0. Setup Paths

```python
import os


CUSTOM_MODEL_NAME = 'my_ssd_mobnet'
PRETRAINED_MODEL_NAME = 'ssd_mobilenet_v2_fpnlite_320x320_coco17_tpu-8'
PRETRAINED_MODEL_URL = 'http://download.tensorflow.org/models/object_detection/tf2/2020071
TF_RECORD_SCRIPT_NAME = 'generate_tfrecord.py'
LABEL_MAP_NAME = 'label_map.pbtxt'


paths = {
    'WORKSPACE_PATH': os.path.join('Tensorflow', 'workspace'),
    'SCRIPTS_PATH': os.path.join('Tensorflow','scripts'),
    'APIMODEL_PATH': os.path.join('Tensorflow','models'),
    'ANNOTATION_PATH': os.path.join('Tensorflow', 'workspace','annotations'),
    'IMAGE_PATH': os.path.join('Tensorflow', 'workspace','images'),
    'MODEL_PATH': os.path.join('Tensorflow', 'workspace','models'),
    'PRETRAINED_MODEL_PATH': os.path.join('Tensorflow', 'workspace','pre-trained-models'),
    'CHECKPOINT_PATH': os.path.join('Tensorflow', 'workspace','models',CUSTOM_MODEL_NAME),
    'OUTPUT_PATH': os.path.join('Tensorflow', 'workspace','models',CUSTOM_MODEL_NAME, 'exp
    'TFJS_PATH':os.path.join('Tensorflow', 'workspace','models',CUSTOM_MODEL_NAME, 'tfjsex
    'TFLITE_PATH':os.path.join('Tensorflow', 'workspace','models',CUSTOM_MODEL_NAME, 'tfli
    'PROTOC_PATH':os.path.join('Tensorflow','protoc')
 }


files = {
    'PIPELINE_CONFIG':os.path.join('Tensorflow', 'workspace','models', CUSTOM_MODEL_NAME,
    'TF_RECORD_SCRIPT': os.path.join(paths['SCRIPTS_PATH'], TF_RECORD_SCRIPT_NAME),
    'LABELMAP': os.path.join(paths['ANNOTATION_PATH'], LABEL_MAP_NAME)
}


for path in paths.values():
    if not os.path.exists(path):
        if os.name == 'posix':
            !mkdir -p {path}
        if os.name == 'nt':
            !mkdir {path}
```

1. Download TF Models Pretrained Models from Tensorflow Model Zoo and Install TFOD

```python
# https://www.tensorflow.org/install/source_windows
```

```
if os.name=='nt':
    !pip3 install wget
    import wget


if not os.path.exists(os.path.join(paths['APIMODEL_PATH'], 'research', 'object_detection')
    !git clone https://github.com/tensorflow/models {paths['APIMODEL_PATH']}
```

```
    Cloning into 'Tensorflow/models'...
    remote: Enumerating objects: 75161, done.
    remote: Total 75161 (delta 0), reused 0 (delta 0), pack-reused 75161
    Receiving objects: 100% (75161/75161), 580.40 MiB | 17.46 MiB/s, done.
    Resolving deltas: 100% (53367/53367), done.
```

```
# Install Tensorflow Object Detection
if os.name=='posix':
    !apt-get install protobuf-compiler
    !cd Tensorflow/models/research && protoc object_detection/protos/*.proto --python_out=

if os.name=='nt':
    url="https://github.com/protocolbuffers/protobuf/releases/download/v3.15.6/protoc-3.15
    wget.download(url)
    !move protoc-3.15.6-win64.zip {paths['PROTOC_PATH']}
    !cd {paths['PROTOC_PATH']} && tar -xf protoc-3.15.6-win64.zip
    os.environ['PATH'] += os.pathsep + os.path.abspath(os.path.join(paths['PROTOC_PATH'],
    !cd Tensorflow/models/research && protoc object_detection/protos/*.proto --python_out=
    !cd Tensorflow/models/research/slim && pip install -e .
```

```
    Reading package lists... Done
    Building dependency tree
    Reading state information... Done
    protobuf-compiler is already the newest version (3.0.0-9.1ubuntu1).
    The following package was automatically installed and is no longer required:
      libnvidia-common-460
    Use 'apt autoremove' to remove it.
    0 upgraded, 0 newly installed, 0 to remove and 62 not upgraded.
    Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheel
    Processing /content/Tensorflow/models/research
      DEPRECATION: A future pip version will change local packages to be built in-place
        pip 21.3 will remove support for this functionality. You can find discussion reg
    Collecting avro-python3
      Downloading avro-python3-1.10.2.tar.gz (38 kB)
    Collecting apache-beam
      Downloading apache_beam-2.40.0-cp37-cp37m-manylinux2010_x86_64.whl (10.9 MB)
          |████████████████████████████████| 10.9 MB 62.6 MB/s
    Requirement already satisfied: pillow in /usr/local/lib/python3.7/dist-packages (f
    Requirement already satisfied: lxml in /usr/local/lib/python3.7/dist-packages (fro
    Requirement already satisfied: matplotlib in /usr/local/lib/python3.7/dist-package
    Requirement already satisfied: Cython in /usr/local/lib/python3.7/dist-packages (f
    Requirement already satisfied: contextlib2 in /usr/local/lib/python3.7/dist-packag
    Collecting tf-slim
      Downloading tf_slim-1.1.0-py2.py3-none-any.whl (352 kB)
          |████████████████████████████████| 352 kB 62.0 MB/s
    Requirement already satisfied: six in /usr/local/lib/python3.7/dist-packages (from
    Requirement already satisfied: pycocotools in /usr/local/lib/python3.7/dist-packag
    Collecting lvis
      Downloading lvis-0.5.3-py3-none-any.whl (14 kB)
```

```
Requirement already satisfied: scipy in /usr/local/lib/python3.7/dist-packages (fro
Requirement already satisfied: pandas in /usr/local/lib/python3.7/dist-packages (f
Collecting tf-models-official>=2.5.1
  Downloading tf_models_official-2.9.2-py2.py3-none-any.whl (2.1 MB)
     |████████████████████████████████| 2.1 MB 63.8 MB/s
Collecting tensorflow_io
  Downloading tensorflow_io-0.26.0-cp37-cp37m-manylinux_2_12_x86_64.manylinux2010_
     |████████████████████████████████| 25.9 MB 1.6 MB/s
Requirement already satisfied: keras in /usr/local/lib/python3.7/dist-packages (fro
Collecting pyparsing==2.4.7
  Downloading pyparsing-2.4.7-py2.py3-none-any.whl (67 kB)
     |████████████████████████████████| 67 kB 6.2 MB/s
Requirement already satisfied: tensorflow-hub>=0.6.0 in /usr/local/lib/python3.7/d
Requirement already satisfied: oauth2client in /usr/local/lib/python3.7/dist-packa
Collecting sentencepiece
  Downloading sentencepiece-0.1.96-cp37-cp37m-manylinux_2_17_x86_64.manylinux2014_
     |████████████████████████████████| 1.2 MB 70.8 MB/s
Collecting sacrebleu
  Downloading sacrebleu-2.1.0-py3-none-any.whl (92 kB)
     |████████████████████████████████| 92 kB 10.7 MB/s
Collecting seqeval
  Downloading seqeval-1.2.2.tar.gz (43 kB)
     |████████████████████████████████| 43 kB 2.3 MB/s
Collecting py-cpuinfo>=3.3.0
  Downloading py-cpuinfo-8.0.0.tar.gz (99 kB)
     |████████████████████████████████| 99 kB 11.2 MB/s
Requirement already satisfied: gin-config in /usr/local/lib/python3.7/dist-package
Collecting tensorflow-model-optimization>=0.4.1
```

```python
VERIFICATION_SCRIPT = os.path.join(paths['APIMODEL_PATH'], 'research', 'object_detection',
# Verify Installation
!python {VERIFICATION_SCRIPT}
```

```
Running tests under Python 3.7.13: /usr/bin/python3
[ RUN      ] ModelBuilderTF2Test.test_create_center_net_deepmac
2022-07-08 04:18:36.786101: W tensorflow/core/common_runtime/gpu/gpu_bfc_allocator
W0708 04:18:37.013534 140713879467904 model_builder.py:1102] Building experimental
INFO:tensorflow:time(__main__.ModelBuilderTF2Test.test_create_center_net_deepmac):
I0708 04:18:37.373150 140713879467904 test_util.py:2459] time(__main__.ModelBuilde
[       OK ] ModelBuilderTF2Test.test_create_center_net_deepmac
[ RUN      ] ModelBuilderTF2Test.test_create_center_net_model0 (customize_head_par
INFO:tensorflow:time(__main__.ModelBuilderTF2Test.test_create_center_net_model0 (c
I0708 04:18:37.861805 140713879467904 test_util.py:2459] time(__main__.ModelBuilde
[       OK ] ModelBuilderTF2Test.test_create_center_net_model0 (customize_head_par
[ RUN      ] ModelBuilderTF2Test.test_create_center_net_model1 (customize_head_par
INFO:tensorflow:time(__main__.ModelBuilderTF2Test.test_create_center_net_model1 (c
I0708 04:18:38.109400 140713879467904 test_util.py:2459] time(__main__.ModelBuilde
[       OK ] ModelBuilderTF2Test.test_create_center_net_model1 (customize_head_par
[ RUN      ] ModelBuilderTF2Test.test_create_center_net_model_from_keypoints
INFO:tensorflow:time(__main__.ModelBuilderTF2Test.test_create_center_net_model_fro
I0708 04:18:38.341692 140713879467904 test_util.py:2459] time(__main__.ModelBuilde
[       OK ] ModelBuilderTF2Test.test_create_center_net_model_from_keypoints
[ RUN      ] ModelBuilderTF2Test.test_create_center_net_model_mobilenet
INFO:tensorflow:time(__main__.ModelBuilderTF2Test.test_create_center_net_model_mob
I0708 04:18:40.227622 140713879467904 test_util.py:2459] time(__main__.ModelBuilde
[       OK ] ModelBuilderTF2Test.test_create_center_net_model_mobilenet
[ RUN      ] ModelBuilderTF2Test.test_create_experimental_model
INFO:tensorflow:time(__main__.ModelBuilderTF2Test.test_create_experimental_model):
```

```
I0708 04:18:40.228773 140713879467904 test_util.py:2459] time(__main__.ModelBuilde
[       OK ] ModelBuilderTF2Test.test_create_experimental_model
[ RUN      ] ModelBuilderTF2Test.test_create_faster_rcnn_from_config_with_crop_fea
INFO:tensorflow:time(__main__.ModelBuilderTF2Test.test_create_faster_rcnn_from_con
I0708 04:18:40.262844 140713879467904 test_util.py:2459] time(__main__.ModelBuilde
[       OK ] ModelBuilderTF2Test.test_create_faster_rcnn_from_config_with_crop_fea
[ RUN      ] ModelBuilderTF2Test.test_create_faster_rcnn_from_config_with_crop_fea
INFO:tensorflow:time(__main__.ModelBuilderTF2Test.test_create_faster_rcnn_from_con
I0708 04:18:40.284468 140713879467904 test_util.py:2459] time(__main__.ModelBuilde
[       OK ] ModelBuilderTF2Test.test_create_faster_rcnn_from_config_with_crop_fea
[ RUN      ] ModelBuilderTF2Test.test_create_faster_rcnn_model_from_config_with_ex
INFO:tensorflow:time(__main__.ModelBuilderTF2Test.test_create_faster_rcnn_model_fr
I0708 04:18:40.307096 140713879467904 test_util.py:2459] time(__main__.ModelBuilde
[       OK ] ModelBuilderTF2Test.test_create_faster_rcnn_model_from_config_with_ex
[ RUN      ] ModelBuilderTF2Test.test_create_faster_rcnn_models_from_config_faster_
INFO:tensorflow:time(__main__.ModelBuilderTF2Test.test_create_faster_rcnn_models_f
I0708 04:18:40.477264 140713879467904 test_util.py:2459] time(__main__.ModelBuilde
[       OK ] ModelBuilderTF2Test.test_create_faster_rcnn_models_from_config_faster_
[ RUN      ] ModelBuilderTF2Test.test_create_faster_rcnn_models_from_config_faster_
INFO:tensorflow:time(__main__.ModelBuilderTF2Test.test_create_faster_rcnn_models_f
I0708 04:18:40.635847 140713879467904 test_util.py:2459] time(__main__.ModelBuilde
[       OK ] ModelBuilderTF2Test.test_create_faster_rcnn_models_from_config_faster_
[ RUN      ] ModelBuilderTF2Test.test_create_faster_rcnn_models_from_config_mask_r
INFO:tensorflow:time(__main__.ModelBuilderTF2Test.test_create_faster_rcnn_models_f
I0708 04:18:40.806089 140713879467904 test_util.py:2459] time(__main__.ModelBuilde
[       OK ] ModelBuilderTF2Test.test_create_faster_rcnn_models_from_config_mask_r
[ RUN      ] ModelBuilderTF2Test.test_create_faster_rcnn_models_from_config_mask_r
INFO:tensorflow:time(__main__.ModelBuilderTF2Test.test_create_faster_rcnn_models_f
I0708 04:18:40.962275 140713879467904 test_util.py:2459] time(__main__.ModelBuilde
[       OK ] ModelBuilderTF2Test.test_create_faster_rcnn_models_from_config_mask_r
[ RUN      ] ModelBuilderTF2Test.test_create_rfcn_model_from_config
INFO:tensorflow:time(__main__.ModelBuilderTF2Test.test_create_rfcn_model_from_conf
```

```
!pip uninstall opencv-python==4.5.2.52
```

```
!pip install opencv-python-headless==4.5.5.62
```

```
Found existing installation: opencv-python 4.1.2.30
Uninstalling opencv-python-4.1.2.30:
  Would remove:
    /usr/local/lib/python3.7/dist-packages/cv2/*
    /usr/local/lib/python3.7/dist-packages/opencv_python-4.1.2.30.dist-info/*
  Would not remove (might be manually added):
    /usr/local/lib/python3.7/dist-packages/cv2/config-3.py
    /usr/local/lib/python3.7/dist-packages/cv2/config.py
    /usr/local/lib/python3.7/dist-packages/cv2/cv2.abi3.so
    /usr/local/lib/python3.7/dist-packages/cv2/gapi/__init__.py
    /usr/local/lib/python3.7/dist-packages/cv2/load_config_py2.py
    /usr/local/lib/python3.7/dist-packages/cv2/load_config_py3.py
    /usr/local/lib/python3.7/dist-packages/cv2/mat_wrapper/__init__.py
    /usr/local/lib/python3.7/dist-packages/cv2/misc/__init__.py
    /usr/local/lib/python3.7/dist-packages/cv2/misc/version.py
    /usr/local/lib/python3.7/dist-packages/cv2/utils/__init__.py
    /usr/local/lib/python3.7/dist-packages/cv2/version.py
Proceed (y/n)? y
  Successfully uninstalled opencv-python-4.1.2.30
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/
Collecting opencv-python-headless==4.5.5.62
  Downloading opencv_python_headless-4.5.5.62-cp36-abi3-manylinux_2_17_x86_64.manylin
```

```
                |████████████████████████| 47.7 MB 1.2 MB/s
      Requirement already satisfied: numpy>=1.14.5 in /usr/local/lib/python3.7/dist-package
      Installing collected packages: opencv-python-headless
        Attempting uninstall: opencv-python-headless
