.0)
Requirement already satisfied: setuptools in /usr/local/lib/python3.10/dist-packages (from tensorflow~=2.14.0->tf-models-official>=2.5.1->object-detection==0.1) (6.7.7.2)
Requirement already satisfied: termcolor>=1.1.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow~=2.14.0->tf-models-official>=2.5.1->object-detection==0.1) (2.3.0)
Requirement already satisfied: wrapt<1.15,>=1.11.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow~=2.14.0->tf-models-official>=2.5.1->object-detection==0.1) (1.14.1)
Requirement already satisfied: tensorboard<2.15,>=2.14 in /usr/local/lib/python3.10/dist-packages (from tensorflow~=2.14.0->tf-models-official>=2.5.1->object-detection==0.1) (2.14.1)
Requirement already satisfied: tensorflow-estimator<2.15,>=2.14.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow~=2.14.0->tf-models-official>=2.5.1->object-detection==0.1) (2.14.0)
Requirement already satisfied: dm-tree~=0.1.1 in /usr/local/lib/python3.10/dist-packages (from tensorflow-model-optimization>=0.4.1->tf-models-official>=2.5.1->object-detection==0.1) (0.1.8)
Requirement already satisfied: pyasn1>=0.1.7 in /usr/local/lib/python3.10/dist-packages (from oauth2client->tf-models-official>=2.5.1->object-detection==0.1) (0.5.0)
Requirement already satisfied: pyasn1-modules>=0.0.5 in /usr/local/lib/python3.10/dist-packages (from oauth2client->tf-models-official>=2.5.1->object-detection==0.1) (0.3.0)
Requirement already satisfied: rsa>=3.1.4 in /usr/local/lib/python3.10/dist-packages (from oauth2client->tf-models-official>=2.5.1->object-detection==0.1) (4.9)
Requirement already satisfied: scikit-learn>=0.21.3 in /usr/local/lib/python3.10/dist-packages (from seqeval->tf-models-official>=2.5.1->object-detection==0.1) (1.2.2)
Requirement already satisfied: array-record in /usr/local/lib/python3.10/dist-packages (from tensorflow-datasets->tf-models-official>=2.5.1->object-detection==0.1) (0.5.0)
Requirement already satisfied: click in /usr/local/lib/python3.10/dist-packages (from tensorflow-datasets->tf-models-official>=2.5.1->object-detection==0.1) (8.1.7)
Requirement already satisfied: etils[enp,epath,etree]>=0.9.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow-datasets->tf-models-official>=2.5.1->object-detection==0.1) (1.5.2)
Requirement already satisfied: promise in /usr/local/lib/python3.10/dist-packages (from tensorflow-datasets->tf-models-official>=2.5.1->object-detection==0.1) (2.3)
Requirement already satisfied: tensorflow-metadata in /usr/local/lib/python3.10/dist-packages (from tensorflow-datasets->tf-models-official>=2.5.1->object-detection==0.1) (1.14.0)
Requirement already satisfied: toml in /usr/local/lib/python3.10/dist-packages (from tensorflow-datasets->tf-models-official>=2.5.1->object-detection==0.1) (0.10.2)
Requirement already satisfied: wheel<1.0,>=0.23.0 in /usr/local/lib/python3.10/dist-packages (from astunparse>=1.6.0->tensorflow~=2.14.0->tf-models-official>=2.5.1->
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object-detection==0.1) (0.41.2)
Requirement already satisfied: fsspec in /usr/local/lib/python3.10/dist-packages (from etils[enp,epath,etree]>=0.9.0->tensorflow-datasets->tf-models-official>=2.5.1->object-detection==0.1) (2023.6.0)
Requirement already satisfied: importlib_resources in /usr/local/lib/python3.10/dist-packages (from etils[enp,epath,etree]>=0.9.0->tensorflow-datasets->tf-models-official>=2.5.1->object-detection==0.1) (6.1.0)
Requirement already satisfied: zipp in /usr/local/lib/python3.10/dist-packages (from etils[enp,epath,etree]>=0.9.0->tensorflow-datasets->tf-models-official>=2.5.1->object-detection==0.1) (3.17.0)
Requirement already satisfied: googleapis-common-protos<2.0.dev0,>=1.56.2 in /usr/local/lib/python3.10/dist-packages (from google-api-core!=2.0.*,!2.1.*,!2.2.*,!2.3.0,<3.0.0dev,>=1.31.5->google-api-python-client)>=1.6.7->tf-models-official>=2.5.1->object-detection==0.1) (1.61.0)
Requirement already satisfied: cachetools<6.0,>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from google-auth<3.0.0dev,>=1.19.0->google-api-python-client)>=1.6.7->tf-models-official>=2.5.1->object-detection==0.1) (5.3.2)
Requirement already satisfied: joblib>=1.1.1 in /usr/local/lib/python3.10/dist-packages (from scikit-learn>=0.21.3->seqeval->tf-models-official)>=2.5.1->object-detection==0.1) (1.3.2)
Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from scikit-learn>=0.21.3->seqeval->tf-models-official)>=2.5.1->object-detection==0.1) (3.2.0)
Requirement already satisfied: google-auth-oauthlib<1.1,>=0.5 in /usr/local/lib/python3.10/dist-packages (from tensorboard<2.15,>=2.14->tensorflow~2.14.0->tf-models-official)>=2.5.1->object-detection==0.1) (1.0.0)
Requirement already satisfied: markdown>=2.6.8 in /usr/local/lib/python3.10/dist-packages (from tensorboard<2.15,>=2.14->tensorflow~2.14.0->tf-models-official)>=2.5.1->object-detection==0.1) (3.5)
Requirement already satisfied: tensorboard-data-server<0.8.0,>=0.7.0 in /usr/local/lib/python3.10/dist-packages (from tensorboard<2.15,>=2.14->tensorflow~2.14.0->tf-models-official)>=2.5.1->object-detection==0.1) (0.7.2)
Requirement already satisfied: werkzeug>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from tensorboard<2.15,>=2.14->tensorflow~2.14.0->tf-models-official)>=2.5.1->object-detection==0.1) (3.0.1)
