In [ ]:

```
# references:
# https://github.com/Kaggle/kaggle-api
# https://towardsdatascience.com/downloading-datasets-into-google-drive-via-google-colab-bcb1b30b0166
# https://www.pyimagesearch.com/2018/12/24/how-to-use-keras-fit-and-fit_generator-a-hands-on-tutorial/
```

In [ ]:

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

```
Mounted at /content/gdrive
```

In [ ]:

```
# importing necessay libraries
import tensorflow as tf
import datetime
import os
from tensorflow.keras.layers import Dense,Activation,Conv2D,Flatten,MaxPooling2D,Dropout
from tensorflow.keras import regularizers,optimizers,initializers
from tensorflow.keras.models import Model
from keras_preprocessing.image import ImageDataGenerator
import pandas as pd
import numpy as np
```

In [ ]:

```
!pip install -q kaggle
from google.colab import files
files.upload()
!mkdir ~/.kaggle
!cp kaggle.json ~/.kaggle/
! chmod 600 ~/.kaggle/kaggle.json
```

In [ ]:

```
!kaggle datasets download -d brahma0545/aaic-assignment-tl
```

```
Downloading aaic-assignment-tl.zip to /content
100% 4.32G/4.34G [01:27<00:00, 78.2MB/s]
100% 4.34G/4.34G [01:28<00:00, 52.9MB/s]
```

In [ ]:

```
!unzip "/content/aaic-assignment-tl.zip" -d "/content/TL"
```

In [ ]:

```
# label data file
dir_path = "/content/TL/labels_final.csv"
```

In [ ]:

```
# fetch labels_final.csv
train_df = pd.read_csv(dir_path)
```

In [ ]:

```
train_df.head()
```

Out[ ]:

	path	label
0	imagesv/v/o/h/voh71d00/509132755+-2755.tif	3
1	imagesl/l/x/t/lxt19d00/502213303.tif	3
2	imagesx/x/e/d/xed05a00/2075325674.tif	2
3	imageso/o/j/b/ojb60d00/517511301+-1301.tif	3
4	imagesq/q/z/k/qzk17e00/2031320195.tif	7

In [ ]:

```
# replacing labels
train_df = train_df.replace({'label':
                             {0:"letter",
                             1:"form",
                             2:"email",
                             3:"handwritten",
                             4:"advertisement",
                             5:"scientifit report",
                             6:"scientific publication",
                             7:"specification",
                             8:"file folder",
                             9:"news article",
                             10:"budget",
                             11:"invoice",
                             12:"presentation",
                             13:"questionnaire",
                             14:"resume",
                             15:"memo"}})
```

In [ ]:

```
# how much data for each category:
train_df['label'].value_counts()
```

Out[ ]:

```
letter                   3016
questionnaire            3007
resume                   3006
presentation             3006
handwritten              3005
file folder              3003
news article             3002
budget                   3002
specification            3000
scientifit report        2999
memo                     2996
advertisement            2994
form                     2994
email                    2993
invoice                  2992
scientific publication   2985
Name: label, dtype: int64
```

Observations:

1. data is balanced

In [ ]:

```
datagen = ImageDataGenerator(rotation_range=90,width_shift_range=0.25,height_shift_range=0.25,horizonta
l_flip=0.25,vertical_flip=0.25,
    rescale=1./255,validation_split=0.30)
```

In [ ]:

```
# train data generator
train_generator = datagen.flow_from_dataframe(
    dataframe=train_df,
    directory="/content/TL/data_final/",
    x_col = "path",
    y_col = "label",
    subset = "training",
    batch_size = 96,
    seed = 39,
    shuffle = True,
    class_mode="categorical",
    target_size = (224,224)
    )
```

```
Found 33600 validated image filenames belonging to 16 classes.
```

In [ ]:

```
# validation data generator
valid_generator = datagen.flow_from_dataframe(
    dataframe=train_df,
    directory="/content/TL/data_final/",
    x_col = "path",
    y_col = "label",
    subset = "validation",
    batch_size = 32,
    seed = 42,
    shuffle = True,
    class_mode="categorical",
    target_size = (224,224)
)
```

```
Found 14400 validated image filenames belonging to 16 classes.
```