          Found existing installation: opencv-python-headless 4.6.0.66
          Uninstalling opencv-python-headless-4.6.0.66:
            Successfully uninstalled opencv-python-headless-4.6.0.66
      Successfully installed opencv-python-headless-4.5.5.62
```

◄ ░░░░░░░░░░░░░░░░░░░░░░░░░░ ►

```
import object_detection
```

```
!pip install pyyaml
```

```
    Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/
    Requirement already satisfied: pyyaml in /usr/local/lib/python3.7/dist-packages (5.4
```

◄ ░░░░░░░░░░░░░░░░░░░░░░░░░░ ►

```
!pip install --upgrade pip
!pip install tensorflow
```

```
    Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheel
    Requirement already satisfied: pip in /usr/local/lib/python3.7/dist-packages (21.1
    Collecting pip
      Downloading pip-22.1.2-py3-none-any.whl (2.1 MB)
                |████████████████████████| 2.1 MB 34.3 MB/s
    Installing collected packages: pip
      Attempting uninstall: pip
        Found existing installation: pip 21.1.3
        Uninstalling pip-21.1.3:
          Successfully uninstalled pip-21.1.3
    Successfully installed pip-22.1.2
    Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheel
    Requirement already satisfied: tensorflow in /usr/local/lib/python3.7/dist-package
    Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.23.1 in /usr/local/
    Requirement already satisfied: grpcio<2.0,>=1.24.3 in /usr/local/lib/python3.7/dis
    Requirement already satisfied: astunparse>=1.6.0 in /usr/local/lib/python3.7/dist-
    Requirement already satisfied: libclang>=13.0.0 in /usr/local/lib/python3.7/dist-p
    Requirement already satisfied: setuptools in /usr/local/lib/python3.7/dist-package
    Requirement already satisfied: google-pasta>=0.1.1 in /usr/local/lib/python3.7/dis
    Requirement already satisfied: keras<2.10.0,>=2.9.0rc0 in /usr/local/lib/python3.7/
    Requirement already satisfied: flatbuffers<2,>=1.12 in /usr/local/lib/python3.7/di
    Requirement already satisfied: tensorboard<2.10,>=2.9 in /usr/local/lib/python3.7/
    Requirement already satisfied: tensorflow-estimator<2.10.0,>=2.9.0rc0 in /usr/loca
    Requirement already satisfied: numpy>=1.20 in /usr/local/lib/python3.7/dist-packag
    Requirement already satisfied: wrapt>=1.11.0 in /usr/local/lib/python3.7/dist-pack
    Requirement already satisfied: keras-preprocessing>=1.1.1 in /usr/local/lib/python
    Requirement already satisfied: packaging in /usr/local/lib/python3.7/dist-packages
    Requirement already satisfied: gast<=0.4.0,>=0.2.1 in /usr/local/lib/python3.7/dis
    Requirement already satisfied: absl-py>=1.0.0 in /usr/local/lib/python3.7/dist-pac
    Requirement already satisfied: opt-einsum>=2.3.2 in /usr/local/lib/python3.7/dist-
    Requirement already satisfied: six>=1.12.0 in /usr/local/lib/python3.7/dist-packag
    Requirement already satisfied: termcolor>=1.1.0 in /usr/local/lib/python3.7/dist-p
    Requirement already satisfied: protobuf<3.20,>=3.9.2 in /usr/local/lib/python3.7/d
    Requirement already satisfied: typing-extensions>=3.6.6 in /usr/local/lib/python3.
    Requirement already satisfied: h5py>=2.9.0 in /usr/local/lib/python3.7/dist-packag
```

```
Requirement already satisfied: wheel<1.0,>=0.23.0 in /usr/local/lib/python3.7/dist
Requirement already satisfied: cached-property in /usr/local/lib/python3.7/dist-pa
Requirement already satisfied: tensorboard-plugin-wit>=1.6.0 in /usr/local/lib/pyt
Requirement already satisfied: google-auth-oauthlib<0.5,>=0.4.1 in /usr/local/lib/
Requirement already satisfied: werkzeug>=1.0.1 in /usr/local/lib/python3.7/dist-pa
Requirement already satisfied: tensorboard-data-server<0.7.0,>=0.6.0 in /usr/local,
Requirement already satisfied: requests<3,>=2.21.0 in /usr/local/lib/python3.7/dis
Requirement already satisfied: google-auth<3,>=1.6.3 in /usr/local/lib/python3.7/d
Requirement already satisfied: markdown>=2.6.8 in /usr/local/lib/python3.7/dist-pa
Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in /usr/local/lib/python3.
Requirement already satisfied: rsa<5,>=3.1.4 in /usr/local/lib/python3.7/dist-pack
Requirement already satisfied: pyasn1-modules>=0.2.1 in /usr/local/lib/python3.7/d
Requirement already satisfied: cachetools<5.0,>=2.0.0 in /usr/local/lib/python3.7/
Requirement already satisfied: requests-oauthlib>=0.7.0 in /usr/local/lib/python3.
Requirement already satisfied: importlib-metadata>=4.4 in /usr/local/lib/python3.7,
Requirement already satisfied: urllib3<1.27,>=1.21.1 in /usr/local/lib/python3.7/d
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.7/dist
Requirement already satisfied: charset-normalizer<3,>=2 in /usr/local/lib/python3.
