Dataset:-

- We have taken the dataset Labeled Mask Dataset (PASCAL_VOC) from kaggle. (https://www.kaggle.com/datasets/techzizou/labeled-mask-dataset-pascal-voc-format (https://www.kaggle.com/datasets/techzizou/labeled-mask-dataset-pascal-voc-format)) This dataset is divided into 2 sub-categories annotations and images. There are total of 1370 images present belonging to the 2 classes, one with people wearing mask and other without mask images. The bounding box in the PASCAL_VOC format is created for all the images and the annotations for each images is present in the annotation folder. This dataset is mainly used to detect whether the people are wearing mask or not and keeping that into consideration bounding box is created around the people's face so that it can be easy to detect. With the total of 1370 images, 530 without mask images are present and rest 840 are with mask images.

We are also creating training and test record files from this dataset so that it can be used for running multiple times instead of reading this entire dataset.

- Below are the sample of the dataset (with mask and without mask):-

Importing all the required libraries

In [ ]:
```
import os
import glob
import xml.etree.ElementTree as ET
import pandas as pd
import tensorflow as tf
print(tf.__version__)
```

```
2.9.2
```

In [ ]:
```
#mounting the drive
from google.colab import drive
drive.mount('/content/gdrive')

!ln -s /content/gdrive/My\ Drive/ /mydrive
!ls /mydrive
```

```
Mounted at /content/gdrive
'0_0_Vignesh community certificate.jpeg'
 12-1.jpgkk
'4. Word embedding-edited.pdf'
 912A7910.JPG
 912A7911.JPG
 912A7912.JPG
 912A7915.JPG
 912A7916.JPG
 912A7919.JPG
 912A7920.JPG
 912A7926.JPG
 912A7928.JPG
 912A7929.JPG
 912A7932.JPG
 912A7933.JPG
 912A7934.JPG
 912A7935.JPG
 912A7936.JPG
```

In [ ]:
```
# we are clonning the tensorflow model on the colab
!git clone --q https://github.com/tensorflow/models.git

%cd models/research

!protoc object_detection/protos/*.proto --python_out=.

# Installing the tensorFlow object detection API.
!cp object_detection/packages/tf2/setup.py .
!python -m pip install .
```

```
/content/models/research
Looking in indexes: https://pypi.org/simple, (https://pypi.org/simple,) http
s://us-python.pkg.dev/colab-wheels/public/simple/ (https://us-python.pkg.dev/
colab-wheels/public/simple/)
Processing /content/models/research
  DEPRECATION: A future pip version will change local packages to be built in
-place without first copying to a temporary directory. We recommend you use -
-use-feature=in-tree-build to test your packages with this new behavior befor
e it becomes the default.
   pip 21.3 will remove support for this functionality. You can find discussi
on regarding this at https://github.com/pypa/pip/issues/7555. (https://githu
b.com/pypa/pip/issues/7555.)
Collecting avro-python3
  Downloading avro-python3-1.10.2.tar.gz (38 kB)
Collecting apache-beam
  Downloading apache_beam-2.42.0-cp37-cp37m-manylinux2010_x86_64.whl (11.0 M
B)
     |████████████████████████████████| 11.0 MB 38.1 MB/s
Requirement already satisfied: pillow in /usr/local/lib/python3.7/dist-packag
```

In [ ]:
```
# here we are testing the model builder
!python object_detection/builders/model_builder_tf2_test.py
```

```
2022-10-18 17:48:44.584715: E tensorflow/stream_executor/cuda/cuda_blas.cc:29
81] Unable to register cuBLAS factory: Attempting to register factory for plu
gin cuBLAS when one has already been registered
2022-10-18 17:48:45.330756: W tensorflow/stream_executor/platform/default/dso
_loader.cc:64] Could not load dynamic library 'libnvinfer.so.7'; dlerror: lib
nvinfer.so.7: cannot open shared object file: No such file or directory; LD_L
IBRARY_PATH: /usr/lib64-nvidia
2022-10-18 17:48:45.330911: W tensorflow/stream_executor/platform/default/dso
_loader.cc:64] Could not load dynamic library 'libnvinfer_plugin.so.7'; dlerr
or: libnvinfer_plugin.so.7: cannot open shared object file: No such file or d
irectory; LD_LIBRARY_PATH: /usr/lib64-nvidia
2022-10-18 17:48:45.330930: W tensorflow/compiler/tf2tensorrt/utils/py_utils.
cc:38] TF-TRT Warning: Cannot dlopen some TensorRT libraries. If you would li
ke to use Nvidia GPU with TensorRT, please make sure the missing libraries me
ntioned above are installed properly.
Running tests under Python 3.7.15: /usr/bin/python3
[ RUN      ] ModelBuilderTF2Test.test_create_center_net_deepmac
2022-10-18 17:48:48.571730: W tensorflow/core/common_runtime/gpu/gpu_bfc_allo
cator.cc:42] Overriding orig_value setting because the TF_FORCE_GPU_ALLOW_GRO
```

In [ ]:
```
%cd /mydrive/customTF2/data/

# unzip the datasets i.e images and annotations folder
!unzip /mydrive/customTF2/images.zip -d .
!unzip /mydrive/customTF2/annotations.zip -d .
```

```
/content/gdrive/My Drive/customTF2/data
Archive:  /mydrive/customTF2/images.zip
   creating: ./images/
  inflating: ./images/0-with-mask.jpg
  inflating: ./images/0.jpg
  inflating: ./images/1-with-mask.jpg
  inflating: ./images/10-with-mask.jpg
  inflating: ./images/100-with-mask.jpg
  inflating: ./images/101-with-mask.jpg
  inflating: ./images/103-with-mask.jpg
  inflating: ./images/104-with-mask.jpg
  inflating: ./images/105-with-mask.jpg
  inflating: ./images/106-with-mask.jpg
  inflating: ./images/107-with-mask.jpg
  inflating: ./images/108-with-mask.jpg
  inflating: ./images/109-with-mask.jpg
  inflating: ./images/11-with-mask.jpg
  inflating: ./images/110-with-mask.jpg
  inflating: ./images/111-with-mask.jpg
```