In [ ]:

```
%load_ext tensorboard
import tensorflow as tf
import datetime, os
```

VGG16 Pretrained model as base model

Model-1

In [ ]:

```
tf.keras.backend.clear_session()
# loading vgg16 from keras
from keras.applications import VGG16
# load model
base_model = VGG16(include_top=False,input_shape = (224, 224, 3),weights='imagenet')
# no need to train the VGG-16 network
for layer in base_model.layers:
  layer.trainable  = False

# Conv layer
conv1 = Conv2D(256,kernel_size=(3,3),padding='valid',strides=1,activation='relu')(base_model.output)

# max pool layer
max = MaxPooling2D(pool_size=(2,2),strides=(2,2),padding='valid')(conv1)

# Flatten
flat = Flatten()(max)

# FC layer-1
```

```
fc1 = Dense(1024,activation='relu',kernel_initializer=tf.keras.initializers.he_uniform())(flat)

# FC layer-2
fc2 = Dense(256,activation='relu',kernel_initializer=tf.keras.initializers.he_uniform())(fc1)

# output layer
model1 = Dense(16,activation='softmax')(fc2)
final_model1 = Model(base_model.input,model1)
final_model1.compile(optimizer= optimizers.Adam(),
                     loss="categorical_crossentropy",
                     metrics = ['accuracy'])
```

```
Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/vgg16/vgg16_weights_
tf_dim_ordering_tf_kernels_notop.h5
58892288/58889256 [==============================] - 1s 0us/step
```

In [ ]:

```
final_model1.summary()
```

```
Model: "model"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
input_1 (InputLayer)         [(None, 224, 224, 3)]     0
_________________________________________________________________
block1_conv1 (Conv2D)        (None, 224, 224, 64)      1792
_________________________________________________________________
block1_conv2 (Conv2D)        (None, 224, 224, 64)      36928
_________________________________________________________________
block1_pool (MaxPooling2D)   (None, 112, 112, 64)      0
_________________________________________________________________
block2_conv1 (Conv2D)        (None, 112, 112, 128)     73856
_________________________________________________________________
block2_conv2 (Conv2D)        (None, 112, 112, 128)     147584
_________________________________________________________________
block2_pool (MaxPooling2D)   (None, 56, 56, 128)       0
_________________________________________________________________
block3_conv1 (Conv2D)        (None, 56, 56, 256)       295168
_________________________________________________________________
block3_conv2 (Conv2D)        (None, 56, 56, 256)       590080
_________________________________________________________________
block3_conv3 (Conv2D)        (None, 56, 56, 256)       590080
_________________________________________________________________
block3_pool (MaxPooling2D)   (None, 28, 28, 256)       0
_________________________________________________________________
block4_conv1 (Conv2D)        (None, 28, 28, 512)       1180160
_________________________________________________________________
block4_conv2 (Conv2D)        (None, 28, 28, 512)       2359808
_________________________________________________________________
block4_conv3 (Conv2D)        (None, 28, 28, 512)       2359808
_________________________________________________________________
block4_pool (MaxPooling2D)   (None, 14, 14, 512)       0
_________________________________________________________________
block5_conv1 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_conv2 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_conv3 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_pool (MaxPooling2D)   (None, 7, 7, 512)         0
_________________________________________________________________
conv2d (Conv2D)              (None, 5, 5, 256)         1179904
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 2, 2, 256)         0
_________________________________________________________________
flatten (Flatten)            (None, 1024)              0
_________________________________________________________________
dense (Dense)                (None, 1024)              1049600
_________________________________________________________________
dense_1 (Dense)              (None, 256)               262400
_________________________________________________________________
dense_2 (Dense)              (None, 16)                4112
=================================================================
```

```
Total params: 17,210,704
Trainable params: 2,496,016
Non-trainable params: 14,714,688
_________________________________________________________________
```

In [ ]:

```
chech_path = "/content/gdrive/MyDrive/checkpoint/"
```

In [ ]:

```
log_path = "/content/gdrive/MyDrive/logs/"
```

In [ ]:

```
# checkpoint callback:
cp_callback = tf.keras.callbacks.ModelCheckpoint(chech_path,monitor='accuracy',verbose=1,save_weights_only=True,save_freq='epoch')
```