Requirement already satisfied: webencodings in /usr/local/lib/python3.10/dist-packages (from bleach->kaggle)>=1.3.9->tf-models-official)>=2.5.1->object-detection==0.1) (0.5.1)
Requirement already satisfied: text-unidecode>=1.3 in /usr/local/lib/python3.10/dist-packages (from python-slugify->kaggle)>=1.3.9->tf-models-official)>=2.5.1->object-detection==0.1) (1.3)
Requirement already satisfied: requests-oauthlib>=0.7.0 in /usr/local/lib/python3.10/dist-packages (from google-auth-oauthlib<1.1,>=0.5->tensorboard<2.15,>=2.14->tensorflow~2.14.0->tf-models-official)>=2.5.1->object-detection==0.1) (1.3.1)
Requirement already satisfied: MarkupSafe>=2.1.1 in /usr/local/lib/python3.10/dist-packages (from werkzeug>=1.0.1->tensorboard<2.15,>=2.14->tensorflow~2.14.0->tf-models-official)>=2.5.1->object-detection==0.1) (2.1.3)
Requirement already satisfied: oauthlib>=3.0.0 in /usr/local/lib/python3.10/dist-packages (from requests-oauthlib>=0.7.0->google-auth-oauthlib<1.1,>=0.5->tensorboard<2.15,>=2.14->tensorflow~2.14.0->tf-models-official)>=2.5.1->object-detection==0.1) (3.2.2)
Building wheels for collected packages: object-detection, avro-python3, crcmod, dill, hdfs, seqeval, pyjparser, docopt
    Building wheel for object-detection (setup.py): started
    Building wheel for object-detection (setup.py): finished with status 'done'
    Created wheel for object-detection: filename=object_detection-0.1-py3-none-any.whl size=1697354 sha256=2fa22a5ffca327d6eb9441105a4044ec048692c854dd68bd604758c0a1ab0c41
    Stored in directory: /tmp/pip-ephem-wheel-cache_ps411wh/wheels/53/dd/70/2de274d6
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c443c69d367bd6a5606f95e5a6df61aacf1435ec0d
    Building wheel for avro-python3 (setup.py): started
    Building wheel for avro-python3 (setup.py): finished with status 'done'
    Created wheel for avro-python3: filename=avro_python3-1.10.2-py3-none-any.whl size=e=43991 sha256=96298243dd1b3b6b9df109dc516799b6d6f851e39e49a0202c704ce88306db98
    Stored in directory: /root/.cache/pip/wheels/bc/85/62/6cdd81c56f923946b401cecff38
055b94c9b766927f7d8ca82
    Building wheel for crcmod (setup.py): started
    Building wheel for crcmod (setup.py): finished with status 'done'
    Created wheel for crcmod: filename=crcmod-1.7-cp310-cp310-linux_x86_64.whl size=3
1404 sha256=33c45b4d0d3d9db88bfd8e60fad38419206299b558c46b7f38eb7b91493929d
    Stored in directory: /root/.cache/pip/wheels/85/4c/07/72215c529bd59d67e3dac29711d
7aba1b692f543c808ba9e86
    Building wheel for dill (setup.py): started
    Building wheel for dill (setup.py): finished with status 'done'
    Created wheel for dill: filename=dill-0.3.1.1-py3-none-any.whl size=78542 sha256=
cad1231923387737a3758d0a46407097196066a68bdaf10dec2f0ec8d0748644
    Stored in directory: /root/.cache/pip/wheels/ea/e2/86/64980d90e297e7bf2ce588c2b96
e818f5399c515c4bb8a7e4f
    Building wheel for hdfs (setup.py): started
    Building wheel for hdfs (setup.py): finished with status 'done'
    Created wheel for hdfs: filename=hdfs-2.7.3-py3-none-any.whl size=34325 sha256=bc
956b501b601cdba4ada1780959337e4e3c5f942bfb65a3fad92b165541c012
    Stored in directory: /root/.cache/pip/wheels/e5/8d/b6/99c1c0a3ac5788c866b0ecd3f48
b0134a5910e6ed26011800b
    Building wheel for seqeval (setup.py): started
    Building wheel for seqeval (setup.py): finished with status 'done'
    Created wheel for seqeval: filename=seqeval-1.2.2-py3-none-any.whl size=16162 sha
256=de4bb404ea3bbea21864b14d527d950fc9c3c137c46dc0f2fe7f68db5af973cd
    Stored in directory: /root/.cache/pip/wheels/1a/67/4a/ad4082dd7dfc30f2abfe4d80a2e
d5926a506eb8a972b4767fa
    Building wheel for pyjsparser (setup.py): started
    Building wheel for pyjsparser (setup.py): finished with status 'done'
    Created wheel for pyjsparser: filename=pyjsparser-2.7.1-py3-none-any.whl size=259
82 sha256=13a0b7c70bd5e94cd615eac61fdd982a7ae60d0e9c7028643f37a9db28655495
    Stored in directory: /root/.cache/pip/wheels/5e/81/26/5956478df303e2bf5a85a5df595
bb307bd25948a4bab69f7c7
    Building wheel for docopt (setup.py): started
    Building wheel for docopt (setup.py): finished with status 'done'
    Created wheel for docopt: filename=docopt-0.6.2-py2.py3-none-any.whl size=13705 s
ha256=847fd5b35009fe809a48f7a62cb7a9fe3cb49938066b0900a39af0d14a2f00eb
    Stored in directory: /root/.cache/pip/wheels/fc/ab/d4/5da2067ac95b36618c629a5f93f
809425700506f72c9732fac
Successfully built object-detection avro-python3 crcmod dill hdfs seqeval pyjsparse
r docopt
Installing collected packages: sentencepiece, pyjsparser, docopt, crcmod, zstandard
, tensorflow-model-optimization, tensorflow_io, pyparsing, portalocker, orjson, obj
size, js2py, immutabledict, fasteners, fastavro, dnspython, dill, colorama, avro-py
thon3, sacrebleu, pymongo, hdfs, seqeval, lvis, apache-beam, tensorflow-text, tf-mo
dels-official, object-detection
Attempting uninstall: pyparsing
    Found existing installation: pyparsing 3.1.1
    Uninstalling pyparsing-3.1.1:
        Successfully uninstalled pyparsing-3.1.1
Successfully installed apache-beam-2.51.0 avro-python3-1.10.2 colorama-0.4.6 crcmo
d-1.7 dill-0.3.1.1 dnspython-2.4.2 docopt-0.6.2 fastavro-1.9.0 fasteners-0.19 hdf
s-2.7.3 immutabledict-3.0.0 js2py-0.74 lvis-0.5.3 object-detection-0.1 objsiz
e-0.6.1 orjson-3.9.10 portalocker-2.8.2 pyjsparser-2.7.1 pymongo-4.6.0 pyparsin
g-2.4.7 sacrebleu-2.2.0 sentencepiece-0.1.99 seqeval-1.2.2 tensorflow-model-optimiz
```

```
ation-0.7.5 tensorflow-text-2.14.0 tensorflow_io-0.34.0 tf-models-official-2.14.2 z  
standard-0.22.0
```

WARNING: apt does not have a stable CLI interface. Use with caution in scripts.

Now we can import the dependencies we will need later

```
In [ ]: from object_detection.utils import label_map_util  
from object_detection.utils import visualization_utils as viz_utils  
from object_detection.utils import ops as utils_ops  
  
%matplotlib inline
```

Load label map data (for plotting).

Label maps correspond index numbers to category names, so that when our convolution network predicts 5, we know that this corresponds to airplane. Here we use internal utility functions, but anything that returns a dictionary mapping integers to appropriate string labels would be fine.

We are going, for simplicity, to load from the repository that we loaded the Object Detection API code

```
In [ ]: PATH_TO_LABELS = './models/research/object_detection/data/mscoco_label_map.pbtxt'  
category_index = label_map_util.create_category_index_from_labelmap(PATH_TO_LABELS,
```

Build a detection model and load pre-trained model weights

Here we will choose which Object Detection model we will use. Select the architecture and it will be loaded automatically. If you want to change the model to try other architectures later, just change the next cell and execute following ones.

Tip: if you want to read more details about the selected model, you can follow the link (model handle) and read additional documentation on TF Hub. After you select a model, we will print the handle to make it easier.