In [ ]:
```
#creating two dir for training and testing
!mkdir test_labels train_labels

# Dividing the annotations into test_labels(20%) and train_labels(80%).
# Moving the first 274/1370 labels (20% of the labels) to the testing dir: `test_
!ls annotations/* | sort -R | head -274 | xargs -I{} mv {} test_labels/


# rest of the labels ( 1096 labels ) to the training dir: `train_labels`
!ls annotations/* | xargs -I{} mv {} train_labels/
```

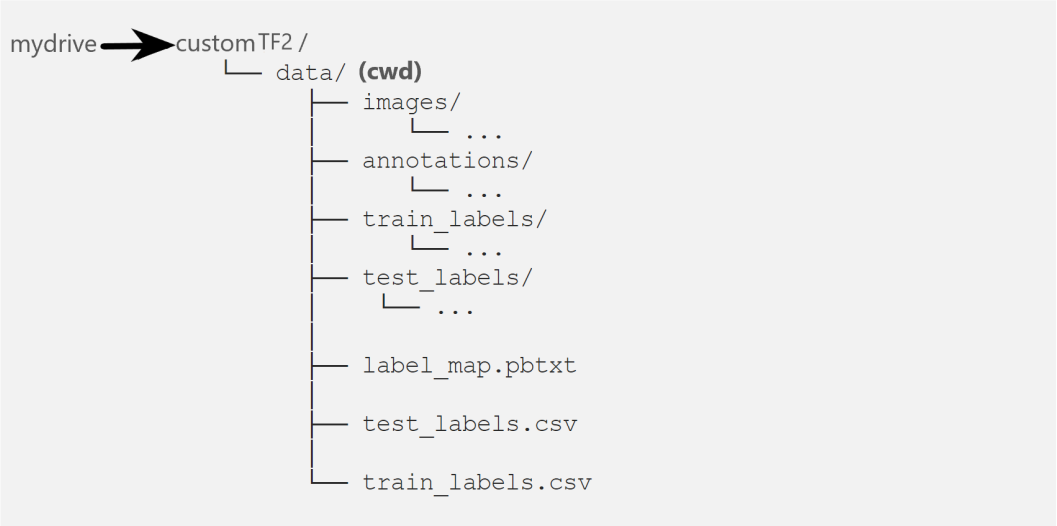
The working directory at this point:

```
mydrive➔customTF2 /
        └── data (cwd)
            ├── images
            │   ├── image_1.jpg
            │   └── ...
            │
            ├── annotations
            │   ├──
            │   └── ...
            │
            ├── train_labels //contains the labels only
            │   ├── image_1.xml
            │   └── ...
            │
            └── test_labels //contains the labels only
                ├── image_50.xml
                └── ...
```

In [ ]:
```
# here we are creating the csv file from the xml file where annotations are store
# we are also creating label_map.pbtxt file frfom the classes mentioned in the xm
# the below function xml_to-csv will be called to create test_labels.csv and trai
def xml_to_csv(path):
  classes_names = []
  xml_list = []

  for xml_file in glob.glob(path + '/*.xml'):
    tree = ET.parse(xml_file)
    root = tree.getroot()
    for member in root.findall('object'):
      classes_names.append(member[0].text)
      value = (root.find('filename').text  ,
               int(root.find('size')[0].text),
               int(root.find('size')[1].text),
               member[0].text,
               int(member[4][0].text),
               int(member[4][1].text),
               int(member[4][2].text),
               int(member[4][3].text))
      xml_list.append(value)
  column_name = ['filename', 'width', 'height', 'class', 'xmin', 'ymin', 'xmax',
  xml_df = pd.DataFrame(xml_list, columns=column_name)
  classes_names = list(set(classes_names))
  classes_names.sort()
  return xml_df, classes_names

for label_path in ['train_labels', 'test_labels']:
  image_path = os.path.join(os.getcwd(), label_path)
  xml_df, classes = xml_to_csv(label_path)
  xml_df.to_csv(f'{label_path}.csv', index=None)
  print(f'Successfully converted {label_path} xml to csv.')

label_map_path = os.path.join("label_map.pbtxt")
pbtxt_content = ""

for i, class_name in enumerate(classes):
    pbtxt_content = (
        pbtxt_content
        + "item {{\n    id: {0}\n    name: '{1}'\n}}\n\n".format(i + 1, class_nam
    )
pbtxt_content = pbtxt_content.strip()
with open(label_map_path, "w") as f:
    f.write(pbtxt_content)
    print('Successfully created label_map.pbtxt ')
```

```
Successfully converted train_labels xml to csv.
Successfully converted test_labels xml to csv.
Successfully created label_map.pbtxt
```

The working directory at this point:



Creating the train.record & test.record files

In [ ]:
```
# we need to create the train and test record files for the trained and test data
# in order to create this data we need to run generate_tfrecord.py script with th
#For train.record
!python /mydrive/customTF2/generate_tfrecord.py train_labels.csv  label_map.pbtxt

#For test.record
!python /mydrive/customTF2/generate_tfrecord.py test_labels.csv  label_map.pbtxt
```

```
2022-10-18 17:53:30.910313: E tensorflow/stream_executor/cuda/cuda_blas.cc:298
1] Unable to register cuBLAS factory: Attempting to register factory for plugin
cuBLAS when one has already been registered
2022-10-18 17:53:31.585427: W tensorflow/stream_executor/platform/default/dso_l
oader.cc:64] Could not load dynamic library 'libnvinfer.so.7'; dlerror: libnvin
fer.so.7: cannot open shared object file: No such file or directory; LD_LIBRARY
_PATH: /usr/lib64-nvidia
2022-10-18 17:53:31.585547: W tensorflow/stream_executor/platform/default/dso_l
oader.cc:64] Could not load dynamic library 'libnvinfer_plugin.so.7'; dlerror:
libnvinfer_plugin.so.7: cannot open shared object file: No such file or directo
ry; LD_LIBRARY_PATH: /usr/lib64-nvidia
2022-10-18 17:53:31.585568: W tensorflow/compiler/tf2tensorrt/utils/py_utils.c
c:38] TF-TRT Warning: Cannot dlopen some TensorRT libraries. If you would like
to use Nvidia GPU with TensorRT, please make sure the missing libraries mention
ed above are installed properly.
groups: 100% 1096/1096 [00:02<00:00, 546.17it/s]
Successfully created the TFRecords: /content/gdrive/My Drive/customTF2/data/tra
in.record
2022-10-18 17:53:36.035628: E tensorflow/stream_executor/cuda/cuda_blas.cc:298
1] Unable to register cuBLAS factory: Attempting to register factory for plugin
cuBLAS when one has already been registered
2022-10-18 17:53:36.715740: W tensorflow/stream_executor/platform/default/dso_l
oader.cc:64] Could not load dynamic library 'libnvinfer.so.7'; dlerror: libnvin
fer.so.7: cannot open shared object file: No such file or directory; LD_LIBRARY
_PATH: /usr/lib64-nvidia
2022-10-18 17:53:36.715850: W tensorflow/stream_executor/platform/default/dso_l
oader.cc:64] Could not load dynamic library 'libnvinfer_plugin.so.7'; dlerror:
libnvinfer_plugin.so.7: cannot open shared object file: No such file or directo
ry; LD_LIBRARY_PATH: /usr/lib64-nvidia
2022-10-18 17:53:36.715871: W tensorflow/compiler/tf2tensorrt/utils/py_utils.c
c:38] TF-TRT Warning: Cannot dlopen some TensorRT libraries. If you would like
to use Nvidia GPU with TensorRT, please make sure the missing libraries mention
ed above are installed properly.
groups: 100% 274/274 [00:00<00:00, 540.33it/s]
Successfully created the TFRecords: /content/gdrive/My Drive/customTF2/data/tes
t.record
```

section 12

section 12 download -> model architecture efficientdet d0 512x512

Description about Efficientdet:

The EfficientDet architecture was written by Google Brain. EfficientDet s built on top of EfficientNet, a convolutional neural network that is pretrained on the ImageNet image database for classification.

Generally, more accurate detectors have found to be more compute demanding which isn't the ideal scenario, especially when we are looking for more and more efficient models. This paper from the Google Brain team has come up with a new family of detectors that are highly efficient, accurate and much faster.

Object Detector HAve 3 main components:

1. Backbone that extracts features from the given image;
2. a feature network that takes multiple levels of features from the backbone as input and outputs a list of fused features that represent salient characteristics of the image;
3. the final class/box network that uses the fused features to predict the class and location of each object

---

Difference between EfficientNet and EfficientDet

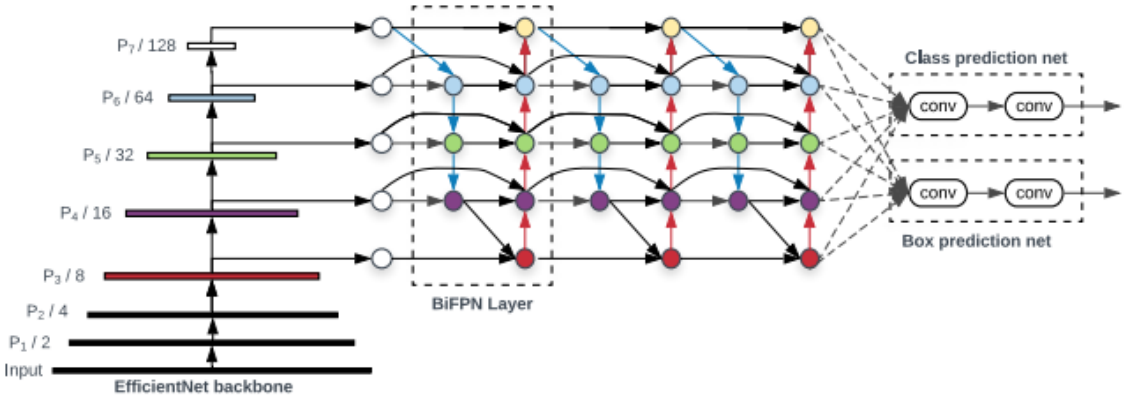
EfficientDet uses the same backbone as EfficientNet but adds a bi directional feature pyramid network to help in multi scale feature fusion.

BiFPN has 5 modifications over a normal FPN:

1. Instead of only top-down feature, it adds another bottom-up feature fusion branch
2. It has skip connections from the initial feature map to the fused feature map
3. Nodes with only one input are removed, cause they do not do much fusion as other nodes
4. The entire module is repeated multiple times
5. Features are not summed directly, instead a weighted average is used hoping different resolution feature maps contribute to the fusion at different capacity. Unbounded weights bring problems in backprop, so we need to normalise it. They tried applying softmax to the weight values which worked but slowed down training. So a simple average after relu activation is used to normalise the weights

---

EfficientDet Architecture:



The need for a new scaling technique comes from the fact that we have the BiFPN as an additional module in the network and that too can be scaled. But there's no heuristic given about the scaling technique here. The input resolution, depth of BiFPN increase linearly with ϕ and the width of BiFPN increases exponentially.