In [ ]:

```
!rm -rf /content/gdrive/MyDrive/logs/
logdir = os.path.join(log_path,datetime.datetime.now().strftime("%Y%m%d-%H%M%S"))
tensorboard_callback = tf.keras.callbacks.TensorBoard(logdir, histogram_freq=1)
vgghist = final_model1.fit(train_generator,
                           validation_data=valid_generator,
                           callbacks=[tensorboard_callback,cp_callback],
                            steps_per_epoch = 350,
                           epochs = 70
                           )
```

```
Epoch 1/70
350/350 [==============================] - 915s 3s/step - loss: 2.1734 - accuracy: 0.3032 - val_loss: 1
.7295 - val_accuracy: 0.4519

Epoch 00001: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 2/70
350/350 [==============================] - 878s 3s/step - loss: 1.6993 - accuracy: 0.4604 - val_loss: 1
.6136 - val_accuracy: 0.4872

Epoch 00002: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 3/70
350/350 [==============================] - 842s 2s/step - loss: 1.6037 - accuracy: 0.4878 - val_loss: 1
.5800 - val_accuracy: 0.5013

Epoch 00003: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 4/70
350/350 [==============================] - 814s 2s/step - loss: 1.5538 - accuracy: 0.5039 - val_loss: 1
.5648 - val_accuracy: 0.5067

Epoch 00004: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 5/70
350/350 [==============================] - 798s 2s/step - loss: 1.5148 - accuracy: 0.5164 - val_loss: 1
.5284 - val_accuracy: 0.5182

Epoch 00005: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 6/70
350/350 [==============================] - 797s 2s/step - loss: 1.4913 - accuracy: 0.5240 - val_loss: 1
.4938 - val_accuracy: 0.5253

Epoch 00006: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 7/70
350/350 [==============================] - 800s 2s/step - loss: 1.4804 - accuracy: 0.5326 - val_loss: 1
.4615 - val_accuracy: 0.5392

Epoch 00007: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 8/70
350/350 [==============================] - 796s 2s/step - loss: 1.4354 - accuracy: 0.5416 - val_loss: 1
.4660 - val_accuracy: 0.5385

Epoch 00008: saving model to /content/gdrive/MyDrive/checkpoint/
```

```
Epoch 00008: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 9/70
350/350 [==============================] - 801s 2s/step - loss: 1.4302 - accuracy: 0.5505 - val_loss: 1
.4604 - val_accuracy: 0.5412

Epoch 00009: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 10/70
350/350 [==============================] - 801s 2s/step - loss: 1.4156 - accuracy: 0.5523 - val_loss: 1
.4159 - val_accuracy: 0.5517

Epoch 00010: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 11/70
350/350 [==============================] - 792s 2s/step - loss: 1.3956 - accuracy: 0.5567 - val_loss: 1
.4310 - val_accuracy: 0.5540

Epoch 00011: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 12/70
350/350 [==============================] - 771s 2s/step - loss: 1.3830 - accuracy: 0.5618 - val_loss: 1
.4358 - val_accuracy: 0.5561

Epoch 00012: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 13/70
350/350 [==============================] - 756s 2s/step - loss: 1.3757 - accuracy: 0.5629 - val_loss: 1
.3903 - val_accuracy: 0.5651

Epoch 00013: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 14/70
350/350 [==============================] - 751s 2s/step - loss: 1.3503 - accuracy: 0.5734 - val_loss: 1
.3868 - val_accuracy: 0.5667

Epoch 00014: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 15/70
350/350 [==============================] - 757s 2s/step - loss: 1.3639 - accuracy: 0.5678 - val_loss: 1
.3890 - val_accuracy: 0.5671

Epoch 00015: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 16/70
350/350 [==============================] - 753s 2s/step - loss: 1.3496 - accuracy: 0.5706 - val_loss: 1
.3716 - val_accuracy: 0.5697

Epoch 00016: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 17/70
350/350 [==============================] - 760s 2s/step - loss: 1.3388 - accuracy: 0.5762 - val_loss: 1
.3882 - val_accuracy: 0.5644

Epoch 00017: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 18/70
350/350 [==============================] - 741s 2s/step - loss: 1.3171 - accuracy: 0.5838 - val_loss: 1
.3684 - val_accuracy: 0.5705

Epoch 00018: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 19/70
350/350 [==============================] - 730s 2s/step - loss: 1.3225 - accuracy: 0.5864 - val_loss: 1
.3647 - val_accuracy: 0.5728

Epoch 00019: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 20/70
350/350 [==============================] - 719s 2s/step - loss: 1.3129 - accuracy: 0.5852 - val_loss: 1