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.7/dist-packa
Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.7/dist-packages
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in /usr/local/lib/python3.7/di
Requirement already satisfied: oauthlib>=3.0.0 in /usr/local/lib/python3.7/dist-pa
```

```
!pip list
```

```
Package                        Version
------------------------------ ------------------------------
absl-py                        1.1.0
alabaster                      0.7.12
albumentations                 0.1.12
altair                         4.2.0
apache-beam                    2.40.0
appdirs                        1.4.4
argon2-cffi                    21.3.0
argon2-cffi-bindings           21.2.0
arviz                          0.12.1
astor                          0.8.1
astropy                        4.3.1
astunparse                     1.6.3
atari-py                       0.2.9
atomicwrites                   1.4.0
attrs                          21.4.0
audioread                      2.1.9
autograd                       1.4
avro-python3                   1.10.2
Babel                          2.10.2
backcall                       0.2.0
beautifulsoup4                 4.6.3
bleach                         5.0.0
blis                           0.7.7
bokeh                          2.3.3
branca                         0.5.0
bs4                            0.0.1
CacheControl                   0.12.11
cached-property                1.5.2
cachetools                     4.2.4
catalogue                      2.0.7
certifi                        2022.6.15
```

```
cffi                             1.15.0
cftime                           1.6.0
chardet                          3.0.4
charset-normalizer               2.1.0
click                            7.1.2
cloudpickle                      2.1.0
cmake                            3.22.5
cmdstanpy                        0.9.5
colorama                         0.4.5
colorcet                         3.0.0
colorlover                       0.3.0
community                        1.0.0b1
contextlib2                      0.5.5
convertdate                      2.4.0
coverage                         3.7.1
coveralls                        0.5
crcmod                           1.7
cufflinks                        0.17.3
cupy-cuda111                     9.4.0
cvxopt                           1.2.7
cvxpy                            1.0.31
cycler                           0.11.0
cymem                            2.0.6
Cython                           0.29.30
```

```python
if os.name =='posix':
    !wget {PRETRAINED_MODEL_URL}
    !mv {PRETRAINED_MODEL_NAME+'.tar.gz'} {paths['PRETRAINED_MODEL_PATH']}
    !cd {paths['PRETRAINED_MODEL_PATH']} && tar -zxvf {PRETRAINED_MODEL_NAME+'.tar.gz'}
if os.name == 'nt':
    wget.download(PRETRAINED_MODEL_URL)
    !move {PRETRAINED_MODEL_NAME+'.tar.gz'} {paths['PRETRAINED_MODEL_PATH']}
    !cd {paths['PRETRAINED_MODEL_PATH']} && tar -zxvf {PRETRAINED_MODEL_NAME+'.tar.gz'}
```

```
--2022-07-08 04:27:26--  http://download.tensorflow.org/models/object_detection/tf2/2
Resolving download.tensorflow.org (download.tensorflow.org)... 74.125.200.128, 2404:6
Connecting to download.tensorflow.org (download.tensorflow.org)|74.125.200.128|:80..
HTTP request sent, awaiting response... 200 OK
Length: 20515344 (20M) [application/x-tar]
Saving to: 'ssd_mobilenet_v2_fpnlite_320x320_coco17_tpu-8.tar.gz'

ssd_mobilenet_v2_fp 100%[===================>]  19.56M  --.-KB/s    in 0.08s

2022-07-08 04:27:27 (250 MB/s) - 'ssd_mobilenet_v2_fpnlite_320x320_coco17_tpu-8.tar.g

ssd_mobilenet_v2_fpnlite_320x320_coco17_tpu-8/
ssd_mobilenet_v2_fpnlite_320x320_coco17_tpu-8/checkpoint/
ssd_mobilenet_v2_fpnlite_320x320_coco17_tpu-8/checkpoint/ckpt-0.data-00000-of-00001
ssd_mobilenet_v2_fpnlite_320x320_coco17_tpu-8/checkpoint/checkpoint
ssd_mobilenet_v2_fpnlite_320x320_coco17_tpu-8/checkpoint/ckpt-0.index
ssd_mobilenet_v2_fpnlite_320x320_coco17_tpu-8/pipeline.config
ssd_mobilenet_v2_fpnlite_320x320_coco17_tpu-8/saved_model/
ssd_mobilenet_v2_fpnlite_320x320_coco17_tpu-8/saved_model/saved_model.pb
ssd_mobilenet_v2_fpnlite_320x320_coco17_tpu-8/saved_model/variables/
ssd_mobilenet_v2_fpnlite_320x320_coco17_tpu-8/saved_model/variables/variables.data-00
ssd_mobilenet_v2_fpnlite_320x320_coco17_tpu-8/saved_model/variables/variables.index
```

2. Create Label Map

```python
labels = [{'name':'thumbsup', 'id':1}, {'name':'thumbsdown', 'id':2}, {'name':'ok', 'id':3

with open(files['LABELMAP'], 'w') as f:
    for label in labels:
        f.write('item { \n')
        f.write('\tname:\'{}\'\n'.format(label['name']))
        f.write('\tid:{}\n'.format(label['id']))
        f.write('}\n')
```

3. Create TF records

```python
ARCHIVE_FILES = os.path.join(paths['IMAGE_PATH'], 'archive.tar.gz')
if os.path.exists(ARCHIVE_FILES):
  !tar -zxvf {ARCHIVE_FILES}
```

```python
if not os.path.exists(files['TF_RECORD_SCRIPT']):
    !git clone https://github.com/nicknochnack/GenerateTFRecord {paths['SCRIPTS_PATH']}

    Cloning into 'Tensorflow/scripts'...
    remote: Enumerating objects: 3, done.
    remote: Counting objects: 100% (3/3), done.
    remote: Compressing objects: 100% (2/2), done.
    remote: Total 3 (delta 0), reused 1 (delta 0), pack-reused 0
    Unpacking objects: 100% (3/3), done.