Input to EfficientDet D0 Model:

Image, name - image_arrays, shape - 1, 512, 512, 3, format is B, H, W, C, where:

B - batch size

H - height

W - width

C - channel

In [ ]:
```
http://download.tensorflow.org/models/object_detection/tf2/20200711/efficientdet_
```

In [ ]:
```
#Download the pre-trained model .

!wget http://download.tensorflow.org/models/object_detection/tf2/20200711/efficie
!tar -xzvf efficientdet_d0_coco17_tpu-32.tar.gz
```

```
--2022-10-18 17:57:07--  http://download.tensorflow.org/models/object_detectio
n/tf2/20200711/efficientdet_d0_coco17_tpu-32.tar.gz (http://download.tensorflo
w.org/models/object_detection/tf2/20200711/efficientdet_d0_coco17_tpu-32.tar.g
z)
Resolving download.tensorflow.org (download.tensorflow.org)... 172.217.194.128,
2404:6800:4003:c04::80
Connecting to download.tensorflow.org (download.tensorflow.org)|172.217.194.128
|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 30736482 (29M) [application/x-tar]
Saving to: ‘efficientdet_d0_coco17_tpu-32.tar.gz’

efficientdet_d0_coc 100%[===================>]  29.31M  63.7MB/s    in 0.5s

2022-10-18 17:57:08 (63.7 MB/s) - ‘efficientdet_d0_coco17_tpu-32.tar.gz’ saved
 [30736482/30736482]

efficientdet_d0_coco17_tpu-32/
efficientdet_d0_coco17_tpu-32/checkpoint/
efficientdet_d0_coco17_tpu-32/checkpoint/ckpt-0.data-00000-of-00001
efficientdet_d0_coco17_tpu-32/checkpoint/checkpoint
efficientdet_d0_coco17_tpu-32/checkpoint/ckpt-0.index
efficientdet_d0_coco17_tpu-32/pipeline.config
efficientdet_d0_coco17_tpu-32/saved_model/
efficientdet_d0_coco17_tpu-32/saved_model/saved_model.pb
efficientdet_d0_coco17_tpu-32/saved_model/assets/
efficientdet_d0_coco17_tpu-32/saved_model/variables/
efficientdet_d0_coco17_tpu-32/saved_model/variables/variables.data-00000-of-000
01
efficientdet_d0_coco17_tpu-32/saved_model/variables/variables.index
```

In [ ]:
```
#copy the edited config file from the configs/tf2 directory to the data

!cp /content/models/research/object_detection/configs/tf2/ssd_mobilenet_v2_fpnlit
```

Training the model

In [ ]:
```
#Navigatting to the object-detection folder
%cd /content/models/research/object_detection
```

```
/content/models/research/object_detection
```

Training using model_main_tf2.py

Here **{PIPELINE_CONFIG_PATH}** points to the pipeline config and **{MODEL_DIR}** points to the directory in which training checkpoints and events will be written. In order to get the best result we tried to stop the training when the loss is less than 0.1, because training the model until the loss did not show any major change. So we tried to keep the ideal loss below 0.05 because more than this would overfit the model.

In [ ]:
```
/content/gdrive/MyDrive/customTF2/data/efficientdet_d0_coco17_tpu-32/pipeline.cor
```

In [ ]:
```
# Run the command below from the content/models/research/object_detection directo
"""
PIPELINE_CONFIG_PATH=path/to/pipeline.config
MODEL_DIR=path to training checkpoints directory
NUM_TRAIN_STEPS=50000
SAMPLE_1_OF_N_EVAL_EXAMPLES=1

python model_main_tf2.py -- \
  --model_dir=$MODEL_DIR --num_train_steps=$NUM_TRAIN_STEPS \
  --sample_1_of_n_eval_examples=$SAMPLE_1_OF_N_EVAL_EXAMPLES \
  --pipeline_config_path=$PIPELINE_CONFIG_PATH \
  --alsologtostderr
"""

!python model_main_tf2.py --pipeline_config_path=/mydrive/customTF2/data/efficier
```

```
2022-10-18 18:21:59.072281: E tensorflow/stream_executor/cuda/cuda_blas.cc:29
81] Unable to register cuBLAS factory: Attempting to register factory for plu
gin cuBLAS when one has already been registered
2022-10-18 18:21:59.826426: W tensorflow/stream_executor/platform/default/dso
_loader.cc:64] Could not load dynamic library 'libnvinfer.so.7'; dlerror: lib
nvinfer.so.7: cannot open shared object file: No such file or directory; LD_L
IBRARY_PATH: /usr/lib64-nvidia
2022-10-18 18:21:59.826550: W tensorflow/stream_executor/platform/default/dso
_loader.cc:64] Could not load dynamic library 'libnvinfer_plugin.so.7'; dlerr
or: libnvinfer_plugin.so.7: cannot open shared object file: No such file or d
irectory; LD_LIBRARY_PATH: /usr/lib64-nvidia
2022-10-18 18:21:59.826571: W tensorflow/compiler/tf2tensorrt/utils/py_utils.
cc:38] TF-TRT Warning: Cannot dlopen some TensorRT libraries. If you would li
ke to use Nvidia GPU with TensorRT, please make sure the missing libraries me
ntioned above are installed properly.
2022-10-18 18:22:02.779186: W tensorflow/core/common_runtime/gpu/gpu_bfc_allo
cator.cc:42] Overriding orig_value setting because the TF_FORCE_GPU_ALLOW_GRO
WTH environment variable is set. Original config value was 0.
INFO:tensorflow:Using MirroredStrategy with devices ('/job:localhost/replica:
```

Evaluation using model_main_tf2.py

Here **{CHECKPOINT_DIR}** points to the directory with checkpoints produced by the training job. Evaluation events are updated to **{MODEL_DIR/eval}**.