.3892 - val_accuracy: 0.5652

Epoch 00020: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 21/70
350/350 [==============================] - 712s 2s/step - loss: 1.3088 - accuracy: 0.5891 - val_loss: 1
.3780 - val_accuracy: 0.5699

Epoch 00021: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 22/70
350/350 [==============================] - 724s 2s/step - loss: 1.2951 - accuracy: 0.5963 - val_loss: 1
.3691 - val_accuracy: 0.5776

Epoch 00022: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 23/70
350/350 [==============================] - 717s 2s/step - loss: 1.2962 - accuracy: 0.5904 - val_loss: 1
.3816 - val_accuracy: 0.5708

Epoch 00023: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 24/70
350/350 [==============================] - 712s 2s/step - loss: 1.2703 - accuracy: 0.5916 - val_loss: 1
```

```
350/350 [==============================] - 713s 2s/step - loss: 1.2793 - accuracy: 0.5916 - val_loss: 1
.3463 - val_accuracy: 0.5869

Epoch 00024: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 25/70
350/350 [==============================] - 709s 2s/step - loss: 1.2713 - accuracy: 0.5994 - val_loss: 1
.3454 - val_accuracy: 0.5793

Epoch 00025: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 26/70
350/350 [==============================] - 710s 2s/step - loss: 1.2715 - accuracy: 0.5994 - val_loss: 1
.3782 - val_accuracy: 0.5710

Epoch 00026: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 27/70
350/350 [==============================] - 722s 2s/step - loss: 1.2596 - accuracy: 0.5997 - val_loss: 1
.3563 - val_accuracy: 0.5779

Epoch 00027: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 28/70
350/350 [==============================] - 715s 2s/step - loss: 1.2623 - accuracy: 0.5997 - val_loss: 1
.3554 - val_accuracy: 0.5797

Epoch 00028: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 29/70
350/350 [==============================] - 722s 2s/step - loss: 1.2570 - accuracy: 0.6043 - val_loss: 1
.3964 - val_accuracy: 0.5684

Epoch 00029: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 30/70
350/350 [==============================] - 723s 2s/step - loss: 1.2658 - accuracy: 0.5977 - val_loss: 1
.3586 - val_accuracy: 0.5753

Epoch 00030: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 31/70
350/350 [==============================] - 718s 2s/step - loss: 1.2622 - accuracy: 0.6019 - val_loss: 1
.3275 - val_accuracy: 0.5916

Epoch 00031: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 32/70
350/350 [==============================] - 719s 2s/step - loss: 1.2348 - accuracy: 0.6114 - val_loss: 1
.3432 - val_accuracy: 0.5852

Epoch 00032: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 33/70
350/350 [==============================] - 720s 2s/step - loss: 1.2425 - accuracy: 0.6053 - val_loss: 1
.3336 - val_accuracy: 0.5827

Epoch 00033: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 34/70
350/350 [==============================] - 720s 2s/step - loss: 1.2320 - accuracy: 0.6100 - val_loss: 1
.3143 - val_accuracy: 0.5983

Epoch 00034: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 35/70
350/350 [==============================] - 732s 2s/step - loss: 1.2387 - accuracy: 0.6022 - val_loss: 1
.3398 - val_accuracy: 0.5835

Epoch 00035: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 36/70
350/350 [==============================] - 737s 2s/step - loss: 1.2285 - accuracy: 0.6121 - val_loss: 1
.3523 - val_accuracy: 0.5806

Epoch 00036: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 37/70
350/350 [==============================] - 731s 2s/step - loss: 1.2358 - accuracy: 0.6061 - val_loss: 1
.3202 - val_accuracy: 0.5956

Epoch 00037: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 38/70
350/350 [==============================] - 721s 2s/step - loss: 1.2200 - accuracy: 0.6163 - val_loss: 1
.3288 - val_accuracy: 0.5933

Epoch 00038: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 39/70
350/350 [==============================] - 724s 2s/step - loss: 1.2187 - accuracy: 0.6158 - val_loss: 1
.3121 - val_accuracy: 0.5908
```

```
Epoch 00039: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 40/70
350/350 [==============================] - 740s 2s/step - loss: 1.2176 - accuracy: 0.6105 - val_loss: 1
.3183 - val_accuracy: 0.5913

Epoch 00040: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 41/70
350/350 [==============================] - 706s 2s/step - loss: 1.2299 - accuracy: 0.6092 - val_loss: 1
.3309 - val_accuracy: 0.5928

Epoch 00041: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 42/70
350/350 [==============================] - ETA: 0s - loss: 1.2048 - accuracy: 0.6175
```