```

```python
!python {files['TF_RECORD_SCRIPT']} -x {os.path.join(paths['IMAGE_PATH'], 'train')} -l {fi
!python {files['TF_RECORD_SCRIPT']} -x {os.path.join(paths['IMAGE_PATH'], 'test')} -l {fil

    Successfully created the TFRecord file: Tensorflow/workspace/annotations/train.recor
    Successfully created the TFRecord file: Tensorflow/workspace/annotations/test.record
```

4. Copy Model Config to Training Folder

```python
if os.name =='posix':
    !cp {os.path.join(paths['PRETRAINED_MODEL_PATH'], PRETRAINED_MODEL_NAME, 'pipeline.con
if os.name == 'nt':
    !copy {os.path.join(paths['PRETRAINED_MODEL_PATH'], PRETRAINED_MODEL_NAME, 'pipeline.c
```

5. Update Config For Transfer Learning

```python
import tensorflow as tf
from object_detection.utils import config_util
from object_detection.protos import pipeline_pb2
from google.protobuf import text_format
```

```python
config = config_util.get_configs_from_pipeline_file(files['PIPELINE_CONFIG'])
```

```python
config
```

```
{'eval_config': metrics_set: "coco_detection_metrics"
 use_moving_averages: false,
 'eval_input_config': label_map_path: "PATH_TO_BE_CONFIGURED"
 shuffle: false
 num_epochs: 1
 tf_record_input_reader {
   input_path: "PATH_TO_BE_CONFIGURED"
 },
 'eval_input_configs': [label_map_path: "PATH_TO_BE_CONFIGURED"
 shuffle: false
 num_epochs: 1
 tf_record_input_reader {
   input_path: "PATH_TO_BE_CONFIGURED"
 }
 ],
 'model': ssd {
   num_classes: 90
   image_resizer {
     fixed_shape_resizer {
       height: 320
       width: 320
     }
   }
   feature_extractor {
     type: "ssd_mobilenet_v2_fpn_keras"
     depth_multiplier: 1.0
     min_depth: 16
     conv_hyperparams {
       regularizer {
         l2_regularizer {
           weight: 3.9999998989515007e-05
         }
       }
       initializer {
         random_normal_initializer {
           mean: 0.0
           stddev: 0.009999999776482582
         }
       }
       activation: RELU_6
       batch_norm {
         decay: 0.996999979019165
         scale: true
         epsilon: 0.0010000000474974513
       }
     }
     use_depthwise: true
```

```
        override_base_feature_extractor_hyperparams: true
        fpn {
          min_level: 3
          max_level: 7
          additional_layer_depth: 128
        }
      }
      box_coder {
        faster_rcnn_box_coder {
          y_scale: 10.0
          x_scale: 10.0
```

```python
pipeline_config = pipeline_pb2.TrainEvalPipelineConfig()
with tf.io.gfile.GFile(files['PIPELINE_CONFIG'], "r") as f:
    proto_str = f.read()
    text_format.Merge(proto_str, pipeline_config)
```

```python
pipeline_config.model.ssd.num_classes = len(labels)
pipeline_config.train_config.batch_size = 4
pipeline_config.train_config.fine_tune_checkpoint = os.path.join(paths['PRETRAINED_MODEL_P
pipeline_config.train_config.fine_tune_checkpoint_type = "detection"
pipeline_config.train_input_reader.label_map_path= files['LABELMAP']
pipeline_config.train_input_reader.tf_record_input_reader.input_path[:] = [os.path.join(pa
pipeline_config.eval_input_reader[0].label_map_path = files['LABELMAP']
pipeline_config.eval_input_reader[0].tf_record_input_reader.input_path[:] = [os.path.join(
```

```python
config_text = text_format.MessageToString(pipeline_config)
with tf.io.gfile.GFile(files['PIPELINE_CONFIG'], "wb") as f:
    f.write(config_text)
```

▾ 6. Train the model

```python
TRAINING_SCRIPT = os.path.join(paths['APIMODEL_PATH'], 'research', 'object_detection', 'mo
```

```python
command = "python {} --model_dir={} --pipeline_config_path={} --num_train_steps=2000".form
```

```python
print(command)
```

```python
!pip install "git+https://github.com/philferriere/cocoapi.git#egg=pycocotools&subdirectory
```

```python
 !apt install --allow-change-held-packages libcudnn8=8.1.0.77-1+cuda11.2
```

```python
!{command}
```

```
    2022-07-07 15:51:59.523656: W tensorflow/core/common_runtime/gpu/gpu_bfc_allocator
    INFO:tensorflow:Using MirroredStrategy with devices ('/job:localhost/replica:0/tas
    I0707 15:51:59.529087 139652754663296 mirrored_strategy.py:374] Using MirroredStra
    INFO:tensorflow:Maybe overwriting train_steps: 2000
```

```
I0707 15:51:59.532637 139652754663296 config_util.py:552] Maybe overwriting train_
INFO:tensorflow:Maybe overwriting use_bfloat16: False
I0707 15:51:59.532810 139652754663296 config_util.py:552] Maybe overwriting use_bf
WARNING:tensorflow:From /usr/local/lib/python3.7/dist-packages/object_detection/mo
Instructions for updating:
rename to distribute_datasets_from_function
W0707 15:51:59.558044 139652754663296 deprecation.py:356] From /usr/local/lib/pyth
Instructions for updating:
rename to distribute_datasets_from_function
INFO:tensorflow:Reading unweighted datasets: ['Tensorflow/workspace/annotations/tr
I0707 15:51:59.562418 139652754663296 dataset_builder.py:162] Reading unweighted d
INFO:tensorflow:Reading record datasets for input file: ['Tensorflow/workspace/ann
I0707 15:51:59.562588 139652754663296 dataset_builder.py:79] Reading record datase
INFO:tensorflow:Number of filenames to read: 1
I0707 15:51:59.562672 139652754663296 dataset_builder.py:80] Number of filenames t
WARNING:tensorflow:num_readers has been reduced to 1 to match input file shards.
W0707 15:51:59.562741 139652754663296 dataset_builder.py:87] num_readers has been
WARNING:tensorflow:From /usr/local/lib/python3.7/dist-packages/object_detection/bu
Instructions for updating:
Use `tf.data.Dataset.interleave(map_func, cycle_length, block_length, num_parallel_
W0707 15:51:59.564901 139652754663296 deprecation.py:356] From /usr/local/lib/pyth
Instructions for updating:
Use `tf.data.Dataset.interleave(map_func, cycle_length, block_length, num_parallel_
WARNING:tensorflow:From /usr/local/lib/python3.7/dist-packages/object_detection/bu
Instructions for updating:
Use `tf.data.Dataset.map()
W0707 15:51:59.585163 139652754663296 deprecation.py:356] From /usr/local/lib/pyth
Instructions for updating:
Use `tf.data.Dataset.map()
WARNING:tensorflow:From /usr/local/lib/python3.7/dist-packages/tensorflow/python/u
Instructions for updating:
Create a `tf.sparse.SparseTensor` and use `tf.sparse.to_dense` instead.
W0707 15:52:13.175103 139652754663296 deprecation.py:356] From /usr/local/lib/pyth
Instructions for updating:
Create a `tf.sparse.SparseTensor` and use `tf.sparse.to_dense` instead.
WARNING:tensorflow:From /usr/local/lib/python3.7/dist-packages/tensorflow/python/u
Instructions for updating:
`seed2` arg is deprecated.Use sample_distorted_bounding_box_v2 instead.
W0707 15:52:16.032905 139652754663296 deprecation.py:356] From /usr/local/lib/pyth
Instructions for updating:
`seed2` arg is deprecated.Use sample_distorted_bounding_box_v2 instead.
WARNING:tensorflow:From /usr/local/lib/python3.7/dist-packages/tensorflow/python/u
Instructions for updating:
Use `tf.cast` instead.
W0707 15:52:17.550576 139652754663296 deprecation.py:356] From /usr/local/lib/pyth
Instructions for updating:
Use `tf.cast` instead.
2022-07-07 15:52:20.169858: W tensorflow/core/framework/cpu_allocator_impl.cc:82]
2022-07-07 15:52:20.214116: W tensorflow/core/framework/cpu_allocator_impl.cc:82]
2022-07-07 15:52:20.222006: W tensorflow/core/framework/cpu_allocator_impl.cc:82]
2022-07-07 15:52:20.222185: W tensorflow/core/framework/cpu_allocator_impl.cc:82]
2022-07-07 15:52:20.237275: W tensorflow/core/framework/cpu_allocator_impl.cc:82]
/usr/local/lib/python3.7/dist-packages/keras/backend.py:450: UserWarning: `tf.kera
```

7. Evaluate the Model

```
command = "python {} --model_dir={} --pipeline_config_path={} --checkpoint_dir={}".format(

print(command)

    python Tensorflow/models/research/object_detection/model_main_tf2.py --model_dir=Tens
```

◄ ▬▬▬▬▬▬▬▬▬   ►

```
!{command}
```

```
    WARNING:tensorflow:Forced number of epochs for all eval validations to be 1.
    W0707 16:01:06.464889 140259848042368 model_lib_v2.py:1090] Forced number of epoch
    INFO:tensorflow:Maybe overwriting sample_1_of_n_eval_examples: None
    I0707 16:01:06.465097 140259848042368 config_util.py:552] Maybe overwriting sample_
    INFO:tensorflow:Maybe overwriting use_bfloat16: False
    I0707 16:01:06.465177 140259848042368 config_util.py:552] Maybe overwriting use_bf
    INFO:tensorflow:Maybe overwriting eval_num_epochs: 1
    I0707 16:01:06.465260 140259848042368 config_util.py:552] Maybe overwriting eval_n
    WARNING:tensorflow:Expected number of evaluation epochs is 1, but instead encounte
    W0707 16:01:06.465371 140259848042368 model_lib_v2.py:1110] Expected number of eva
    2022-07-07 16:01:07.287255: W tensorflow/core/common_runtime/gpu/gpu_bfc_allocator
    INFO:tensorflow:Reading unweighted datasets: ['Tensorflow/workspace/annotations/te
    I0707 16:01:07.319176 140259848042368 dataset_builder.py:162] Reading unweighted d
    INFO:tensorflow:Reading record datasets for input file: ['Tensorflow/workspace/ann
    I0707 16:01:07.319417 140259848042368 dataset_builder.py:79] Reading record datase
    INFO:tensorflow:Number of filenames to read: 1
    I0707 16:01:07.319523 140259848042368 dataset_builder.py:80] Number of filenames t
    WARNING:tensorflow:num_readers has been reduced to 1 to match input file shards.
    W0707 16:01:07.319593 140259848042368 dataset_builder.py:87] num_readers has been
    WARNING:tensorflow:From /usr/local/lib/python3.7/dist-packages/object_detection/bu
    Instructions for updating:
    Use `tf.data.Dataset.interleave(map_func, cycle_length, block_length, num_parallel_
    W0707 16:01:07.321493 140259848042368 deprecation.py:356] From /usr/local/lib/pyth
    Instructions for updating:
    Use `tf.data.Dataset.interleave(map_func, cycle_length, block_length, num_parallel_
    WARNING:tensorflow:From /usr/local/lib/python3.7/dist-packages/object_detection/bu
    Instructions for updating:
    Use `tf.data.Dataset.map()
    W0707 16:01:07.341386 140259848042368 deprecation.py:356] From /usr/local/lib/pyth
    Instructions for updating:
    Use `tf.data.Dataset.map()
    WARNING:tensorflow:From /usr/local/lib/python3.7/dist-packages/tensorflow/python/u
    Instructions for updating:
    Create a `tf.sparse.SparseTensor` and use `tf.sparse.to_dense` instead.
    W0707 16:01:11.151592 140259848042368 deprecation.py:356] From /usr/local/lib/pyth
    Instructions for updating:
    Create a `tf.sparse.SparseTensor` and use `tf.sparse.to_dense` instead.
    WARNING:tensorflow:From /usr/local/lib/python3.7/dist-packages/tensorflow/python/u
    Instructions for updating:
    Use `tf.cast` instead.
    W0707 16:01:12.193752 140259848042368 deprecation.py:356] From /usr/local/lib/pyth
    Instructions for updating:
    Use `tf.cast` instead.
    INFO:tensorflow:Waiting for new checkpoint at Tensorflow/workspace/models/my_ssd_m
    I0707 16:01:14.546907 140259848042368 checkpoint_utils.py:136] Waiting for new che
    INFO:tensorflow:Found new checkpoint at Tensorflow/workspace/models/my_ssd_mobnet/
    I0707 16:01:14.547892 140259848042368 checkpoint_utils.py:145] Found new checkpoin
    /usr/local/lib/python3.7/dist-packages/keras/backend.py:450: UserWarning: `tf.kera
      warnings.warn('`tf.keras.backend.set_learning_phase` is deprecated and '
```

```
WARNING:tensorflow:From /usr/local/lib/python3.7/dist-packages/tensorflow/python/u
Instructions for updating:
Use `tf.cast` instead.
W0707 16:01:37.622709 140259848042368 deprecation.py:356] From /usr/local/lib/pyth
Instructions for updating:
Use `tf.cast` instead.
INFO:tensorflow:Finished eval step 0
```

8. Load Train Model From Checkpoint

```python
import os
import tensorflow as tf
from object_detection.utils import label_map_util
from object_detection.utils import visualization_utils as viz_utils
from object_detection.builders import model_builder
from object_detection.utils import config_util


 # Load pipeline config and build a detection model
configs = config_util.get_configs_from_pipeline_file(files['PIPELINE_CONFIG'])
detection_model = model_builder.build(model_config=configs['model'], is_training=False)

# Restore checkpoint
ckpt = tf.compat.v2.train.Checkpoint(model=detection_model)
ckpt.restore(os.path.join(paths['CHECKPOINT_PATH'], 'ckpt-3')).expect_partial()

@tf.function
def detect_fn(image):
    image, shapes = detection_model.preprocess(image)
    prediction_dict = detection_model.predict(image, shapes)
    detections = detection_model.postprocess(prediction_dict, shapes)
    return detections
```

9. Detect from an Image

```python
import cv2
import numpy as np
from matplotlib import pyplot as plt
%matplotlib inline


category_index = label_map_util.create_category_index_from_labelmap(files['LABELMAP'])


IMAGE_PATH = os.path.join(paths['IMAGE_PATH'], 'test', 'istockphoto-1167770705-612x612.jpg


img = cv2.imread(IMAGE_PATH)
image_np = np.array(img)
```

```python
input_tensor = tf.convert_to_tensor(np.expand_dims(image_np, 0), dtype=tf.float32)
detections = detect_fn(input_tensor)

num_detections = int(detections.pop('num_detections'))
detections = {key: value[0, :num_detections].numpy()
              for key, value in detections.items()}
detections['num_detections'] = num_detections

# detection_classes should be ints.
detections['detection_classes'] = detections['detection_classes'].astype(np.int64)

label_id_offset = 1
image_np_with_detections = image_np.copy()

viz_utils.visualize_boxes_and_labels_on_image_array(
            image_np_with_detections,
            detections['detection_boxes'],
            detections['detection_classes']+label_id_offset,
            detections['detection_scores'],
            category_index,
            use_normalized_coordinates=True,
            max_boxes_to_draw=1,
            min_score_thresh=0.4,
            agnostic_mode=False)

plt.imshow(cv2.cvtColor(image_np_with_detections, cv2.COLOR_BGR2RGB))
plt.show()
```
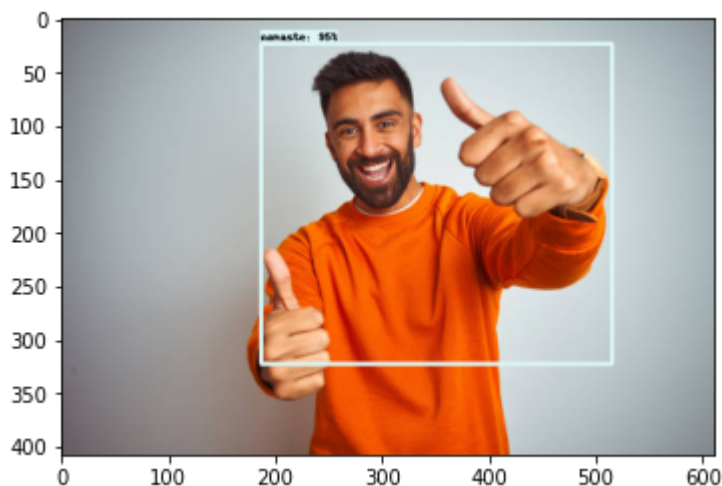
```
WARNING:tensorflow:5 out of the last 23 calls to <function detect_fn at 0x7f92e91a6e1
```


▾ 13. Zip and Export Models

```python
!tar -czf models.tar.gz {paths['CHECKPOINT_PATH']}
```

```python
from google.colab import drive
drive.mount('/content/drive')
```

Colab paid products - Cancel contracts here