In [ ]:
```
# Run the command below from the content/models/research/object_detection directo
"""
PIPELINE_CONFIG_PATH=path/to/pipeline.config
MODEL_DIR=path to training checkpoints directory
CHECKPOINT_DIR=${MODEL_DIR}
NUM_TRAIN_STEPS=50000
SAMPLE_1_OF_N_EVAL_EXAMPLES=1

python model_main_tf2.py -- \
  --model_dir=$MODEL_DIR --num_train_steps=$NUM_TRAIN_STEPS \
  --checkpoint_dir=${CHECKPOINT_DIR} \
  --sample_1_of_n_eval_examples=$SAMPLE_1_OF_N_EVAL_EXAMPLES \
  --pipeline_config_path=$PIPELINE_CONFIG_PATH \
  --alsologtostderr
"""

!python model_main_tf2.py --pipeline_config_path=/mydrive/customTF2/data/efficier
```

```
2022-10-18 18:22:43.047129: E tensorflow/stream_executor/cuda/cuda_blas.cc:298
1] Unable to register cuBLAS factory: Attempting to register factory for plugin
cuBLAS when one has already been registered
2022-10-18 18:22:43.792143: W tensorflow/stream_executor/platform/default/dso_l
oader.cc:64] Could not load dynamic library 'libnvinfer.so.7'; dlerror: libnvin
fer.so.7: cannot open shared object file: No such file or directory; LD_LIBRARY
_PATH: /usr/lib64-nvidia
2022-10-18 18:22:43.792232: W tensorflow/stream_executor/platform/default/dso_l
oader.cc:64] Could not load dynamic library 'libnvinfer_plugin.so.7'; dlerror:
libnvinfer_plugin.so.7: cannot open shared object file: No such file or directo
ry; LD_LIBRARY_PATH: /usr/lib64-nvidia
2022-10-18 18:22:43.792242: W tensorflow/compiler/tf2tensorrt/utils/py_utils.c
c:38] TF-TRT Warning: Cannot dlopen some TensorRT libraries. If you would like
to use Nvidia GPU with TensorRT, please make sure the missing libraries mention
ed above are installed properly.
WARNING:tensorflow:Forced number of epochs for all eval validations to be 1.
W1018 18:22:45.954440 140116256298880 model_lib_v2.py:1090] Forced number of ep
ochs for all eval validations to be 1.
INFO:tensorflow:Maybe overwriting sample_1_of_n_eval_examples: None
I1018 18:22:45.954711 140116256298880 config_util.py:552] Maybe overwriting sam
ple_1_of_n_eval_examples: None
INFO:tensorflow:Maybe overwriting use_bfloat16: False
I1018 18:22:45.954806 140116256298880 config_util.py:552] Maybe overwriting use
_bfloat16: False
INFO:tensorflow:Maybe overwriting eval_num_epochs: 1
I1018 18:22:45.954891 140116256298880 config_util.py:552] Maybe overwriting eva
l_num_epochs: 1
WARNING:tensorflow:Expected number of evaluation epochs is 1, but instead encou
ntered `eval_on_train_input_config.num_epochs` = 0. Overwriting `num_epochs` to
1.
W1018 18:22:45.955009 140116256298880 model_lib_v2.py:1110] Expected number of
evaluation epochs is 1, but instead encountered `eval_on_train_input_config.num
_epochs` = 0. Overwriting `num_epochs` to 1.
2022-10-18 18:22:46.735430: W tensorflow/core/common_runtime/gpu/gpu_bfc_alloca
tor.cc:42] Overriding orig_value setting because the TF_FORCE_GPU_ALLOW_GROWTH
environment variable is set. Original config value was 0.
I1018 18:22:46.753464 140116256298880 ssd_efficientnet_bifpn_feature_extractor.
```

```
py:146] EfficientDet EfficientNet backbone version: efficientnet-b0
I1018 18:22:46.753644 140116256298880 ssd_efficientnet_bifpn_feature_extractor.
py:147] EfficientDet BiFPN num filters: 64
I1018 18:22:46.753712 140116256298880 ssd_efficientnet_bifpn_feature_extractor.
py:149] EfficientDet BiFPN num iterations: 3
I1018 18:22:46.757249 140116256298880 efficientnet_model.py:143] round_filter i
nput=32 output=32
I1018 18:22:46.790945 140116256298880 efficientnet_model.py:143] round_filter i
nput=32 output=32
I1018 18:22:46.791082 140116256298880 efficientnet_model.py:143] round_filter i
nput=16 output=16
I1018 18:22:46.865937 140116256298880 efficientnet_model.py:143] round_filter i
nput=16 output=16
I1018 18:22:46.866072 140116256298880 efficientnet_model.py:143] round_filter i
nput=24 output=24
I1018 18:22:47.052250 140116256298880 efficientnet_model.py:143] round_filter i
nput=24 output=24
I1018 18:22:47.052392 140116256298880 efficientnet_model.py:143] round_filter i
nput=40 output=40
I1018 18:22:47.233865 140116256298880 efficientnet_model.py:143] round_filter i
nput=40 output=40
I1018 18:22:47.234028 140116256298880 efficientnet_model.py:143] round_filter i
nput=80 output=80
I1018 18:22:47.497279 140116256298880 efficientnet_model.py:143] round_filter i
nput=80 output=80
I1018 18:22:47.497435 140116256298880 efficientnet_model.py:143] round_filter i
nput=112 output=112
I1018 18:22:47.769259 140116256298880 efficientnet_model.py:143] round_filter i
nput=112 output=112