```
In [ ]: #@title Model Selection { display-mode: "form", run: "auto" }  
model_display_name = 'SSD MobileNet V1 FPN 640x640' # @param ['CenterNet HourGlass1'  
model_handle = ALL_MODELS[model_display_name]  
  
print('Selected model:' + model_display_name)  
print('Model Handle at TensorFlow Hub: {}'.format(model_handle))
```

```
Selected model:SSD MobileNet V1 FPN 640x640  
Model Handle at TensorFlow Hub: https://tfhub.dev/tensorflow/ssd_mobilenet_v1/fpn_6  
40x640/1
```

Loading the selected model from TensorFlow Hub

Here we just need the model handle that was selected and use the Tensorflow Hub library to load it to memory.

```
In [ ]: print('loading model...')  
hub_model = hub.load(model_handle)  
print('model loaded!')  
  
loading model...  
model loaded!
```

Loading an image

Let's try the model on a simple image. To help with this, we provide a list of test images.

Here are some simple things to try out if you are curious:

- Try running inference on your own images, just upload them to colab and load the same way it's done in the cell below.
- Modify some of the input images and see if detection still works. Some simple things to try out here include flipping the image horizontally, or converting to grayscale (note that we still expect the input image to have 3 channels).

Be careful: when using images with an alpha channel, the model expect 3 channels images and the alpha will count as a 4th.

```
In [ ]: #@title Image Selection (don't forget to execute the cell!) { display-mode: "form"}  
selected_image = 'Lycee' # @param ['Beach', 'Savane', 'Zevent', 'Bouchon', 'Bouchon  
flip_image_horizontally = False #@param {type:"boolean"}  
convert_image_to_grayscale = False #@param {type:"boolean"}  
  
image_path = IMAGES_FOR_TEST[selected_image]  
image_np = load_image_into_numpy_array(image_path)  
  
# Flip horizontally  
if(flip_image_horizontally):  
    image_np[0] = np.fliplr(image_np[0]).copy()  
  
# Convert image to grayscale  
if(convert_image_to_grayscale):  
    image_np[0] = np.tile(  
        np.mean(image_np[0], 2, keepdims=True), (1, 1, 3)).astype(np.uint8)  
  
plt.figure(figsize=(24,32))  
plt.imshow(image_np[0])  
plt.show()
```



Doing the inference

To do the inference we just need to call our TF Hub loaded model.

Things you can try:

- Print out `result['detection_boxes']` and try to match the box locations to the boxes in the image. Notice that coordinates are given in normalized form (i.e., in the interval [0, 1]).
- inspect other output keys present in the result. A full documentation can be seen on the models documentation page (pointing your browser to the model handle printed earlier)

```
In [ ]: # running inference
results = hub_model(image_np)

# different object detection models have additional results
# all of them are explained in the documentation
result = {key:value.numpy() for key,value in results.items()}
print(result.keys())

dict_keys(['detection_anchor_indices', 'raw_detection_scores', 'num_detections', 'detection_classes', 'raw_detection_boxes', 'detection_multiclass_scores', 'detection_boxes', 'detection_scores'])
```

Visualizing the results

Here is where we will need the TensorFlow Object Detection API to show the squares from the inference step (and the keypoints when available).

the full documentation of this method can be seen [here](#)

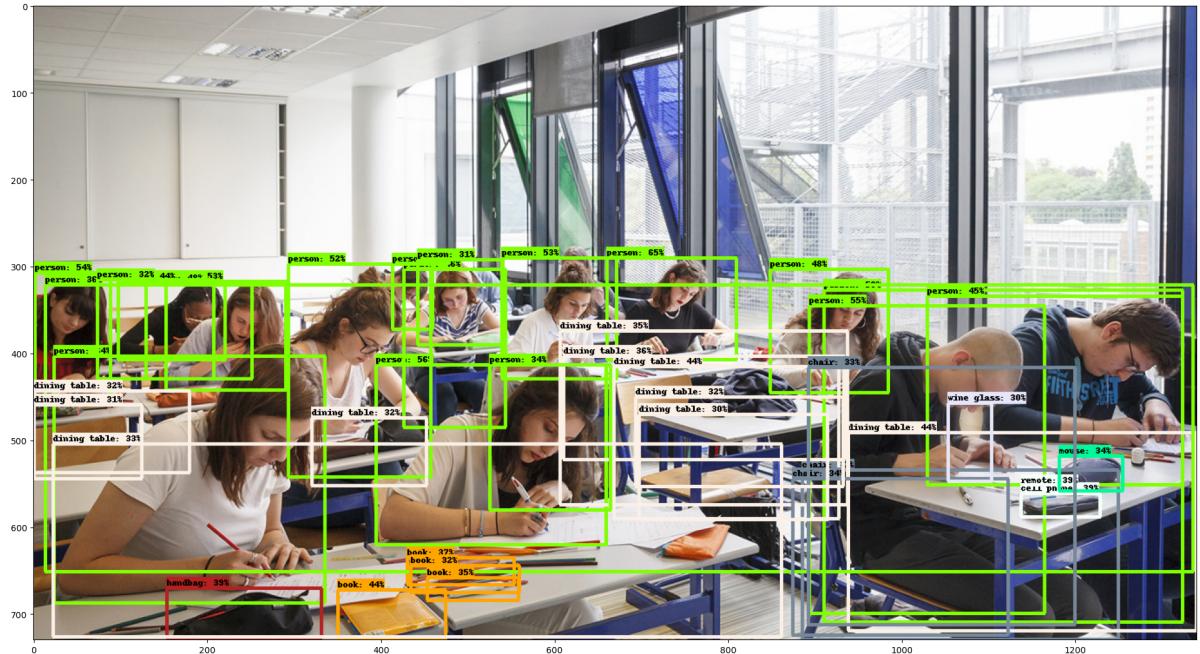
Here you can, for example, set `min_score_thresh` to other values (between 0 and 1) to allow more detections in or to filter out more detections.

```
In [ ]: label_id_offset = 0
image_np_with_detections = image_np.copy()

# Use keypoints if available in detections
keypoints, keypoint_scores = None, None
if 'detection_keypoints' in result:
    keypoints = result['detection_keypoints'][0]
    keypoint_scores = result['detection_keypoint_scores'][0]

viz_utils.visualize_boxes_and_labels_on_image_array(
    image_np_with_detections[0],
    result['detection_boxes'][0],
    (result['detection_classes'][0] + label_id_offset).astype(int),
    result['detection_scores'][0],
    category_index,
    use_normalized_coordinates=True,
    max_boxes_to_draw=200,
    min_score_thresh=.30,
    agnostic_mode=False,
    keypoints=keypoints,
    keypoint_scores=keypoint_scores,
    keypoint_edges=COCO17_HUMAN_POSE_KEYPOINTS)

plt.figure(figsize=(24,32))
plt.imshow(image_np_with_detections[0])
plt.show()
```



[Optional]

Among the available object detection models there's Mask R-CNN and the output of this model allows instance segmentation.

To visualize it we will use the same method we did before but adding an aditional parameter:
`instance_masks=output_dict.get('detection_masks_reframed', None)`

```
In [ ]: # Handle models with masks:  
image_np_with_mask = image_np.copy()  
  
if 'detection_masks' in result:  
    # we need to convert np.arrays to tensors  
    detection_masks = tf.convert_to_tensor(result['detection_masks'][0])  
    detection_boxes = tf.convert_to_tensor(result['detection_boxes'][0])  
  
    # Reframe the bbox mask to the image size.  
    detection_masks_reframed = utils_ops.reframe_box_masks_to_image_masks(  
        detection_masks, detection_boxes,  
        image_np.shape[1], image_np.shape[2])  
    detection_masks_reframed = tf.cast(detection_masks_reframed > 0.5,  
        tf.uint8)  
    result['detection_masks_reframed'] = detection_masks_reframed.numpy()  
  
viz_utils.visualize_boxes_and_labels_on_image_array(  
    image_np_with_mask[0],  
    result['detection_boxes'][0],  
    (result['detection_classes'][0] + label_id_offset).astype(int),  
    result['detection_scores'][0],  
    category_index,  
    use_normalized_coordinates=True,  
    max_boxes_to_draw=200,  
    min_score_thresh=.30,  
    agnostic_mode=False,  
    instance_masks=result.get('detection_masks_reframed', None),  
    line_thickness=8)  
  
plt.figure(figsize=(24,32))  
plt.imshow(image_np_with_mask[0])  
plt.show()
```

