In [1]:

```
import tensorflow as tf
import keras_preprocessing
from keras_preprocessing import image
from keras_preprocessing.image import ImageDataGenerator
TRAINING_DIR = r"C:\Users\laksh\TARP PROJECT\FIRE-SMOKE-DATASET\FIRE-SMOKE-DATASET\Train"
training_datagen = ImageDataGenerator(rescale=1./255,zoom_range=0.15,horizontal_flip=True,fill_mode='nearest')
VALIDATION_DIR = r"C:\Users\laksh\TARP PROJECT\FIRE-SMOKE-DATASET\FIRE-SMOKE-DATASET\Test"
validation_datagen = ImageDataGenerator(rescale = 1./255)
train_generator = training_datagen.flow_from_directory(TRAINING_DIR,target_size=(224,224),shuffle = True,class_mo
validation_generator = validation_datagen.flow_from_directory(VALIDATION_DIR,target_size=(224,224),class_mode='ca
```

```
Found 2700 images belonging to 3 classes.
Found 300 images belonging to 3 classes.
```

In [5]:

```
from tensorflow.keras.applications.inception_v3 import InceptionV3
from tensorflow.keras.preprocessing import image
from tensorflow.keras.models import Model
from tensorflow.keras.layers import Dense, GlobalAveragePooling2D, Input, Dropout
input_tensor = Input(shape=(224, 224, 3))
base_model = InceptionV3(input_tensor=input_tensor, weights='imagenet', include_top=False)
x = base_model.output
x = GlobalAveragePooling2D()(x)
x = Dense(2048, activation='relu')(x)
x = Dropout(0.25)(x)
x = Dense(1024, activation='relu')(x)
x = Dropout(0.2)(x)
predictions = Dense(3, activation='softmax')(x)
model = Model(inputs=base_model.input, outputs=predictions)
for layer in base_model.layers:
  layer.trainable = False
model.compile(optimizer='rmsprop', loss='categorical_crossentropy', metrics=['acc'])
history = model.fit(train_generator,steps_per_epoch = 14,epochs = 20,validation_data = validation_generator,valid
```

```
Epoch 1/20
14/14 [==============================] - 172s 11s/step - loss: 9.1838 - acc: 0.5555 - val_loss: 0.7642 - val_acc:
0.7857
Epoch 2/20
14/14 [==============================] - 368s 27s/step - loss: 0.5086 - acc: 0.8052 - val_loss: 0.7949 - val_acc:
0.6020
Epoch 3/20
14/14 [==============================] - 322s 22s/step - loss: 0.5569 - acc: 0.7868 - val_loss: 0.4981 - val_acc:
0.8265
Epoch 4/20
14/14 [==============================] - 378s 28s/step - loss: 0.4808 - acc: 0.8175 - val_loss: 0.3065 - val_acc:
0.8724
Epoch 5/20
14/14 [==============================] - 147s 10s/step - loss: 0.4645 - acc: 0.8305 - val_loss: 0.3128 - val_acc:
0.8980
Epoch 6/20
14/14 [==============================] - 154s 11s/step - loss: 0.4330 - acc: 0.8465 - val_loss: 0.2852 - val_acc:
0.8929
Epoch 7/20
14/14 [==============================] - 151s 11s/step - loss: 0.5632 - acc: 0.8150 - val_loss: 0.3104 - val_acc:
0.8929
Epoch 8/20
14/14 [==============================] - 161s 11s/step - loss: 0.3166 - acc: 0.8789 - val_loss: 0.4709 - val_acc:
0.8265
Epoch 9/20
14/14 [==============================] - 228s 14s/step - loss: 0.3592 - acc: 0.8605 - val_loss: 0.7447 - val_acc:
0.7602
Epoch 10/20
14/14 [==============================] - 146s 10s/step - loss: 0.2982 - acc: 0.8813 - val_loss: 0.2621 - val_acc:
0.8980
Epoch 11/20
14/14 [==============================] - 146s 10s/step - loss: 0.4104 - acc: 0.8711 - val_loss: 0.3899 - val_acc:
0.8776
Epoch 12/20
14/14 [==============================] - 144s 10s/step - loss: 0.2662 - acc: 0.9004 - val_loss: 0.6321 - val_acc:
0.6837
Epoch 13/20
14/14 [==============================] - 104s 7s/step - loss: 0.3658 - acc: 0.8568 - val_loss: 0.3557 - val_acc:
0.8776
Epoch 14/20
14/14 [==============================] - 80s 6s/step - loss: 0.2580 - acc: 0.9021 - val_loss: 0.2351 - val_acc: 0
.9235
Epoch 15/20
14/14 [==============================] - 79s 6s/step - loss: 0.3123 - acc: 0.8980 - val_loss: 0.3670 - val_acc: 0
.8724
Epoch 16/20
14/14 [==============================] - 76s 5s/step - loss: 0.2144 - acc: 0.9260 - val_loss: 0.4105 - val_acc: 0
.8316
Epoch 17/20
14/14 [==============================] - 80s 6s/step - loss: 0.2742 - acc: 0.8908 - val_loss: 0.7559 - val_acc: 0
```

```
.7398
Epoch 18/20
14/14 [==============================] - 88s 6s/step - loss: 0.2699 - acc: 0.9102 - val_loss: 0.2678 - val_acc: 0
.9082
Epoch 19/20
14/14 [==============================] - 80s 6s/step - loss: 0.2214 - acc: 0.9069 - val_loss: 0.2971 - val_acc: 0
.9082
Epoch 20/20
14/14 [==============================] - 83s 6s/step - loss: 0.2302 - acc: 0.9152 - val_loss: 0.2472 - val_acc: 0
.9031
```

In [6]:

```
#To train the top 2 inception blocks, freeze the first 249 layers and unfreeze the rest.
for layer in model.layers[:249]:
  layer.trainable = False
for layer in model.layers[249:]:
  layer.trainable = True
#Recompile the model for these modifications to take effect
from tensorflow.keras.optimizers import SGD
model.compile(optimizer=SGD(lr=0.0001, momentum=0.9), loss='categorical_crossentropy', metrics=['acc'])
history = model.fit(train_generator,steps_per_epoch = 14,epochs = 10,validation_data = validation_generator,valic
```

```
C:\Users\laksh\anaconda3\lib\site-packages\keras\optimizers\optimizer_v2\gradient_descent.py:108: UserWarning: Th
e `lr` argument is deprecated, use `learning_rate` instead.
  super(SGD, self).__init__(name, **kwargs)

Epoch 1/10
14/14 [==============================] - 157s 11s/step - loss: 0.6928 - acc: 0.6856 - val_loss: 0.2758 - val_acc:
0.9082
Epoch 2/10
14/14 [==============================] - 103s 7s/step - loss: 0.6428 - acc: 0.7132 - val_loss: 0.3017 - val_acc:
0.8929
Epoch 3/10
14/14 [==============================] - 97s 7s/step - loss: 0.5222 - acc: 0.7822 - val_loss: 0.2248 - val_acc: 0
.9031
Epoch 4/10
14/14 [==============================] - 129s 9s/step - loss: 0.4690 - acc: 0.7971 - val_loss: 0.2908 - val_acc:
0.8878
Epoch 5/10
14/14 [==============================] - 117s 8s/step - loss: 0.3919 - acc: 0.8490 - val_loss: 0.3074 - val_acc:
0.8724
Epoch 6/10
14/14 [==============================] - 118s 8s/step - loss: 0.3806 - acc: 0.9111 - val_loss: 0.3064 - val_acc:
0.9027
Epoch 7/10
14/14 [==============================] - 108s 8s/step - loss: 0.3231 - acc: 0.9041 - val_loss: 0.3213 - val_acc:
0.9076
Epoch 8/10
14/14 [==============================] - 114s 8s/step - loss: 0.3149 - acc: 0.9289 - val_loss: 0.3014 - val_acc:
0.9327
Epoch 9/10
14/14 [==============================] - 106s 7s/step - loss: 0.3213 - acc: 0.9289 - val_loss: 0.3354 - val_acc:
0.9322
Epoch 10/10
14/14 [==============================] - 98s 7s/step - loss: 0.2976 - acc: 0.9398 - val_loss: 0.2802 - val_acc: 0
.9429
```

In [16]:

```
model.summary()
model.save(r'C:\Users\laksh\TARP PROJECT\InceptionV3.h5')
```

```
Model: "model_3"
__________________________________________________________________________________________________
 Layer (type)                   Output Shape         Param #     Connected to
==================================================================================================
 input_4 (InputLayer)           [(None, 224, 224, 3  0           []
                                )]

 conv2d_282 (Conv2D)            (None, 111, 111, 32  864         ['input_4[0][0]']
                                )

 batch_normalization_282 (Batch  (None, 111, 111, 32  96         ['conv2d_282[0][0]']
 Normalization)                 )

 activation_282 (Activation)    (None, 111, 111, 32  0           ['batch_normalization_282[0][0]']
                                )

 conv2d_283 (Conv2D)            (None, 109, 109, 32  9216        ['activation_282[0][0]']
                                )

 batch_normalization_283 (Batch  (None, 109, 109, 32  96         ['conv2d_283[0][0]']
 Normalization)                 )
```

```
activation_283 (Activation)    (None, 109, 109, 32  0           ['batch_normalization_283[0][0]']
                               )

conv2d_284 (Conv2D)            (None, 109, 109, 64  18432       ['activation_283[0][0]']
                               )

batch_normalization_284 (Batch  (None, 109, 109, 64  192        ['conv2d_284[0][0]']
Normalization)                 )

activation_284 (Activation)    (None, 109, 109, 64  0           ['batch_normalization_284[0][0]']
                               )

max_pooling2d_12 (MaxPooling2D  (None, 54, 54, 64)  0           ['activation_284[0][0]']
)

conv2d_285 (Conv2D)            (None, 54, 54, 80)   5120        ['max_pooling2d_12[0][0]']

batch_normalization_285 (Batch  (None, 54, 54, 80)  240         ['conv2d_285[0][0]']
Normalization)

activation_285 (Activation)    (None, 54, 54, 80)   0           ['batch_normalization_285[0][0]']

conv2d_286 (Conv2D)            (None, 52, 52, 192)  138240      ['activation_285[0][0]']

batch_normalization_286 (Batch  (None, 52, 52, 192)  576        ['conv2d_286[0][0]']
Normalization)

activation_286 (Activation)    (None, 52, 52, 192)  0           ['batch_normalization_286[0][0]']

max_pooling2d_13 (MaxPooling2D  (None, 25, 25, 192)  0          ['activation_286[0][0]']
)

conv2d_290 (Conv2D)            (None, 25, 25, 64)   12288       ['max_pooling2d_13[0][0]']

batch_normalization_290 (Batch  (None, 25, 25, 64)  192         ['conv2d_290[0][0]']
Normalization)

activation_290 (Activation)    (None, 25, 25, 64)   0           ['batch_normalization_290[0][0]']

conv2d_288 (Conv2D)            (None, 25, 25, 48)   9216        ['max_pooling2d_13[0][0]']

conv2d_291 (Conv2D)            (None, 25, 25, 96)   55296       ['activation_290[0][0]']

batch_normalization_288 (Batch  (None, 25, 25, 48)  144         ['conv2d_288[0][0]']
Normalization)

batch_normalization_291 (Batch  (None, 25, 25, 96)  288         ['conv2d_291[0][0]']
Normalization)

activation_288 (Activation)    (None, 25, 25, 48)   0           ['batch_normalization_288[0][0]']

activation_291 (Activation)    (None, 25, 25, 96)   0           ['batch_normalization_291[0][0]']

average_pooling2d_27 (AverageP  (None, 25, 25, 192)  0          ['max_pooling2d_13[0][0]']
ooling2D)

conv2d_287 (Conv2D)            (None, 25, 25, 64)   12288       ['max_pooling2d_13[0][0]']

conv2d_289 (Conv2D)            (None, 25, 25, 64)   76800       ['activation_288[0][0]']

conv2d_292 (Conv2D)            (None, 25, 25, 96)   82944       ['activation_291[0][0]']

conv2d_293 (Conv2D)            (None, 25, 25, 32)   6144        ['average_pooling2d_27[0][0]']

batch_normalization_287 (Batch  (None, 25, 25, 64)  192         ['conv2d_287[0][0]']
Normalization)

batch_normalization_289 (Batch  (None, 25, 25, 64)  192         ['conv2d_289[0][0]']
Normalization)

batch_normalization_292 (Batch  (None, 25, 25, 96)  288         ['conv2d_292[0][0]']
Normalization)

batch_normalization_293 (Batch  (None, 25, 25, 32)  96          ['conv2d_293[0][0]']
Normalization)

activation_287 (Activation)    (None, 25, 25, 64)   0           ['batch_normalization_287[0][0]']

activation_289 (Activation)    (None, 25, 25, 64)   0           ['batch_normalization_289[0][0]']

activation_292 (Activation)    (None, 25, 25, 96)   0           ['batch_normalization_292[0][0]']

activation_293 (Activation)    (None, 25, 25, 32)   0           ['batch_normalization_293[0][0]']

mixed0 (Concatenate)           (None, 25, 25, 256)  0           ['activation_287[0][0]',
                                                                 'activation_289[0][0]',
                                                                 'activation_292[0][0]',
                                                                 'activation_293[0][0]']
```

```
conv2d_297 (Conv2D)            (None, 25, 25, 64)   16384       ['mixed0[0][0]']

batch_normalization_297 (Batch  (None, 25, 25, 64)  192         ['conv2d_297[0][0]']
Normalization)

activation_297 (Activation)    (None, 25, 25, 64)   0           ['batch_normalization_297[0][0]']

conv2d_295 (Conv2D)            (None, 25, 25, 48)   12288       ['mixed0[0][0]']

conv2d_298 (Conv2D)            (None, 25, 25, 96)   55296       ['activation_297[0][0]']

batch_normalization_295 (Batch  (None, 25, 25, 48)  144         ['conv2d_295[0][0]']
Normalization)

batch_normalization_298 (Batch  (None, 25, 25, 96)  288         ['conv2d_298[0][0]']
Normalization)

activation_295 (Activation)    (None, 25, 25, 48)   0           ['batch_normalization_295[0][0]']

activation_298 (Activation)    (None, 25, 25, 96)   0           ['batch_normalization_298[0][0]']

average_pooling2d_28 (AverageP  (None, 25, 25, 256)  0         ['mixed0[0][0]']
ooling2D)

conv2d_294 (Conv2D)            (None, 25, 25, 64)   16384       ['mixed0[0][0]']

conv2d_296 (Conv2D)            (None, 25, 25, 64)   76800       ['activation_295[0][0]']

conv2d_299 (Conv2D)            (None, 25, 25, 96)   82944       ['activation_298[0][0]']

conv2d_300 (Conv2D)            (None, 25, 25, 64)   16384       ['average_pooling2d_28[0][0]']

batch_normalization_294 (Batch  (None, 25, 25, 64)  192         ['conv2d_294[0][0]']
Normalization)

batch_normalization_296 (Batch  (None, 25, 25, 64)  192         ['conv2d_296[0][0]']
Normalization)

batch_normalization_299 (Batch  (None, 25, 25, 96)  288         ['conv2d_299[0][0]']
Normalization)

batch_normalization_300 (Batch  (None, 25, 25, 64)  192         ['conv2d_300[0][0]']
Normalization)

activation_294 (Activation)    (None, 25, 25, 64)   0           ['batch_normalization_294[0][0]']

activation_296 (Activation)    (None, 25, 25, 64)   0           ['batch_normalization_296[0][0]']

activation_299 (Activation)    (None, 25, 25, 96)   0           ['batch_normalization_299[0][0]']

activation_300 (Activation)    (None, 25, 25, 64)   0           ['batch_normalization_300[0][0]']

mixed1 (Concatenate)           (None, 25, 25, 288)  0           ['activation_294[0][0]',
                                                                 'activation_296[0][0]',
                                                                 'activation_299[0][0]',
                                                                 'activation_300[0][0]']

conv2d_304 (Conv2D)            (None, 25, 25, 64)   18432       ['mixed1[0][0]']

batch_normalization_304 (Batch  (None, 25, 25, 64)  192         ['conv2d_304[0][0]']
Normalization)

activation_304 (Activation)    (None, 25, 25, 64)   0           ['batch_normalization_304[0][0]']

conv2d_302 (Conv2D)            (None, 25, 25, 48)   13824       ['mixed1[0][0]']

conv2d_305 (Conv2D)            (None, 25, 25, 96)   55296       ['activation_304[0][0]']

batch_normalization_302 (Batch  (None, 25, 25, 48)  144         ['conv2d_302[0][0]']
Normalization)

batch_normalization_305 (Batch  (None, 25, 25, 96)  288         ['conv2d_305[0][0]']
Normalization)

activation_302 (Activation)    (None, 25, 25, 48)   0           ['batch_normalization_302[0][0]']

activation_305 (Activation)    (None, 25, 25, 96)   0           ['batch_normalization_305[0][0]']

average_pooling2d_29 (AverageP  (None, 25, 25, 288)  0         ['mixed1[0][0]']
ooling2D)

conv2d_301 (Conv2D)            (None, 25, 25, 64)   18432       ['mixed1[0][0]']

conv2d_303 (Conv2D)            (None, 25, 25, 64)   76800       ['activation_302[0][0]']

conv2d_306 (Conv2D)            (None, 25, 25, 96)   82944       ['activation_305[0][0]']

conv2d_307 (Conv2D)            (None, 25, 25, 64)   18432       ['average_pooling2d_29[0][0]']
```

```
batch_normalization_301 (Batch  (None, 25, 25, 64)  192         ['conv2d_301[0][0]']
Normalization)

batch_normalization_303 (Batch  (None, 25, 25, 64)  192         ['conv2d_303[0][0]']
Normalization)

batch_normalization_306 (Batch  (None, 25, 25, 96)  288         ['conv2d_306[0][0]']
Normalization)

batch_normalization_307 (Batch  (None, 25, 25, 64)  192         ['conv2d_307[0][0]']
Normalization)

activation_301 (Activation)    (None, 25, 25, 64)   0           ['batch_normalization_301[0][0]']

activation_303 (Activation)    (None, 25, 25, 64)   0           ['batch_normalization_303[0][0]']

activation_306 (Activation)    (None, 25, 25, 96)   0           ['batch_normalization_306[0][0]']

activation_307 (Activation)    (None, 25, 25, 64)   0           ['batch_normalization_307[0][0]']

mixed2 (Concatenate)           (None, 25, 25, 288)  0           ['activation_301[0][0]',
                                                                 'activation_303[0][0]',
                                                                 'activation_306[0][0]',
                                                                 'activation_307[0][0]']

conv2d_309 (Conv2D)            (None, 25, 25, 64)   18432       ['mixed2[0][0]']

batch_normalization_309 (Batch  (None, 25, 25, 64)  192         ['conv2d_309[0][0]']
Normalization)

activation_309 (Activation)    (None, 25, 25, 64)   0           ['batch_normalization_309[0][0]']

conv2d_310 (Conv2D)            (None, 25, 25, 96)   55296       ['activation_309[0][0]']

batch_normalization_310 (Batch  (None, 25, 25, 96)  288         ['conv2d_310[0][0]']
Normalization)

activation_310 (Activation)    (None, 25, 25, 96)   0           ['batch_normalization_310[0][0]']

conv2d_308 (Conv2D)            (None, 12, 12, 384)  995328      ['mixed2[0][0]']

conv2d_311 (Conv2D)            (None, 12, 12, 96)   82944       ['activation_310[0][0]']

batch_normalization_308 (Batch  (None, 12, 12, 384)  1152       ['conv2d_308[0][0]']
Normalization)

batch_normalization_311 (Batch  (None, 12, 12, 96)  288         ['conv2d_311[0][0]']
Normalization)

activation_308 (Activation)    (None, 12, 12, 384)  0           ['batch_normalization_308[0][0]']

activation_311 (Activation)    (None, 12, 12, 96)   0           ['batch_normalization_311[0][0]']

max_pooling2d_14 (MaxPooling2D  (None, 12, 12, 288)  0          ['mixed2[0][0]']
)

mixed3 (Concatenate)           (None, 12, 12, 768)  0           ['activation_308[0][0]',
                                                                 'activation_311[0][0]',
                                                                 'max_pooling2d_14[0][0]']

conv2d_316 (Conv2D)            (None, 12, 12, 128)  98304       ['mixed3[0][0]']

batch_normalization_316 (Batch  (None, 12, 12, 128)  384       ['conv2d_316[0][0]']
Normalization)

activation_316 (Activation)    (None, 12, 12, 128)  0           ['batch_normalization_316[0][0]']

conv2d_317 (Conv2D)            (None, 12, 12, 128)  114688      ['activation_316[0][0]']

batch_normalization_317 (Batch  (None, 12, 12, 128)  384       ['conv2d_317[0][0]']
Normalization)

activation_317 (Activation)    (None, 12, 12, 128)  0           ['batch_normalization_317[0][0]']

conv2d_313 (Conv2D)            (None, 12, 12, 128)  98304       ['mixed3[0][0]']

conv2d_318 (Conv2D)            (None, 12, 12, 128)  114688      ['activation_317[0][0]']

batch_normalization_313 (Batch  (None, 12, 12, 128)  384       ['conv2d_313[0][0]']
Normalization)

batch_normalization_318 (Batch  (None, 12, 12, 128)  384       ['conv2d_318[0][0]']
Normalization)

activation_313 (Activation)    (None, 12, 12, 128)  0           ['batch_normalization_313[0][0]']

activation_318 (Activation)    (None, 12, 12, 128)  0           ['batch_normalization_318[0][0]']

conv2d_314 (Conv2D)            (None, 12, 12, 128)  114688      ['activation_313[0][0]']
```

```
conv2d_319 (Conv2D)           (None, 12, 12, 128)  114688      ['activation_318[0][0]']

batch_normalization_314 (Batch  (None, 12, 12, 128)  384        ['conv2d_314[0][0]']
Normalization)

batch_normalization_319 (Batch  (None, 12, 12, 128)  384        ['conv2d_319[0][0]']
Normalization)

activation_314 (Activation)    (None, 12, 12, 128)  0           ['batch_normalization_314[0][0]']

activation_319 (Activation)    (None, 12, 12, 128)  0           ['batch_normalization_319[0][0]']

average_pooling2d_30 (AverageP  (None, 12, 12, 768)  0          ['mixed3[0][0]']
ooling2D)

conv2d_312 (Conv2D)           (None, 12, 12, 192)  147456      ['mixed3[0][0]']

conv2d_315 (Conv2D)           (None, 12, 12, 192)  172032      ['activation_314[0][0]']

conv2d_320 (Conv2D)           (None, 12, 12, 192)  172032      ['activation_319[0][0]']

conv2d_321 (Conv2D)           (None, 12, 12, 192)  147456      ['average_pooling2d_30[0][0]']

batch_normalization_312 (Batch  (None, 12, 12, 192)  576        ['conv2d_312[0][0]']
Normalization)

batch_normalization_315 (Batch  (None, 12, 12, 192)  576        ['conv2d_315[0][0]']
Normalization)

batch_normalization_320 (Batch  (None, 12, 12, 192)  576        ['conv2d_320[0][0]']
Normalization)

batch_normalization_321 (Batch  (None, 12, 12, 192)  576        ['conv2d_321[0][0]']
Normalization)

activation_312 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_312[0][0]']

activation_315 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_315[0][0]']

activation_320 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_320[0][0]']

activation_321 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_321[0][0]']

mixed4 (Concatenate)           (None, 12, 12, 768)  0           ['activation_312[0][0]',
                                                                 'activation_315[0][0]',
                                                                 'activation_320[0][0]',
                                                                 'activation_321[0][0]']

conv2d_326 (Conv2D)           (None, 12, 12, 160)  122880      ['mixed4[0][0]']

batch_normalization_326 (Batch  (None, 12, 12, 160)  480        ['conv2d_326[0][0]']
Normalization)

activation_326 (Activation)    (None, 12, 12, 160)  0           ['batch_normalization_326[0][0]']

conv2d_327 (Conv2D)           (None, 12, 12, 160)  179200      ['activation_326[0][0]']

batch_normalization_327 (Batch  (None, 12, 12, 160)  480        ['conv2d_327[0][0]']
Normalization)

activation_327 (Activation)    (None, 12, 12, 160)  0           ['batch_normalization_327[0][0]']

conv2d_323 (Conv2D)           (None, 12, 12, 160)  122880      ['mixed4[0][0]']

conv2d_328 (Conv2D)           (None, 12, 12, 160)  179200      ['activation_327[0][0]']

batch_normalization_323 (Batch  (None, 12, 12, 160)  480        ['conv2d_323[0][0]']
Normalization)

batch_normalization_328 (Batch  (None, 12, 12, 160)  480        ['conv2d_328[0][0]']
Normalization)

activation_323 (Activation)    (None, 12, 12, 160)  0           ['batch_normalization_323[0][0]']

activation_328 (Activation)    (None, 12, 12, 160)  0           ['batch_normalization_328[0][0]']

conv2d_324 (Conv2D)           (None, 12, 12, 160)  179200      ['activation_323[0][0]']

conv2d_329 (Conv2D)           (None, 12, 12, 160)  179200      ['activation_328[0][0]']

batch_normalization_324 (Batch  (None, 12, 12, 160)  480        ['conv2d_324[0][0]']
Normalization)

batch_normalization_329 (Batch  (None, 12, 12, 160)  480        ['conv2d_329[0][0]']
Normalization)

activation_324 (Activation)    (None, 12, 12, 160)  0           ['batch_normalization_324[0][0]']
```

```
activation_329 (Activation)    (None, 12, 12, 160)  0           ['batch_normalization_329[0][0]']

average_pooling2d_31 (AverageP  (None, 12, 12, 768)  0         ['mixed4[0][0]']
ooling2D)

conv2d_322 (Conv2D)            (None, 12, 12, 192)  147456      ['mixed4[0][0]']

conv2d_325 (Conv2D)            (None, 12, 12, 192)  215040      ['activation_324[0][0]']

conv2d_330 (Conv2D)            (None, 12, 12, 192)  215040      ['activation_329[0][0]']

conv2d_331 (Conv2D)            (None, 12, 12, 192)  147456      ['average_pooling2d_31[0][0]']

batch_normalization_322 (Batch  (None, 12, 12, 192)  576        ['conv2d_322[0][0]']
Normalization)

batch_normalization_325 (Batch  (None, 12, 12, 192)  576        ['conv2d_325[0][0]']
Normalization)

batch_normalization_330 (Batch  (None, 12, 12, 192)  576        ['conv2d_330[0][0]']
Normalization)

batch_normalization_331 (Batch  (None, 12, 12, 192)  576        ['conv2d_331[0][0]']
Normalization)

activation_322 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_322[0][0]']

activation_325 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_325[0][0]']

activation_330 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_330[0][0]']

activation_331 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_331[0][0]']

mixed5 (Concatenate)           (None, 12, 12, 768)  0           ['activation_322[0][0]',
                                                                 'activation_325[0][0]',
                                                                 'activation_330[0][0]',
                                                                 'activation_331[0][0]']

conv2d_336 (Conv2D)            (None, 12, 12, 160)  122880      ['mixed5[0][0]']

batch_normalization_336 (Batch  (None, 12, 12, 160)  480        ['conv2d_336[0][0]']
Normalization)

activation_336 (Activation)    (None, 12, 12, 160)  0           ['batch_normalization_336[0][0]']

conv2d_337 (Conv2D)            (None, 12, 12, 160)  179200      ['activation_336[0][0]']

batch_normalization_337 (Batch  (None, 12, 12, 160)  480        ['conv2d_337[0][0]']
Normalization)

activation_337 (Activation)    (None, 12, 12, 160)  0           ['batch_normalization_337[0][0]']

conv2d_333 (Conv2D)            (None, 12, 12, 160)  122880      ['mixed5[0][0]']

conv2d_338 (Conv2D)            (None, 12, 12, 160)  179200      ['activation_337[0][0]']

batch_normalization_333 (Batch  (None, 12, 12, 160)  480        ['conv2d_333[0][0]']
Normalization)

batch_normalization_338 (Batch  (None, 12, 12, 160)  480        ['conv2d_338[0][0]']
Normalization)

activation_333 (Activation)    (None, 12, 12, 160)  0           ['batch_normalization_333[0][0]']

activation_338 (Activation)    (None, 12, 12, 160)  0           ['batch_normalization_338[0][0]']

conv2d_334 (Conv2D)            (None, 12, 12, 160)  179200      ['activation_333[0][0]']

conv2d_339 (Conv2D)            (None, 12, 12, 160)  179200      ['activation_338[0][0]']

batch_normalization_334 (Batch  (None, 12, 12, 160)  480        ['conv2d_334[0][0]']
Normalization)

batch_normalization_339 (Batch  (None, 12, 12, 160)  480        ['conv2d_339[0][0]']
Normalization)

activation_334 (Activation)    (None, 12, 12, 160)  0           ['batch_normalization_334[0][0]']

activation_339 (Activation)    (None, 12, 12, 160)  0           ['batch_normalization_339[0][0]']

average_pooling2d_32 (AverageP  (None, 12, 12, 768)  0         ['mixed5[0][0]']
ooling2D)

conv2d_332 (Conv2D)            (None, 12, 12, 192)  147456      ['mixed5[0][0]']

conv2d_335 (Conv2D)            (None, 12, 12, 192)  215040      ['activation_334[0][0]']

conv2d_340 (Conv2D)            (None, 12, 12, 192)  215040      ['activation_339[0][0]']
```

```
conv2d_341 (Conv2D)            (None, 12, 12, 192)  147456      ['average_pooling2d_32[0][0]']

batch_normalization_332 (Batch  (None, 12, 12, 192)  576        ['conv2d_332[0][0]']
Normalization)

batch_normalization_335 (Batch  (None, 12, 12, 192)  576        ['conv2d_335[0][0]']
Normalization)

batch_normalization_340 (Batch  (None, 12, 12, 192)  576        ['conv2d_340[0][0]']
Normalization)

batch_normalization_341 (Batch  (None, 12, 12, 192)  576        ['conv2d_341[0][0]']
Normalization)

activation_332 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_332[0][0]']

activation_335 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_335[0][0]']

activation_340 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_340[0][0]']

activation_341 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_341[0][0]']

mixed6 (Concatenate)           (None, 12, 12, 768)  0           ['activation_332[0][0]',
                                                                 'activation_335[0][0]',
                                                                 'activation_340[0][0]',
                                                                 'activation_341[0][0]']

conv2d_346 (Conv2D)            (None, 12, 12, 192)  147456      ['mixed6[0][0]']

batch_normalization_346 (Batch  (None, 12, 12, 192)  576        ['conv2d_346[0][0]']
Normalization)

activation_346 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_346[0][0]']

conv2d_347 (Conv2D)            (None, 12, 12, 192)  258048      ['activation_346[0][0]']

batch_normalization_347 (Batch  (None, 12, 12, 192)  576        ['conv2d_347[0][0]']
Normalization)

activation_347 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_347[0][0]']

conv2d_343 (Conv2D)            (None, 12, 12, 192)  147456      ['mixed6[0][0]']

conv2d_348 (Conv2D)            (None, 12, 12, 192)  258048      ['activation_347[0][0]']

batch_normalization_343 (Batch  (None, 12, 12, 192)  576        ['conv2d_343[0][0]']
Normalization)

batch_normalization_348 (Batch  (None, 12, 12, 192)  576        ['conv2d_348[0][0]']
Normalization)

activation_343 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_343[0][0]']

activation_348 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_348[0][0]']

conv2d_344 (Conv2D)            (None, 12, 12, 192)  258048      ['activation_343[0][0]']

conv2d_349 (Conv2D)            (None, 12, 12, 192)  258048      ['activation_348[0][0]']

batch_normalization_344 (Batch  (None, 12, 12, 192)  576        ['conv2d_344[0][0]']
Normalization)

batch_normalization_349 (Batch  (None, 12, 12, 192)  576        ['conv2d_349[0][0]']
Normalization)

activation_344 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_344[0][0]']

activation_349 (Activation)    (None, 12, 12, 192)  0           ['batch_normalization_349[0][0]']

average_pooling2d_33 (AverageP  (None, 12, 12, 768)  0         ['mixed6[0][0]']
ooling2D)

conv2d_342 (Conv2D)            (None, 12, 12, 192)  147456      ['mixed6[0][0]']

conv2d_345 (Conv2D)            (None, 12, 12, 192)  258048      ['activation_344[0][0]']

conv2d_350 (Conv2D)            (None, 12, 12, 192)  258048      ['activation_349[0][0]']

conv2d_351 (Conv2D)            (None, 12, 12, 192)  147456      ['average_pooling2d_33[0][0]']

batch_normalization_342 (Batch  (None, 12, 12, 192)  576        ['conv2d_342[0][0]']
Normalization)

batch_normalization_345 (Batch  (None, 12, 12, 192)  576        ['conv2d_345[0][0]']
Normalization)

batch_normalization_350 (Batch  (None, 12, 12, 192)  576        ['conv2d_350[0][0]']
Normalization)
```

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batch_normalization_351 (Batch  (None, 12, 12, 192)  576        ['conv2d_351[0][0]']
Normalization)

activation_342 (Activation)    (None, 12, 12, 192)  0          ['batch_normalization_342[0][0]']

activation_345 (Activation)    (None, 12, 12, 192)  0          ['batch_normalization_345[0][0]']

activation_350 (Activation)    (None, 12, 12, 192)  0          ['batch_normalization_350[0][0]']

activation_351 (Activation)    (None, 12, 12, 192)  0          ['batch_normalization_351[0][0]']

mixed7 (Concatenate)           (None, 12, 12, 768)  0          ['activation_342[0][0]',
                                                                 'activation_345[0][0]',
                                                                 'activation_350[0][0]',
                                                                 'activation_351[0][0]']

conv2d_354 (Conv2D)            (None, 12, 12, 192)  147456     ['mixed7[0][0]']

batch_normalization_354 (Batch  (None, 12, 12, 192)  576        ['conv2d_354[0][0]']
Normalization)

activation_354 (Activation)    (None, 12, 12, 192)  0          ['batch_normalization_354[0][0]']

conv2d_355 (Conv2D)            (None, 12, 12, 192)  258048     ['activation_354[0][0]']

batch_normalization_355 (Batch  (None, 12, 12, 192)  576        ['conv2d_355[0][0]']
Normalization)

activation_355 (Activation)    (None, 12, 12, 192)  0          ['batch_normalization_355[0][0]']

conv2d_352 (Conv2D)            (None, 12, 12, 192)  147456     ['mixed7[0][0]']

conv2d_356 (Conv2D)            (None, 12, 12, 192)  258048     ['activation_355[0][0]']

batch_normalization_352 (Batch  (None, 12, 12, 192)  576        ['conv2d_352[0][0]']
Normalization)

batch_normalization_356 (Batch  (None, 12, 12, 192)  576        ['conv2d_356[0][0]']
Normalization)

activation_352 (Activation)    (None, 12, 12, 192)  0          ['batch_normalization_352[0][0]']

activation_356 (Activation)    (None, 12, 12, 192)  0          ['batch_normalization_356[0][0]']

conv2d_353 (Conv2D)            (None, 5, 5, 320)    552960     ['activation_352[0][0]']

conv2d_357 (Conv2D)            (None, 5, 5, 192)    331776     ['activation_356[0][0]']

batch_normalization_353 (Batch  (None, 5, 5, 320)   960        ['conv2d_353[0][0]']
Normalization)

batch_normalization_357 (Batch  (None, 5, 5, 192)   576        ['conv2d_357[0][0]']
Normalization)

activation_353 (Activation)    (None, 5, 5, 320)    0          ['batch_normalization_353[0][0]']

activation_357 (Activation)    (None, 5, 5, 192)    0          ['batch_normalization_357[0][0]']

max_pooling2d_15 (MaxPooling2D  (None, 5, 5, 768)   0          ['mixed7[0][0]']
)

mixed8 (Concatenate)           (None, 5, 5, 1280)   0          ['activation_353[0][0]',
                                                                 'activation_357[0][0]',
                                                                 'max_pooling2d_15[0][0]']

conv2d_362 (Conv2D)            (None, 5, 5, 448)    573440     ['mixed8[0][0]']

batch_normalization_362 (Batch  (None, 5, 5, 448)   1344       ['conv2d_362[0][0]']
Normalization)

activation_362 (Activation)    (None, 5, 5, 448)    0          ['batch_normalization_362[0][0]']

conv2d_359 (Conv2D)            (None, 5, 5, 384)    491520     ['mixed8[0][0]']

conv2d_363 (Conv2D)            (None, 5, 5, 384)    1548288    ['activation_362[0][0]']

batch_normalization_359 (Batch  (None, 5, 5, 384)   1152       ['conv2d_359[0][0]']
Normalization)

batch_normalization_363 (Batch  (None, 5, 5, 384)   1152       ['conv2d_363[0][0]']
Normalization)

activation_359 (Activation)    (None, 5, 5, 384)    0          ['batch_normalization_359[0][0]']

activation_363 (Activation)    (None, 5, 5, 384)    0          ['batch_normalization_363[0][0]']

conv2d_360 (Conv2D)            (None, 5, 5, 384)    442368     ['activation_359[0][0]']

conv2d_361 (Conv2D)            (None, 5, 5, 384)    442368     ['activation_359[0][0]']
```

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conv2d_364 (Conv2D)            (None, 5, 5, 384)    442368      ['activation_363[0][0]']

conv2d_365 (Conv2D)            (None, 5, 5, 384)    442368      ['activation_363[0][0]']

average_pooling2d_34 (AverageP  (None, 5, 5, 1280)  0           ['mixed8[0][0]']
ooling2D)

conv2d_358 (Conv2D)            (None, 5, 5, 320)    409600      ['mixed8[0][0]']

batch_normalization_360 (Batch  (None, 5, 5, 384)   1152        ['conv2d_360[0][0]']
Normalization)

batch_normalization_361 (Batch  (None, 5, 5, 384)   1152        ['conv2d_361[0][0]']
Normalization)

batch_normalization_364 (Batch  (None, 5, 5, 384)   1152        ['conv2d_364[0][0]']
Normalization)

batch_normalization_365 (Batch  (None, 5, 5, 384)   1152        ['conv2d_365[0][0]']
Normalization)

conv2d_366 (Conv2D)            (None, 5, 5, 192)    245760      ['average_pooling2d_34[0][0]']

batch_normalization_358 (Batch  (None, 5, 5, 320)   960         ['conv2d_358[0][0]']
Normalization)

activation_360 (Activation)    (None, 5, 5, 384)    0           ['batch_normalization_360[0][0]']

activation_361 (Activation)    (None, 5, 5, 384)    0           ['batch_normalization_361[0][0]']

activation_364 (Activation)    (None, 5, 5, 384)    0           ['batch_normalization_364[0][0]']

activation_365 (Activation)    (None, 5, 5, 384)    0           ['batch_normalization_365[0][0]']

batch_normalization_366 (Batch  (None, 5, 5, 192)   576         ['conv2d_366[0][0]']
Normalization)

activation_358 (Activation)    (None, 5, 5, 320)    0           ['batch_normalization_358[0][0]']

mixed9_0 (Concatenate)         (None, 5, 5, 768)    0           ['activation_360[0][0]',
                                                                 'activation_361[0][0]']

concatenate_6 (Concatenate)    (None, 5, 5, 768)    0           ['activation_364[0][0]',
                                                                 'activation_365[0][0]']

activation_366 (Activation)    (None, 5, 5, 192)    0           ['batch_normalization_366[0][0]']

mixed9 (Concatenate)           (None, 5, 5, 2048)   0           ['activation_358[0][0]',
                                                                 'mixed9_0[0][0]',
                                                                 'concatenate_6[0][0]',
                                                                 'activation_366[0][0]']

conv2d_371 (Conv2D)            (None, 5, 5, 448)    917504      ['mixed9[0][0]']

batch_normalization_371 (Batch  (None, 5, 5, 448)   1344        ['conv2d_371[0][0]']
Normalization)

activation_371 (Activation)    (None, 5, 5, 448)    0           ['batch_normalization_371[0][0]']

conv2d_368 (Conv2D)            (None, 5, 5, 384)    786432      ['mixed9[0][0]']

conv2d_372 (Conv2D)            (None, 5, 5, 384)    1548288     ['activation_371[0][0]']

batch_normalization_368 (Batch  (None, 5, 5, 384)   1152        ['conv2d_368[0][0]']
Normalization)

batch_normalization_372 (Batch  (None, 5, 5, 384)   1152        ['conv2d_372[0][0]']
Normalization)

activation_368 (Activation)    (None, 5, 5, 384)    0           ['batch_normalization_368[0][0]']

activation_372 (Activation)    (None, 5, 5, 384)    0           ['batch_normalization_372[0][0]']

conv2d_369 (Conv2D)            (None, 5, 5, 384)    442368      ['activation_368[0][0]']

conv2d_370 (Conv2D)            (None, 5, 5, 384)    442368      ['activation_368[0][0]']

conv2d_373 (Conv2D)            (None, 5, 5, 384)    442368      ['activation_372[0][0]']

conv2d_374 (Conv2D)            (None, 5, 5, 384)    442368      ['activation_372[0][0]']

average_pooling2d_35 (AverageP  (None, 5, 5, 2048)  0           ['mixed9[0][0]']
ooling2D)

conv2d_367 (Conv2D)            (None, 5, 5, 320)    655360      ['mixed9[0][0]']

batch_normalization_369 (Batch  (None, 5, 5, 384)   1152        ['conv2d_369[0][0]']
Normalization)
```

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batch_normalization_370 (Batch  (None, 5, 5, 384)   1152        ['conv2d_370[0][0]']
Normalization)

batch_normalization_373 (Batch  (None, 5, 5, 384)   1152        ['conv2d_373[0][0]']
Normalization)

batch_normalization_374 (Batch  (None, 5, 5, 384)   1152        ['conv2d_374[0][0]']
Normalization)

conv2d_375 (Conv2D)             (None, 5, 5, 192)   393216      ['average_pooling2d_35[0][0]']

batch_normalization_367 (Batch  (None, 5, 5, 320)   960         ['conv2d_367[0][0]']
Normalization)

activation_369 (Activation)     (None, 5, 5, 384)   0           ['batch_normalization_369[0][0]']

activation_370 (Activation)     (None, 5, 5, 384)   0           ['batch_normalization_370[0][0]']

activation_373 (Activation)     (None, 5, 5, 384)   0           ['batch_normalization_373[0][0]']

activation_374 (Activation)     (None, 5, 5, 384)   0           ['batch_normalization_374[0][0]']

batch_normalization_375 (Batch  (None, 5, 5, 192)   576         ['conv2d_375[0][0]']
Normalization)

activation_367 (Activation)     (None, 5, 5, 320)   0           ['batch_normalization_367[0][0]']

mixed9_1 (Concatenate)          (None, 5, 5, 768)   0           ['activation_369[0][0]',
                                                                 'activation_370[0][0]']

concatenate_7 (Concatenate)     (None, 5, 5, 768)   0           ['activation_373[0][0]',
                                                                 'activation_374[0][0]']

activation_375 (Activation)     (None, 5, 5, 192)   0           ['batch_normalization_375[0][0]']

mixed10 (Concatenate)           (None, 5, 5, 2048)  0           ['activation_367[0][0]',
                                                                 'mixed9_1[0][0]',
                                                                 'concatenate_7[0][0]',
                                                                 'activation_375[0][0]']

global_average_pooling2d_3 (Gl  (None, 2048)        0           ['mixed10[0][0]']
obalAveragePooling2D)

dense_9 (Dense)                 (None, 2048)        4196352     ['global_average_pooling2d_3[0][0
                                                                ']']

dropout_6 (Dropout)             (None, 2048)        0           ['dense_9[0][0]']

dense_10 (Dense)                (None, 1024)        2098176     ['dropout_6[0][0]']

dropout_7 (Dropout)             (None, 1024)        0           ['dense_10[0][0]']

dense_11 (Dense)                (None, 3)           3075        ['dropout_7[0][0]']

==================================================================================================
Total params: 28,100,387
Trainable params: 17,412,483
Non-trainable params: 10,687,904
__________________________________________________________________________________________________
```

In [ ]:

```python
import cv2
import numpy as np
from PIL import Image
import tensorflow as tf
from keras.preprocessing import image
#Load the saved model
model = tf.keras.models.load_model(r'C:\Users\laksh\TARP PROJECT\InceptionV3.h5')
video = cv2.VideoCapture(0)
while True:
        _, frame = video.read()
#Convert the captured frame into RGB
        im = Image.fromarray(frame, 'RGB')
#Resizing into 224x224 because we trained the model with this image size.
        im = im.resize((224,224))
        img_array = tf.keras.utils.img_to_array(im)
        img_array = np.expand_dims(img_array, axis=0) / 255
        probabilities = model.predict(img_array)[0]
        #Calling the predict method on model to predict 'fire' on the image
        prediction = np.argmax(probabilities)
        #if prediction is 0, which means there is fire in the frame.
        if prediction == 0:
                frame = cv2.cvtColor(frame, cv2.COLOR_RGB2GRAY)
                print(probabilities[prediction])
cv2.imshow("Capturing", frame)
```

```
key=cv2.waitKey(1)
if key == ord('q'):
    break
video.release()
cv2.destroyAllWindows()
```

```
1/1 [==============================] - 4s 4s/step
1/1 [==============================] - 0s 101ms/step
1/1 [==============================] - 0s 106ms/step
1/1 [==============================] - 0s 103ms/step
1/1 [==============================] - 0s 107ms/step
1/1 [==============================] - 0s 101ms/step
1/1 [==============================] - 0s 100ms/step
1/1 [==============================] - 0s 139ms/step
1/1 [==============================] - 0s 102ms/step
1/1 [==============================] - 0s 103ms/step
1/1 [==============================] - 0s 105ms/step
1/1 [==============================] - 0s 153ms/step
1/1 [==============================] - 0s 121ms/step
1/1 [==============================] - 0s 182ms/step
1/1 [==============================] - 0s 98ms/step
1/1 [==============================] - 0s 104ms/step
1/1 [==============================] - 0s 98ms/step
1/1 [==============================] - 0s 103ms/step
1/1 [==============================] - 0s 97ms/step
1/1 [==============================] - 0s 100ms/step
1/1 [==============================] - 0s 122ms/step
1/1 [==============================] - 0s 95ms/step
1/1 [==============================] - 0s 113ms/step
1/1 [==============================] - 0s 126ms/step
1/1 [==============================] - 0s 108ms/step
1/1 [==============================] - 0s 98ms/step
1/1 [==============================] - 0s 98ms/step
1/1 [==============================] - 0s 99ms/step
1/1 [==============================] - 0s 98ms/step
1/1 [==============================] - 0s 90ms/step
1/1 [==============================] - 0s 161ms/step
1/1 [==============================] - 0s 98ms/step
1/1 [==============================] - 0s 98ms/step
1/1 [==============================] - 0s 89ms/step
1/1 [==============================] - 0s 120ms/step
1/1 [==============================] - 0s 95ms/step
1/1 [==============================] - 0s 105ms/step
1/1 [==============================] - 0s 175ms/step
1/1 [==============================] - 0s 96ms/step
1/1 [==============================] - 0s 121ms/step
1/1 [==============================] - 0s 93ms/step
1/1 [==============================] - 0s 91ms/step
1/1 [==============================] - 0s 141ms/step
1/1 [==============================] - 0s 105ms/step
1/1 [==============================] - 0s 149ms/step
1/1 [==============================] - 0s 129ms/step
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In [12]:

```
!pip install opencv-python -i http://pypi.douban.com/simple/ --trusted-host pypi.douban.com
```

```
Looking in indexes: http://pypi.douban.com/simple/
Collecting opencv-python
  Downloading http://pypi.doubanio.com/packages/80/5b/6eee3a1dc0f296904f44a13749f3b2cd29569c817aa931ead50c4d085d5
1/opencv_python-4.7.0.68-cp37-abi3-win_amd64.whl (38.2 MB)
Requirement already satisfied: numpy>=1.17.0 in c:\users\laksh\anaconda3\lib\site-packages (from opencv-python) (
1.20.3)
Installing collected packages: opencv-python
Successfully installed opencv-python-4.7.0.68
```

In [11]:

```
!pip install cv2
```

```
ERROR: Could not find a version that satisfies the requirement cv2 (from versions: none)
ERROR: No matching distribution found for cv2
```