I1018 18:22:47.769408 140116256298880 efficientnet_model.py:143] round_filter i
nput=192 output=192
I1018 18:22:48.124636 140116256298880 efficientnet_model.py:143] round_filter i
nput=192 output=192
I1018 18:22:48.124792 140116256298880 efficientnet_model.py:143] round_filter i
nput=320 output=320
I1018 18:22:48.209171 140116256298880 efficientnet_model.py:143] round_filter i
nput=1280 output=1280
I1018 18:22:48.253066 140116256298880 efficientnet_model.py:453] Building model
efficientnet with params ModelConfig(width_coefficient=1.0, depth_coefficient=
1.0, resolution=224, dropout_rate=0.2, blocks=(BlockConfig(input_filters=32, ou
tput_filters=16, kernel_size=3, num_repeat=1, expand_ratio=1, strides=(1, 1), s
e_ratio=0.25, id_skip=True, fused_conv=False, conv_type='depthwise'), BlockConf
ig(input_filters=16, output_filters=24, kernel_size=3, num_repeat=2, expand_rat
io=6, strides=(2, 2), se_ratio=0.25, id_skip=True, fused_conv=False, conv_type
='depthwise'), BlockConfig(input_filters=24, output_filters=40, kernel_size=5,
num_repeat=2, expand_ratio=6, strides=(2, 2), se_ratio=0.25, id_skip=True, fuse
d_conv=False, conv_type='depthwise'), BlockConfig(input_filters=40, output_filt
ers=80, kernel_size=3, num_repeat=3, expand_ratio=6, strides=(2, 2), se_ratio=
0.25, id_skip=True, fused_conv=False, conv_type='depthwise'), BlockConfig(input
_filters=80, output_filters=112, kernel_size=5, num_repeat=3, expand_ratio=6, s
trides=(1, 1), se_ratio=0.25, id_skip=True, fused_conv=False, conv_type='depthw
ise'), BlockConfig(input_filters=112, output_filters=192, kernel_size=5, num_re
peat=4, expand_ratio=6, strides=(2, 2), se_ratio=0.25, id_skip=True, fused_conv
=False, conv_type='depthwise'), BlockConfig(input_filters=192, output_filters=3
20, kernel_size=3, num_repeat=1, expand_ratio=6, strides=(1, 1), se_ratio=0.25,
id_skip=True, fused_conv=False, conv_type='depthwise')), stem_base_filters=32,
top_base_filters=1280, activation='simple_swish', batch_norm='default', bn_mome
```

```
ntum=0.99, bn_epsilon=0.001, weight_decay=5e-06, drop_connect_rate=0.2, depth_d
ivisor=8, min_depth=None, use_se=True, input_channels=3, num_classes=1000, mode
l_name='efficientnet', rescale_input=False, data_format='channels_last', dtype
='float32')
Traceback (most recent call last):
  File "model_main_tf2.py", line 114, in <module>
    tf.compat.v1.app.run()
  File "/usr/local/lib/python3.7/dist-packages/tensorflow/python/platform/app.p
y", line 36, in run
    _run(main=main, argv=argv, flags_parser=_parse_flags_tolerate_undef)
  File "/usr/local/lib/python3.7/dist-packages/absl/app.py", line 308, in run
    _run_main(main, args)
  File "/usr/local/lib/python3.7/dist-packages/absl/app.py", line 254, in _run_
main
    sys.exit(main(argv))
  File "model_main_tf2.py", line 89, in main
    wait_interval=300, timeout=FLAGS.eval_timeout)
  File "/usr/local/lib/python3.7/dist-packages/object_detection/model_lib_v2.p
y", line 1127, in eval_continuously
    model=detection_model))
  File "/usr/local/lib/python3.7/dist-packages/object_detection/inputs.py", lin
e 1076, in eval_input
    reduce_to_frame_fn=reduce_to_frame_fn)
  File "/usr/local/lib/python3.7/dist-packages/object_detection/builders/datase
t_builder.py", line 209, in build
    decoder = decoder_builder.build(input_reader_config)
  File "/usr/local/lib/python3.7/dist-packages/object_detection/builders/decode
r_builder.py", line 63, in build
    load_keypoint_depth_features=input_reader_config
  File "/usr/local/lib/python3.7/dist-packages/object_detection/data_decoders/t
f_example_decoder.py", line 460, in __init__
    default_value=''),
  File "/usr/local/lib/python3.7/dist-packages/object_detection/data_decoders/t
f_example_decoder.py", line 93, in __init__
    label_map_proto_file, use_display_name=False)
  File "/usr/local/lib/python3.7/dist-packages/object_detection/utils/label_map
_util.py", line 201, in get_label_map_dict
    label_map = load_labelmap(label_map_path_or_proto)
  File "/usr/local/lib/python3.7/dist-packages/object_detection/utils/label_map
_util.py", line 168, in load_labelmap
    label_map_string = fid.read()
  File "/usr/local/lib/python3.7/dist-packages/tensorflow/python/lib/io/file_i
o.py", line 114, in read
    self._preread_check()
  File "/usr/local/lib/python3.7/dist-packages/tensorflow/python/lib/io/file_i
o.py", line 77, in _preread_check
    compat.path_to_str(self.__name), 1024 * 512)
tensorflow.python.framework.errors_impl.NotFoundError: PATH_TO_BE_CONFIGURED/la
bel_map.txt; No such file or directory
```