In [ ]:

```
final_model1.load_weights(chech_path)
```

Out[ ]:

```
<tensorflow.python.training.tracking.util.CheckpointLoadStatus at 0x7f8b901a89e8>
```

In [ ]:

```
logdir = os.path.join(log_path,datetime.datetime.now().strftime("%Y%m%d-%H%M%S"))
tensorboard_callback = tf.keras.callbacks.TensorBoard(logdir, histogram_freq=1)
vgghist = final_model1.fit(train_generator,
                           validation_data=valid_generator,
                           callbacks=[tensorboard_callback,cp_callback],
                            steps_per_epoch = 350,
                           epochs = 30
                           )
```

```
Epoch 1/30
350/350 [==============================] - 730s 2s/step - loss: 1.2161 - accuracy: 0.6130 - val_loss: 1
.3257 - val_accuracy: 0.5862

Epoch 00001: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 2/30
350/350 [==============================] - 758s 2s/step - loss: 1.2052 - accuracy: 0.6155 - val_loss: 1
.2997 - val_accuracy: 0.6022

Epoch 00002: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 3/30
350/350 [==============================] - 733s 2s/step - loss: 1.1982 - accuracy: 0.6165 - val_loss: 1
.3140 - val_accuracy: 0.5972

Epoch 00003: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 4/30
350/350 [==============================] - 723s 2s/step - loss: 1.1957 - accuracy: 0.6200 - val_loss: 1
.3197 - val_accuracy: 0.5997

Epoch 00004: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 5/30
350/350 [==============================] - 722s 2s/step - loss: 1.1876 - accuracy: 0.6224 - val_loss: 1
.3112 - val_accuracy: 0.5978

Epoch 00005: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 6/30
350/350 [==============================] - 723s 2s/step - loss: 1.1870 - accuracy: 0.6238 - val_loss: 1
.3247 - val_accuracy: 0.6001

Epoch 00006: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 7/30
350/350 [==============================] - 714s 2s/step - loss: 1.2059 - accuracy: 0.6181 - val_loss: 1
.3014 - val_accuracy: 0.6022

Epoch 00007: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 8/30
350/350 [==============================] - 730s 2s/step - loss: 1.1906 - accuracy: 0.6226 - val_loss: 1
.3258 - val_accuracy: 0.5946
```

```
Epoch 00008: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 9/30
350/350 [==============================] - 711s 2s/step - loss: 1.1840 - accuracy: 0.6240 - val_loss: 1
.3099 - val_accuracy: 0.6037

Epoch 00009: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 10/30
350/350 [==============================] - 726s 2s/step - loss: 1.1924 - accuracy: 0.6194 - val_loss: 1
.2875 - val_accuracy: 0.6036

Epoch 00010: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 11/30
350/350 [==============================] - 713s 2s/step - loss: 1.1828 - accuracy: 0.6245 - val_loss: 1
.2921 - val_accuracy: 0.6044

Epoch 00011: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 12/30
350/350 [==============================] - 714s 2s/step - loss: 1.1738 - accuracy: 0.6272 - val_loss: 1
.3261 - val_accuracy: 0.5965

Epoch 00012: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 13/30
350/350 [==============================] - 753s 2s/step - loss: 1.1762 - accuracy: 0.6280 - val_loss: 1
.2885 - val_accuracy: 0.6028

Epoch 00013: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 14/30
350/350 [==============================] - 757s 2s/step - loss: 1.1722 - accuracy: 0.6290 - val_loss: 1
.3016 - val_accuracy: 0.6069

Epoch 00014: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 15/30
350/350 [==============================] - 768s 2s/step - loss: 1.1713 - accuracy: 0.6289 - val_loss: 1
.3641 - val_accuracy: 0.5867

Epoch 00015: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 16/30
350/350 [==============================] - 766s 2s/step - loss: 1.1723 - accuracy: 0.6284 - val_loss: 1
.2984 - val_accuracy: 0.6006

Epoch 00016: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 17/30
350/350 [==============================] - 769s 2s/step - loss: 1.1770 - accuracy: 0.6294 - val_loss: 1
.3072 - val_accuracy: 0.6019

Epoch 00017: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 18/30
350/350 [==============================] - 758s 2s/step - loss: 1.1687 - accuracy: 0.6279 - val_loss: 1
.3305 - val_accuracy: 0.5994

Epoch 00018: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 19/30
350/350 [==============================] - 728s 2s/step - loss: 1.1604 - accuracy: 0.6320 - val_loss: 1
.2936 - val_accuracy: 0.6016

Epoch 00019: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 20/30
350/350 [==============================] - 716s 2s/step - loss: 1.1578 - accuracy: 0.6315 - val_loss: 1
.3154 - val_accuracy: 0.6049

Epoch 00020: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 21/30
350/350 [==============================] - 719s 2s/step - loss: 1.1635 - accuracy: 0.6286 - val_loss: 1
.3148 - val_accuracy: 0.6047

Epoch 00021: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 22/30
350/350 [==============================] - 725s 2s/step - loss: 1.1667 - accuracy: 0.6303 - val_loss: 1
.3030 - val_accuracy: 0.6045

Epoch 00022: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 23/30
350/350 [==============================] - 724s 2s/step - loss: 1.1655 - accuracy: 0.6278 - val_loss: 1
.3192 - val_accuracy: 0.5978

Epoch 00023: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 24/30
```

```
350/350 [==============================] - 747s 2s/step - loss: 1.1517 - accuracy: 0.6310 - val_loss: 1
.2934 - val_accuracy: 0.6082

Epoch 00024: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 25/30
350/350 [==============================] - 743s 2s/step - loss: 1.1588 - accuracy: 0.6310 - val_loss: 1
.2896 - val_accuracy: 0.6073

Epoch 00025: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 26/30
350/350 [==============================] - 709s 2s/step - loss: 1.1529 - accuracy: 0.6327 - val_loss: 1
.2894 - val_accuracy: 0.6070

Epoch 00026: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 27/30
350/350 [==============================] - 711s 2s/step - loss: 1.1527 - accuracy: 0.6324 - val_loss: 1
.3281 - val_accuracy: 0.5948

Epoch 00027: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 28/30
350/350 [==============================] - 705s 2s/step - loss: 1.1449 - accuracy: 0.6356 - val_loss: 1
.3081 - val_accuracy: 0.6065

Epoch 00028: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 29/30
350/350 [==============================] - 714s 2s/step - loss: 1.1413 - accuracy: 0.6360 - val_loss: 1
.3076 - val_accuracy: 0.6017

Epoch 00029: saving model to /content/gdrive/MyDrive/checkpoint/
Epoch 30/30
350/350 [==============================] - 714s 2s/step - loss: 1.1450 - accuracy: 0.6364 - val_loss: 1
.3097 - val_accuracy: 0.6069

Epoch 00030: saving model to /content/gdrive/MyDrive/checkpoint/
```

In [ ]:

```
# !tensorboard dev upload --logdir /content/gdrive/MyDrive/logs/20210202-154031 \
#   --name "Transfer Learning Model:1 (initial_42 epochs)" \
#   --description " from TF_1.ipynb " \
#   --one_shot
```

In [ ]:

```
# !tensorboard dev upload --logdir /content/gdrive/MyDrive/logs/20210203-061009 \
#   --name "Transfer Learning Model:1 (next 30 epochs)" \
#   --description " from TF_1.ipynb " \
#   --one_shot
```

In [ ]:

```

```