Results

In [ ]:
```
##Export inference graph
!python exporter_main_v2.py --trained_checkpoint_dir=/mydrive/customTF2/training
```

```
2022-10-18 18:23:47.969747: E tensorflow/stream_executor/cuda/cuda_blas.cc:298
1] Unable to register cuBLAS factory: Attempting to register factory for plugin
cuBLAS when one has already been registered
2022-10-18 18:23:48.704616: W tensorflow/stream_executor/platform/default/dso_l
oader.cc:64] Could not load dynamic library 'libnvinfer.so.7'; dlerror: libnvin
fer.so.7: cannot open shared object file: No such file or directory; LD_LIBRARY
_PATH: /usr/lib64-nvidia
2022-10-18 18:23:48.704734: W tensorflow/stream_executor/platform/default/dso_l
oader.cc:64] Could not load dynamic library 'libnvinfer_plugin.so.7'; dlerror:
libnvinfer_plugin.so.7: cannot open shared object file: No such file or directo
ry; LD_LIBRARY_PATH: /usr/lib64-nvidia
2022-10-18 18:23:48.704754: W tensorflow/compiler/tf2tensorrt/utils/py_utils.c
c:38] TF-TRT Warning: Cannot dlopen some TensorRT libraries. If you would like
to use Nvidia GPU with TensorRT, please make sure the missing libraries mention
ed above are installed properly.
2022-10-18 18:23:51.349122: W tensorflow/core/common_runtime/gpu/gpu_bfc_alloca
tor.cc:42] Overriding orig_value setting because the TF_FORCE_GPU_ALLOW_GROWTH
environment variable is set. Original config value was 0.
I1018 18:23:51.369985 140374880749440 ssd_efficientnet_bifpn_feature_extractor.
py:146] EfficientDet EfficientNet backbone version: efficientnet-b0
I1018 18:23:51.370159 140374880749440 ssd_efficientnet_bifpn_feature_extractor.
py:147] EfficientDet BiFPN num filters: 64
I1018 18:23:51.370218 140374880749440 ssd_efficientnet_bifpn_feature_extractor.
py:149] EfficientDet BiFPN num iterations: 3
I1018 18:23:51.373785 140374880749440 efficientnet_model.py:143] round_filter i
nput=32 output=32
I1018 18:23:51.406620 140374880749440 efficientnet_model.py:143] round_filter i
nput=32 output=32
I1018 18:23:51.406725 140374880749440 efficientnet_model.py:143] round_filter i
nput=16 output=16
I1018 18:23:51.480174 140374880749440 efficientnet_model.py:143] round_filter i
nput=16 output=16
I1018 18:23:51.480301 140374880749440 efficientnet_model.py:143] round_filter i
nput=24 output=24
I1018 18:23:51.668230 140374880749440 efficientnet_model.py:143] round_filter i
nput=24 output=24
I1018 18:23:51.668431 140374880749440 efficientnet_model.py:143] round_filter i
nput=40 output=40
I1018 18:23:51.989490 140374880749440 efficientnet_model.py:143] round_filter i
nput=40 output=40
I1018 18:23:51.989681 140374880749440 efficientnet_model.py:143] round_filter i
nput=80 output=80
I1018 18:23:52.271986 140374880749440 efficientnet_model.py:143] round_filter i
nput=80 output=80
I1018 18:23:52.272155 140374880749440 efficientnet_model.py:143] round_filter i
nput=112 output=112
I1018 18:23:52.554323 140374880749440 efficientnet_model.py:143] round_filter i
nput=112 output=112
I1018 18:23:52.554509 140374880749440 efficientnet_model.py:143] round_filter i
nput=192 output=192
I1018 18:23:52.931051 140374880749440 efficientnet_model.py:143] round_filter i
nput=192 output=192
I1018 18:23:52.931231 140374880749440 efficientnet_model.py:143] round_filter i
```

```
nput=320 output=320
I1018 18:23:53.016561 140374880749440 efficientnet_model.py:143] round_filter i
nput=1280 output=1280
I1018 18:23:53.059387 140374880749440 efficientnet_model.py:453] Building model
efficientnet with params ModelConfig(width_coefficient=1.0, depth_coefficient=
1.0, resolution=224, dropout_rate=0.2, blocks=(BlockConfig(input_filters=32, ou
tput_filters=16, kernel_size=3, num_repeat=1, expand_ratio=1, strides=(1, 1), s
e_ratio=0.25, id_skip=True, fused_conv=False, conv_type='depthwise'), BlockConf
ig(input_filters=16, output_filters=24, kernel_size=3, num_repeat=2, expand_rat
io=6, strides=(2, 2), se_ratio=0.25, id_skip=True, fused_conv=False, conv_type
='depthwise'), BlockConfig(input_filters=24, output_filters=40, kernel_size=5,
num_repeat=2, expand_ratio=6, strides=(2, 2), se_ratio=0.25, id_skip=True, fuse
d_conv=False, conv_type='depthwise'), BlockConfig(input_filters=40, output_filt
ers=80, kernel_size=3, num_repeat=3, expand_ratio=6, strides=(2, 2), se_ratio=
0.25, id_skip=True, fused_conv=False, conv_type='depthwise'), BlockConfig(input
_filters=80, output_filters=112, kernel_size=5, num_repeat=3, expand_ratio=6, s
trides=(1, 1), se_ratio=0.25, id_skip=True, fused_conv=False, conv_type='depthw
ise'), BlockConfig(input_filters=112, output_filters=192, kernel_size=5, num_re
peat=4, expand_ratio=6, strides=(2, 2), se_ratio=0.25, id_skip=True, fused_conv
=False, conv_type='depthwise'), BlockConfig(input_filters=192, output_filters=3
20, kernel_size=3, num_repeat=1, expand_ratio=6, strides=(1, 1), se_ratio=0.25,
id_skip=True, fused_conv=False, conv_type='depthwise')), stem_base_filters=32,
top_base_filters=1280, activation='simple_swish', batch_norm='default', bn_mome
ntum=0.99, bn_epsilon=0.001, weight_decay=5e-06, drop_connect_rate=0.2, depth_d
ivisor=8, min_depth=None, use_se=True, input_channels=3, num_classes=1000, mode
l_name='efficientnet', rescale_input=False, data_format='channels_last', dtype
='float32')
WARNING:tensorflow:From /usr/local/lib/python3.7/dist-packages/tensorflow/pytho
n/autograph/impl/api.py:458: calling map_fn_v2 (from tensorflow.python.ops.map_
fn) with back_prop=False is deprecated and will be removed in a future version.
Instructions for updating:
back_prop=False is deprecated. Consider using tf.stop_gradient instead.
Instead of:
results = tf.map_fn(fn, elems, back_prop=False)
Use:
results = tf.nest.map_structure(tf.stop_gradient, tf.map_fn(fn, elems))
W1018 18:23:53.214324 140374880749440 deprecation.py:628] From /usr/local/lib/p
ython3.7/dist-packages/tensorflow/python/autograph/impl/api.py:458: calling map
_fn_v2 (from tensorflow.python.ops.map_fn) with back_prop=False is deprecated a
nd will be removed in a future version.
Instructions for updating:
back_prop=False is deprecated. Consider using tf.stop_gradient instead.
Instead of:
results = tf.map_fn(fn, elems, back_prop=False)
Use:
results = tf.nest.map_structure(tf.stop_gradient, tf.map_fn(fn, elems))
Traceback (most recent call last):
  File "exporter_main_v2.py", line 164, in <module>
    app.run(main)
  File "/usr/local/lib/python3.7/dist-packages/absl/app.py", line 308, in run
    _run_main(main, args)
  File "/usr/local/lib/python3.7/dist-packages/absl/app.py", line 254, in _run_
main
    sys.exit(main(argv))
  File "exporter_main_v2.py", line 160, in main
    FLAGS.side_input_types, FLAGS.side_input_names)
  File "/usr/local/lib/python3.7/dist-packages/object_detection/exporter_lib_v
```

```
2.py", line 271, in export_inference_graph
    status.assert_existing_objects_matched()
  File "/usr/local/lib/python3.7/dist-packages/tensorflow/python/checkpoint/che
ckpoint.py", line 952, in assert_existing_objects_matched
    "No checkpoint specified (save_path=None); nothing is being restored.")
AssertionError: No checkpoint specified (save_path=None); nothing is being rest
ored.
```

Testing the trained Object Detection model on images

In [ ]:
```
# Different font-type for labels text.
!wget https://freefontsdownload.net/download/160187/arial.zip
!unzip arial.zip -d .

%cd utils/
!sed -i "s/font = ImageFont.truetype('arial.ttf', 24)/font = ImageFont.truetype('
%cd ..
```

```
--2022-10-18 18:24:36--  https://freefontsdownload.net/download/160187/arial.zi
p (https://freefontsdownload.net/download/160187/arial.zip)
Resolving freefontsdownload.net (freefontsdownload.net)... 172.67.180.27, 104.2
1.75.182, 2606:4700:3036::6815:4bb6, ...
Connecting to freefontsdownload.net (freefontsdownload.net)|172.67.180.27|:44
3... connected.
HTTP request sent, awaiting response... 200 OK
Length: 172804 (169K) [application/force-download]
Saving to: ‘arial.zip’

arial.zip           100%[===================>] 168.75K   229KB/s    in 0.7s

2022-10-18 18:24:38 (229 KB/s) - ‘arial.zip’ saved [172804/172804]

Archive:  arial.zip
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@################################@
@#        Downloaded from       #@
@#                              #@
@#   www.FreeFontsDownload.net  #@
@#                              #@
@# ---------- More site -------- #@
@#      https://funnytv.net (https://funnytv.net)      #@
@#                              #@
@#                              #@
@################################@
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
 extracting: ./www.freefontsdownload.net.url
 extracting: ./arial.png
  inflating: ./arial.ttf
  inflating: ./freefontsdownload.txt
/content/models/research/object_detection/utils
/content/models/research/object_detection
```

In [ ]:
```
#Loading the saved_model
import tensorflow as tf
import time
import numpy as np
import warnings
warnings.filterwarnings('ignore')
from PIL import Image
from google.colab.patches import cv2_imshow
from object_detection.utils import label_map_util
from object_detection.utils import visualization_utils as viz_utils

IMAGE_SIZE = (12, 8) # Output display size as you want
import matplotlib.pyplot as plt
PATH_TO_SAVED_MODEL="/mydrive/customTF2/data/inference_graph/saved_model"
print('Loading model...', end='')

# Load saved model and build the detection function
detect_fn=tf.saved_model.load(PATH_TO_SAVED_MODEL)
print('Done!')

#Loading the label_map
category_index=label_map_util.create_category_index_from_labelmap("/mydrive/custo
#category_index=label_map_util.create_category_index_from_labelmap([path_to_label

def load_image_into_numpy_array(path):

    return np.array(Image.open(path))

image_path = "/mydrive/mask_test_images/image2.jpg"
#print('Running inference for {}... '.format(image_path), end='')

image_np = load_image_into_numpy_array(image_path)

# The input needs to be a tensor, convert it using `tf.convert_to_tensor`.
input_tensor = tf.convert_to_tensor(image_np)
# The model expects a batch of images, so add an axis with `tf.newaxis`.
input_tensor = input_tensor[tf.newaxis, ...]

detections = detect_fn(input_tensor)

# All outputs are batches tensors.
# Convert to numpy arrays, and take index [0] to remove the batch dimension.
# We're only interested in the first num_detections.
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

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'],
      detections['detection_scores'],
      category_index,
      use_normalized_coordinates=True,
      max_boxes_to_draw=200,
      min_score_thresh=.4, # Adjust this value to set the minimum probability box
      agnostic_mode=False)
%matplotlib inline
plt.figure(figsize=IMAGE_SIZE, dpi=200)
plt.axis("off")
plt.imshow(image_np_with_detections)
plt.show()
```

```
Loading model...Done!
```

In [ ]: