CarStyle

October 2, 2024

[1]:
```
import tensorflow as tf
import os
import cv2
import math
import json
import numpy as np
from matplotlib import pyplot as plt
from keras.applications import InceptionResNetV2
from keras.models import Model
from keras.layers import Dense, GlobalAveragePooling2D
from keras.metrics import Precision, Recall, SparseCategoricalAccuracy
```

[2]:
```
print("Num GPUs Available: ", len(tf.config.list_physical_devices('GPU')))
gpus = tf.config.experimental.list_physical_devices('GPU')
if gpus:
    try:
        for gpu in gpus:
            tf.config.experimental.set_memory_growth(gpu, True)
        logical_gpus = tf.config.experimental.list_logical_devices('GPU')
        print(len(gpus), "Physical GPUs,", len(logical_gpus), "Logical GPUs")
    except RuntimeError as e:
        print(e)
```

```
Num GPUs Available:  1
1 Physical GPUs, 1 Logical GPUs
```

[3]:
```
base_dir = 'Styles'
train_dir = os.path.join(base_dir, 'train')
val_dir = os.path.join(base_dir, 'valid')
test_dir = os.path.join(base_dir, 'test')

img_size = (224, 224)
batch_size = 32

train_data = tf.keras.utils.image_dataset_from_directory(
    train_dir,
    image_size=img_size,
    batch_size=batch_size,
```

```
    label_mode='int',
    interpolation='bilinear'
)

val_data = tf.keras.utils.image_dataset_from_directory(
    val_dir,
    image_size=img_size,
    batch_size=batch_size,
    label_mode='int',
    interpolation='bilinear'
)

test_data = tf.keras.utils.image_dataset_from_directory(
    test_dir,
    image_size=img_size,
    batch_size=batch_size,
    label_mode='int',
    interpolation='bilinear'
)
```

```
Found 5350 files belonging to 7 classes.
Found 1397 files belonging to 7 classes.
Found 802 files belonging to 7 classes.
```

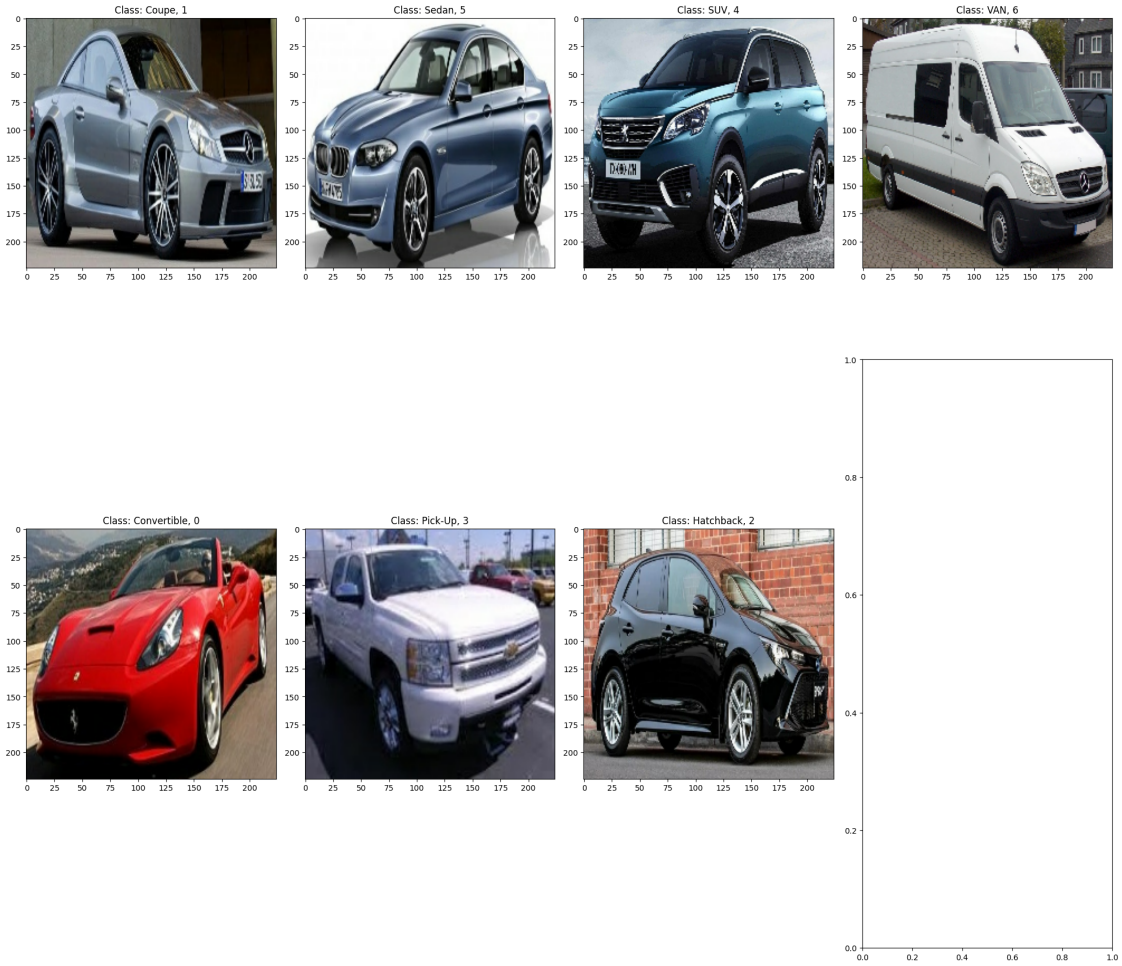
[4]:
```
class_names = train_data.class_names
print("Class names test:", class_names)

with open('CarStyle map.json', 'w') as f:
    json.dump(class_names, f)

data_iterator = train_data.as_numpy_iterator()
```

```
Class names test: ['Convertible', 'Coupe', 'Hatchback', 'Pick-Up', 'SUV',
'Sedan', 'VAN']
```

[5]:
```
batch = data_iterator.next()
num_classes = len(class_names)
```

[6]:
```
ncols = 4
nrows = math.ceil(num_classes / ncols)
fig, ax = plt.subplots(nrows=nrows, ncols=ncols, figsize=(20, 20))

if nrows == 1:
    ax = ax.flatten()
elif ncols == 1:
    ax = ax.flatten()

plotted = set()
```

```
count = 0
while count < num_classes:
    batch = next(data_iterator)

    for idx, img in enumerate(batch[0]):
        label = batch[1][idx]
        if label not in plotted:
            ax_idx = count if nrows == 1 or ncols == 1 else (count // ncols,␣
 ↪count % ncols)
            ax[ax_idx].imshow(img.astype(int))
            ax[ax_idx].title.set_text(f"Class: {class_names[label]}, {label}")
            plotted.add(label)
            count += 1

        if count == num_classes:
            break

plt.tight_layout()
plt.show()
```



[7]:
```
base_model = InceptionResNetV2(
    weights='imagenet',
    include_top=False,
    input_shape=(224, 224, 3)
)
base_model.summary()
```

```
Downloading data from https://storage.googleapis.com/tensorflow/keras-applicatio
ns/inception_resnet_v2/inception_resnet_v2_weights_tf_dim_ordering_tf_kernels_no
top.h5
219055592/219055592 [==============================] - 3s 0us/step
Model: "inception_resnet_v2"
__________________________________________________________________________________
__________________
 Layer (type)                   Output Shape         Param #     Connected to
==================================================================================
==================
 input_1 (InputLayer)           [(None, 224, 224, 3  0           []
                                )]

 conv2d (Conv2D)                (None, 111, 111, 32  864
['input_1[0][0]']
                                )

 batch_normalization (BatchNorm  (None, 111, 111, 32  96
['conv2d[0][0]']
 alization)                     )

 activation (Activation)        (None, 111, 111, 32  0
['batch_normalization[0][0]']
                                )

 conv2d_1 (Conv2D)              (None, 109, 109, 32  9216
['activation[0][0]']
                                )

 batch_normalization_1 (BatchNo  (None, 109, 109, 32  96
['conv2d_1[0][0]']
 rmalization)                   )

 activation_1 (Activation)      (None, 109, 109, 32  0
['batch_normalization_1[0][0]']
                                )

 conv2d_2 (Conv2D)              (None, 109, 109, 64  18432
```

```
['activation_1[0][0]']
                                )

 batch_normalization_2 (BatchNo  (None, 109, 109, 64  192
['conv2d_2[0][0]']
 rmalization)                   )

 activation_2 (Activation)      (None, 109, 109, 64  0
['batch_normalization_2[0][0]']
                                )

 max_pooling2d (MaxPooling2D)   (None, 54, 54, 64)   0
['activation_2[0][0]']

 conv2d_3 (Conv2D)              (None, 54, 54, 80)   5120
['max_pooling2d[0][0]']

 batch_normalization_3 (BatchNo  (None, 54, 54, 80)  240
['conv2d_3[0][0]']
 rmalization)

 activation_3 (Activation)      (None, 54, 54, 80)   0
['batch_normalization_3[0][0]']

 conv2d_4 (Conv2D)              (None, 52, 52, 192)  138240
['activation_3[0][0]']

 batch_normalization_4 (BatchNo  (None, 52, 52, 192)  576
['conv2d_4[0][0]']
 rmalization)

 activation_4 (Activation)      (None, 52, 52, 192)  0
['batch_normalization_4[0][0]']

 max_pooling2d_1 (MaxPooling2D)  (None, 25, 25, 192)  0
['activation_4[0][0]']

 conv2d_8 (Conv2D)              (None, 25, 25, 64)   12288
['max_pooling2d_1[0][0]']

 batch_normalization_8 (BatchNo  (None, 25, 25, 64)  192
['conv2d_8[0][0]']
 rmalization)

 activation_8 (Activation)      (None, 25, 25, 64)   0
['batch_normalization_8[0][0]']

 conv2d_6 (Conv2D)              (None, 25, 25, 48)   9216
```

```
['max_pooling2d_1[0][0]']

 conv2d_9 (Conv2D)              (None, 25, 25, 96)   55296
['activation_8[0][0]']

 batch_normalization_6 (BatchNo  (None, 25, 25, 48)  144
['conv2d_6[0][0]']
 rmalization)

 batch_normalization_9 (BatchNo  (None, 25, 25, 96)  288
['conv2d_9[0][0]']
 rmalization)

 activation_6 (Activation)      (None, 25, 25, 48)   0
['batch_normalization_6[0][0]']

 activation_9 (Activation)      (None, 25, 25, 96)   0
['batch_normalization_9[0][0]']

 average_pooling2d (AveragePool  (None, 25, 25, 192)  0
['max_pooling2d_1[0][0]']
 ing2D)

 conv2d_5 (Conv2D)              (None, 25, 25, 96)   18432
['max_pooling2d_1[0][0]']

 conv2d_7 (Conv2D)              (None, 25, 25, 64)   76800
['activation_6[0][0]']

 conv2d_10 (Conv2D)             (None, 25, 25, 96)   82944
['activation_9[0][0]']

 conv2d_11 (Conv2D)             (None, 25, 25, 64)   12288
['average_pooling2d[0][0]']

 batch_normalization_5 (BatchNo  (None, 25, 25, 96)  288
['conv2d_5[0][0]']
 rmalization)

 batch_normalization_7 (BatchNo  (None, 25, 25, 64)  192
['conv2d_7[0][0]']
 rmalization)

 batch_normalization_10 (BatchN  (None, 25, 25, 96)  288
['conv2d_10[0][0]']
 ormalization)

 batch_normalization_11 (BatchN  (None, 25, 25, 64)  192
```

```
['conv2d_11[0][0]']
 ormalization)

 activation_5 (Activation)      (None, 25, 25, 96)   0
['batch_normalization_5[0][0]']

 activation_7 (Activation)      (None, 25, 25, 64)   0
['batch_normalization_7[0][0]']

 activation_10 (Activation)     (None, 25, 25, 96)   0
['batch_normalization_10[0][0]']

 activation_11 (Activation)     (None, 25, 25, 64)   0
['batch_normalization_11[0][0]']

 mixed_5b (Concatenate)         (None, 25, 25, 320)  0
['activation_5[0][0]',
'activation_7[0][0]',
'activation_10[0][0]',
'activation_11[0][0]']

 conv2d_15 (Conv2D)             (None, 25, 25, 32)   10240
['mixed_5b[0][0]']

 batch_normalization_15 (BatchN  (None, 25, 25, 32)  96
['conv2d_15[0][0]']
 ormalization)

 activation_15 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_15[0][0]']

 conv2d_13 (Conv2D)             (None, 25, 25, 32)   10240
['mixed_5b[0][0]']

 conv2d_16 (Conv2D)             (None, 25, 25, 48)   13824
['activation_15[0][0]']

 batch_normalization_13 (BatchN  (None, 25, 25, 32)  96
['conv2d_13[0][0]']
 ormalization)

 batch_normalization_16 (BatchN  (None, 25, 25, 48)  144
['conv2d_16[0][0]']
 ormalization)

 activation_13 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_13[0][0]']
```

```
 activation_16 (Activation)     (None, 25, 25, 48)   0
['batch_normalization_16[0][0]']

 conv2d_12 (Conv2D)             (None, 25, 25, 32)   10240
['mixed_5b[0][0]']

 conv2d_14 (Conv2D)             (None, 25, 25, 32)   9216
['activation_13[0][0]']

 conv2d_17 (Conv2D)             (None, 25, 25, 64)   27648
['activation_16[0][0]']

 batch_normalization_12 (BatchN  (None, 25, 25, 32)  96
['conv2d_12[0][0]']
 ormalization)

 batch_normalization_14 (BatchN  (None, 25, 25, 32)  96
['conv2d_14[0][0]']
 ormalization)

 batch_normalization_17 (BatchN  (None, 25, 25, 64)  192
['conv2d_17[0][0]']
 ormalization)

 activation_12 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_12[0][0]']

 activation_14 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_14[0][0]']

 activation_17 (Activation)     (None, 25, 25, 64)   0
['batch_normalization_17[0][0]']

 block35_1_mixed (Concatenate)  (None, 25, 25, 128)  0
['activation_12[0][0]',
'activation_14[0][0]',
'activation_17[0][0]']

 block35_1_conv (Conv2D)        (None, 25, 25, 320)  41280
['block35_1_mixed[0][0]']

 block35_1 (Lambda)             (None, 25, 25, 320)  0
['mixed_5b[0][0]',
'block35_1_conv[0][0]']

 block35_1_ac (Activation)      (None, 25, 25, 320)  0
['block35_1[0][0]']
```

```
 conv2d_21 (Conv2D)             (None, 25, 25, 32)   10240
['block35_1_ac[0][0]']

 batch_normalization_21 (BatchN  (None, 25, 25, 32)  96
['conv2d_21[0][0]']
 ormalization)

 activation_21 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_21[0][0]']

 conv2d_19 (Conv2D)             (None, 25, 25, 32)   10240
['block35_1_ac[0][0]']

 conv2d_22 (Conv2D)             (None, 25, 25, 48)   13824
['activation_21[0][0]']

 batch_normalization_19 (BatchN  (None, 25, 25, 32)  96
['conv2d_19[0][0]']
 ormalization)

 batch_normalization_22 (BatchN  (None, 25, 25, 48)  144
['conv2d_22[0][0]']
 ormalization)

 activation_19 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_19[0][0]']

 activation_22 (Activation)     (None, 25, 25, 48)   0
['batch_normalization_22[0][0]']

 conv2d_18 (Conv2D)             (None, 25, 25, 32)   10240
['block35_1_ac[0][0]']

 conv2d_20 (Conv2D)             (None, 25, 25, 32)   9216
['activation_19[0][0]']

 conv2d_23 (Conv2D)             (None, 25, 25, 64)   27648
['activation_22[0][0]']

 batch_normalization_18 (BatchN  (None, 25, 25, 32)  96
['conv2d_18[0][0]']
 ormalization)

 batch_normalization_20 (BatchN  (None, 25, 25, 32)  96
['conv2d_20[0][0]']
 ormalization)

 batch_normalization_23 (BatchN  (None, 25, 25, 64)  192
```

```
['conv2d_23[0][0]']
 ormalization)

 activation_18 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_18[0][0]']

 activation_20 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_20[0][0]']

 activation_23 (Activation)     (None, 25, 25, 64)   0
['batch_normalization_23[0][0]']

 block35_2_mixed (Concatenate)  (None, 25, 25, 128)  0
['activation_18[0][0]',
'activation_20[0][0]',
'activation_23[0][0]']

 block35_2_conv (Conv2D)        (None, 25, 25, 320)  41280
['block35_2_mixed[0][0]']

 block35_2 (Lambda)             (None, 25, 25, 320)  0
['block35_1_ac[0][0]',
'block35_2_conv[0][0]']

 block35_2_ac (Activation)      (None, 25, 25, 320)  0
['block35_2[0][0]']

 conv2d_27 (Conv2D)             (None, 25, 25, 32)   10240
['block35_2_ac[0][0]']

 batch_normalization_27 (BatchN  (None, 25, 25, 32)  96
['conv2d_27[0][0]']
 ormalization)

 activation_27 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_27[0][0]']

 conv2d_25 (Conv2D)             (None, 25, 25, 32)   10240
['block35_2_ac[0][0]']

 conv2d_28 (Conv2D)             (None, 25, 25, 48)   13824
['activation_27[0][0]']

 batch_normalization_25 (BatchN  (None, 25, 25, 32)  96
['conv2d_25[0][0]']
 ormalization)

 batch_normalization_28 (BatchN  (None, 25, 25, 48)  144
```

```
['conv2d_28[0][0]']
 ormalization)

 activation_25 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_25[0][0]']

 activation_28 (Activation)     (None, 25, 25, 48)   0
['batch_normalization_28[0][0]']

 conv2d_24 (Conv2D)             (None, 25, 25, 32)   10240
['block35_2_ac[0][0]']

 conv2d_26 (Conv2D)             (None, 25, 25, 32)   9216
['activation_25[0][0]']

 conv2d_29 (Conv2D)             (None, 25, 25, 64)   27648
['activation_28[0][0]']

 batch_normalization_24 (BatchN  (None, 25, 25, 32)  96
['conv2d_24[0][0]']
 ormalization)

 batch_normalization_26 (BatchN  (None, 25, 25, 32)  96
['conv2d_26[0][0]']
 ormalization)

 batch_normalization_29 (BatchN  (None, 25, 25, 64)  192
['conv2d_29[0][0]']
 ormalization)

 activation_24 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_24[0][0]']

 activation_26 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_26[0][0]']

 activation_29 (Activation)     (None, 25, 25, 64)   0
['batch_normalization_29[0][0]']

 block35_3_mixed (Concatenate)  (None, 25, 25, 128)  0
['activation_24[0][0]',
'activation_26[0][0]',
'activation_29[0][0]']

 block35_3_conv (Conv2D)        (None, 25, 25, 320)  41280
['block35_3_mixed[0][0]']

 block35_3 (Lambda)             (None, 25, 25, 320)  0
```

```
['block35_2_ac[0][0]',
'block35_3_conv[0][0]']

 block35_3_ac (Activation)      (None, 25, 25, 320)  0
['block35_3[0][0]']

 conv2d_33 (Conv2D)             (None, 25, 25, 32)   10240
['block35_3_ac[0][0]']

 batch_normalization_33 (BatchN  (None, 25, 25, 32)  96
['conv2d_33[0][0]']
 ormalization)

 activation_33 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_33[0][0]']

 conv2d_31 (Conv2D)             (None, 25, 25, 32)   10240
['block35_3_ac[0][0]']

 conv2d_34 (Conv2D)             (None, 25, 25, 48)   13824
['activation_33[0][0]']

 batch_normalization_31 (BatchN  (None, 25, 25, 32)  96
['conv2d_31[0][0]']
 ormalization)

 batch_normalization_34 (BatchN  (None, 25, 25, 48)  144
['conv2d_34[0][0]']
 ormalization)

 activation_31 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_31[0][0]']

 activation_34 (Activation)     (None, 25, 25, 48)   0
['batch_normalization_34[0][0]']

 conv2d_30 (Conv2D)             (None, 25, 25, 32)   10240
['block35_3_ac[0][0]']

 conv2d_32 (Conv2D)             (None, 25, 25, 32)   9216
['activation_31[0][0]']

 conv2d_35 (Conv2D)             (None, 25, 25, 64)   27648
['activation_34[0][0]']

 batch_normalization_30 (BatchN  (None, 25, 25, 32)  96
['conv2d_30[0][0]']
 ormalization)
```

```
 batch_normalization_32 (BatchN  (None, 25, 25, 32)  96
['conv2d_32[0][0]']
 ormalization)

 batch_normalization_35 (BatchN  (None, 25, 25, 64)  192
['conv2d_35[0][0]']
 ormalization)

 activation_30 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_30[0][0]']

 activation_32 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_32[0][0]']

 activation_35 (Activation)     (None, 25, 25, 64)   0
['batch_normalization_35[0][0]']

 block35_4_mixed (Concatenate)  (None, 25, 25, 128)  0
['activation_30[0][0]',
'activation_32[0][0]',
'activation_35[0][0]']

 block35_4_conv (Conv2D)        (None, 25, 25, 320)  41280
['block35_4_mixed[0][0]']

 block35_4 (Lambda)             (None, 25, 25, 320)  0
['block35_3_ac[0][0]',
'block35_4_conv[0][0]']

 block35_4_ac (Activation)      (None, 25, 25, 320)  0
['block35_4[0][0]']

 conv2d_39 (Conv2D)             (None, 25, 25, 32)   10240
['block35_4_ac[0][0]']

 batch_normalization_39 (BatchN  (None, 25, 25, 32)  96
['conv2d_39[0][0]']
 ormalization)

 activation_39 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_39[0][0]']

 conv2d_37 (Conv2D)             (None, 25, 25, 32)   10240
['block35_4_ac[0][0]']

 conv2d_40 (Conv2D)             (None, 25, 25, 48)   13824
['activation_39[0][0]']
```

```
 batch_normalization_37 (BatchN  (None, 25, 25, 32)  96
['conv2d_37[0][0]']
 ormalization)

 batch_normalization_40 (BatchN  (None, 25, 25, 48)  144
['conv2d_40[0][0]']
 ormalization)

 activation_37 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_37[0][0]']

 activation_40 (Activation)     (None, 25, 25, 48)   0
['batch_normalization_40[0][0]']

 conv2d_36 (Conv2D)             (None, 25, 25, 32)   10240
['block35_4_ac[0][0]']

 conv2d_38 (Conv2D)             (None, 25, 25, 32)   9216
['activation_37[0][0]']

 conv2d_41 (Conv2D)             (None, 25, 25, 64)   27648
['activation_40[0][0]']

 batch_normalization_36 (BatchN  (None, 25, 25, 32)  96
['conv2d_36[0][0]']
 ormalization)

 batch_normalization_38 (BatchN  (None, 25, 25, 32)  96
['conv2d_38[0][0]']
 ormalization)

 batch_normalization_41 (BatchN  (None, 25, 25, 64)  192
['conv2d_41[0][0]']
 ormalization)

 activation_36 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_36[0][0]']

 activation_38 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_38[0][0]']

 activation_41 (Activation)     (None, 25, 25, 64)   0
['batch_normalization_41[0][0]']

 block35_5_mixed (Concatenate)  (None, 25, 25, 128)  0
['activation_36[0][0]',
'activation_38[0][0]',
```

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'activation_41[0][0]']

 block35_5_conv (Conv2D)        (None, 25, 25, 320)  41280
['block35_5_mixed[0][0]']

 block35_5 (Lambda)             (None, 25, 25, 320)  0
['block35_4_ac[0][0]',
'block35_5_conv[0][0]']

 block35_5_ac (Activation)      (None, 25, 25, 320)  0
['block35_5[0][0]']

 conv2d_45 (Conv2D)             (None, 25, 25, 32)   10240
['block35_5_ac[0][0]']

 batch_normalization_45 (BatchN  (None, 25, 25, 32)  96
['conv2d_45[0][0]']
 ormalization)

 activation_45 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_45[0][0]']

 conv2d_43 (Conv2D)             (None, 25, 25, 32)   10240
['block35_5_ac[0][0]']

 conv2d_46 (Conv2D)             (None, 25, 25, 48)   13824
['activation_45[0][0]']

 batch_normalization_43 (BatchN  (None, 25, 25, 32)  96
['conv2d_43[0][0]']
 ormalization)

 batch_normalization_46 (BatchN  (None, 25, 25, 48)  144
['conv2d_46[0][0]']
 ormalization)

 activation_43 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_43[0][0]']

 activation_46 (Activation)     (None, 25, 25, 48)   0
['batch_normalization_46[0][0]']

 conv2d_42 (Conv2D)             (None, 25, 25, 32)   10240
['block35_5_ac[0][0]']

 conv2d_44 (Conv2D)             (None, 25, 25, 32)   9216
['activation_43[0][0]']
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```
 conv2d_47 (Conv2D)             (None, 25, 25, 64)   27648
['activation_46[0][0]']

 batch_normalization_42 (BatchN  (None, 25, 25, 32)  96
['conv2d_42[0][0]']
 ormalization)

 batch_normalization_44 (BatchN  (None, 25, 25, 32)  96
['conv2d_44[0][0]']
 ormalization)

 batch_normalization_47 (BatchN  (None, 25, 25, 64)  192
['conv2d_47[0][0]']
 ormalization)

 activation_42 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_42[0][0]']

 activation_44 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_44[0][0]']

 activation_47 (Activation)     (None, 25, 25, 64)   0
['batch_normalization_47[0][0]']

 block35_6_mixed (Concatenate)  (None, 25, 25, 128)  0
['activation_42[0][0]',
'activation_44[0][0]',
'activation_47[0][0]']

 block35_6_conv (Conv2D)        (None, 25, 25, 320)  41280
['block35_6_mixed[0][0]']

 block35_6 (Lambda)             (None, 25, 25, 320)  0
['block35_5_ac[0][0]',
'block35_6_conv[0][0]']

 block35_6_ac (Activation)      (None, 25, 25, 320)  0
['block35_6[0][0]']

 conv2d_51 (Conv2D)             (None, 25, 25, 32)   10240
['block35_6_ac[0][0]']

 batch_normalization_51 (BatchN  (None, 25, 25, 32)  96
['conv2d_51[0][0]']
 ormalization)

 activation_51 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_51[0][0]']
```

```
 conv2d_49 (Conv2D)             (None, 25, 25, 32)   10240
['block35_6_ac[0][0]']

 conv2d_52 (Conv2D)             (None, 25, 25, 48)   13824
['activation_51[0][0]']

 batch_normalization_49 (BatchN  (None, 25, 25, 32)  96
['conv2d_49[0][0]']
 ormalization)

 batch_normalization_52 (BatchN  (None, 25, 25, 48)  144
['conv2d_52[0][0]']
 ormalization)

 activation_49 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_49[0][0]']

 activation_52 (Activation)     (None, 25, 25, 48)   0
['batch_normalization_52[0][0]']

 conv2d_48 (Conv2D)             (None, 25, 25, 32)   10240
['block35_6_ac[0][0]']

 conv2d_50 (Conv2D)             (None, 25, 25, 32)   9216
['activation_49[0][0]']

 conv2d_53 (Conv2D)             (None, 25, 25, 64)   27648
['activation_52[0][0]']

 batch_normalization_48 (BatchN  (None, 25, 25, 32)  96
['conv2d_48[0][0]']
 ormalization)

 batch_normalization_50 (BatchN  (None, 25, 25, 32)  96
['conv2d_50[0][0]']
 ormalization)

 batch_normalization_53 (BatchN  (None, 25, 25, 64)  192
['conv2d_53[0][0]']
 ormalization)

 activation_48 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_48[0][0]']

 activation_50 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_50[0][0]']
```

```
 activation_53 (Activation)     (None, 25, 25, 64)   0
['batch_normalization_53[0][0]']

 block35_7_mixed (Concatenate)  (None, 25, 25, 128)  0
['activation_48[0][0]',
'activation_50[0][0]',
'activation_53[0][0]']

 block35_7_conv (Conv2D)        (None, 25, 25, 320)  41280
['block35_7_mixed[0][0]']

 block35_7 (Lambda)             (None, 25, 25, 320)  0
['block35_6_ac[0][0]',
'block35_7_conv[0][0]']

 block35_7_ac (Activation)      (None, 25, 25, 320)  0
['block35_7[0][0]']

 conv2d_57 (Conv2D)             (None, 25, 25, 32)   10240
['block35_7_ac[0][0]']

 batch_normalization_57 (BatchN  (None, 25, 25, 32)  96
['conv2d_57[0][0]']
 ormalization)

 activation_57 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_57[0][0]']

 conv2d_55 (Conv2D)             (None, 25, 25, 32)   10240
['block35_7_ac[0][0]']

 conv2d_58 (Conv2D)             (None, 25, 25, 48)   13824
['activation_57[0][0]']

 batch_normalization_55 (BatchN  (None, 25, 25, 32)  96
['conv2d_55[0][0]']
 ormalization)

 batch_normalization_58 (BatchN  (None, 25, 25, 48)  144
['conv2d_58[0][0]']
 ormalization)

 activation_55 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_55[0][0]']

 activation_58 (Activation)     (None, 25, 25, 48)   0
['batch_normalization_58[0][0]']
```

```
 conv2d_54 (Conv2D)             (None, 25, 25, 32)   10240
['block35_7_ac[0][0]']

 conv2d_56 (Conv2D)             (None, 25, 25, 32)   9216
['activation_55[0][0]']

 conv2d_59 (Conv2D)             (None, 25, 25, 64)   27648
['activation_58[0][0]']

 batch_normalization_54 (BatchN  (None, 25, 25, 32)  96
['conv2d_54[0][0]']
 ormalization)

 batch_normalization_56 (BatchN  (None, 25, 25, 32)  96
['conv2d_56[0][0]']
 ormalization)

 batch_normalization_59 (BatchN  (None, 25, 25, 64)  192
['conv2d_59[0][0]']
 ormalization)

 activation_54 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_54[0][0]']

 activation_56 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_56[0][0]']

 activation_59 (Activation)     (None, 25, 25, 64)   0
['batch_normalization_59[0][0]']

 block35_8_mixed (Concatenate)  (None, 25, 25, 128)  0
['activation_54[0][0]',
'activation_56[0][0]',
'activation_59[0][0]']

 block35_8_conv (Conv2D)        (None, 25, 25, 320)  41280
['block35_8_mixed[0][0]']

 block35_8 (Lambda)             (None, 25, 25, 320)  0
['block35_7_ac[0][0]',
'block35_8_conv[0][0]']

 block35_8_ac (Activation)      (None, 25, 25, 320)  0
['block35_8[0][0]']

 conv2d_63 (Conv2D)             (None, 25, 25, 32)   10240
['block35_8_ac[0][0]']
```

```
 batch_normalization_63 (BatchN  (None, 25, 25, 32)  96
['conv2d_63[0][0]']
 ormalization)

 activation_63 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_63[0][0]']

 conv2d_61 (Conv2D)             (None, 25, 25, 32)   10240
['block35_8_ac[0][0]']

 conv2d_64 (Conv2D)             (None, 25, 25, 48)   13824
['activation_63[0][0]']

 batch_normalization_61 (BatchN  (None, 25, 25, 32)  96
['conv2d_61[0][0]']
 ormalization)

 batch_normalization_64 (BatchN  (None, 25, 25, 48)  144
['conv2d_64[0][0]']
 ormalization)

 activation_61 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_61[0][0]']

 activation_64 (Activation)     (None, 25, 25, 48)   0
['batch_normalization_64[0][0]']

 conv2d_60 (Conv2D)             (None, 25, 25, 32)   10240
['block35_8_ac[0][0]']

 conv2d_62 (Conv2D)             (None, 25, 25, 32)   9216
['activation_61[0][0]']

 conv2d_65 (Conv2D)             (None, 25, 25, 64)   27648
['activation_64[0][0]']

 batch_normalization_60 (BatchN  (None, 25, 25, 32)  96
['conv2d_60[0][0]']
 ormalization)

 batch_normalization_62 (BatchN  (None, 25, 25, 32)  96
['conv2d_62[0][0]']
 ormalization)

 batch_normalization_65 (BatchN  (None, 25, 25, 64)  192
['conv2d_65[0][0]']
 ormalization)
```

```
 activation_60 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_60[0][0]']

 activation_62 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_62[0][0]']

 activation_65 (Activation)     (None, 25, 25, 64)   0
['batch_normalization_65[0][0]']

 block35_9_mixed (Concatenate)  (None, 25, 25, 128)  0
['activation_60[0][0]',
'activation_62[0][0]',
'activation_65[0][0]']

 block35_9_conv (Conv2D)        (None, 25, 25, 320)  41280
['block35_9_mixed[0][0]']

 block35_9 (Lambda)             (None, 25, 25, 320)  0
['block35_8_ac[0][0]',
'block35_9_conv[0][0]']

 block35_9_ac (Activation)      (None, 25, 25, 320)  0
['block35_9[0][0]']

 conv2d_69 (Conv2D)             (None, 25, 25, 32)   10240
['block35_9_ac[0][0]']

 batch_normalization_69 (BatchN  (None, 25, 25, 32)  96
['conv2d_69[0][0]']
 ormalization)

 activation_69 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_69[0][0]']

 conv2d_67 (Conv2D)             (None, 25, 25, 32)   10240
['block35_9_ac[0][0]']

 conv2d_70 (Conv2D)             (None, 25, 25, 48)   13824
['activation_69[0][0]']

 batch_normalization_67 (BatchN  (None, 25, 25, 32)  96
['conv2d_67[0][0]']
 ormalization)

 batch_normalization_70 (BatchN  (None, 25, 25, 48)  144
['conv2d_70[0][0]']
 ormalization)
```

```
 activation_67 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_67[0][0]']

 activation_70 (Activation)     (None, 25, 25, 48)   0
['batch_normalization_70[0][0]']

 conv2d_66 (Conv2D)             (None, 25, 25, 32)   10240
['block35_9_ac[0][0]']

 conv2d_68 (Conv2D)             (None, 25, 25, 32)   9216
['activation_67[0][0]']

 conv2d_71 (Conv2D)             (None, 25, 25, 64)   27648
['activation_70[0][0]']

 batch_normalization_66 (BatchN  (None, 25, 25, 32)  96
['conv2d_66[0][0]']
 ormalization)

 batch_normalization_68 (BatchN  (None, 25, 25, 32)  96
['conv2d_68[0][0]']
 ormalization)

 batch_normalization_71 (BatchN  (None, 25, 25, 64)  192
['conv2d_71[0][0]']
 ormalization)

 activation_66 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_66[0][0]']

 activation_68 (Activation)     (None, 25, 25, 32)   0
['batch_normalization_68[0][0]']

 activation_71 (Activation)     (None, 25, 25, 64)   0
['batch_normalization_71[0][0]']

 block35_10_mixed (Concatenate)  (None, 25, 25, 128)  0
['activation_66[0][0]',
'activation_68[0][0]',
'activation_71[0][0]']

 block35_10_conv (Conv2D)       (None, 25, 25, 320)  41280
['block35_10_mixed[0][0]']

 block35_10 (Lambda)            (None, 25, 25, 320)  0
['block35_9_ac[0][0]',
'block35_10_conv[0][0]']
```

```
 block35_10_ac (Activation)     (None, 25, 25, 320)  0
['block35_10[0][0]']

 conv2d_73 (Conv2D)             (None, 25, 25, 256)  81920
['block35_10_ac[0][0]']

 batch_normalization_73 (BatchN  (None, 25, 25, 256)  768
['conv2d_73[0][0]']
 ormalization)

 activation_73 (Activation)     (None, 25, 25, 256)  0
['batch_normalization_73[0][0]']

 conv2d_74 (Conv2D)             (None, 25, 25, 256)  589824
['activation_73[0][0]']

 batch_normalization_74 (BatchN  (None, 25, 25, 256)  768
['conv2d_74[0][0]']
 ormalization)

 activation_74 (Activation)     (None, 25, 25, 256)  0
['batch_normalization_74[0][0]']

 conv2d_72 (Conv2D)             (None, 12, 12, 384)  1105920
['block35_10_ac[0][0]']

 conv2d_75 (Conv2D)             (None, 12, 12, 384)  884736
['activation_74[0][0]']

 batch_normalization_72 (BatchN  (None, 12, 12, 384)  1152
['conv2d_72[0][0]']
 ormalization)

 batch_normalization_75 (BatchN  (None, 12, 12, 384)  1152
['conv2d_75[0][0]']
 ormalization)

 activation_72 (Activation)     (None, 12, 12, 384)  0
['batch_normalization_72[0][0]']

 activation_75 (Activation)     (None, 12, 12, 384)  0
['batch_normalization_75[0][0]']

 max_pooling2d_2 (MaxPooling2D)  (None, 12, 12, 320)  0
['block35_10_ac[0][0]']

 mixed_6a (Concatenate)         (None, 12, 12, 1088  0
['activation_72[0][0]',
```

```
                                )
'activation_75[0][0]',
'max_pooling2d_2[0][0]']

 conv2d_77 (Conv2D)             (None, 12, 12, 128)  139264
['mixed_6a[0][0]']

 batch_normalization_77 (BatchN  (None, 12, 12, 128)  384
['conv2d_77[0][0]']
 ormalization)

 activation_77 (Activation)     (None, 12, 12, 128)  0
['batch_normalization_77[0][0]']

 conv2d_78 (Conv2D)             (None, 12, 12, 160)  143360
['activation_77[0][0]']

 batch_normalization_78 (BatchN  (None, 12, 12, 160)  480
['conv2d_78[0][0]']
 ormalization)

 activation_78 (Activation)     (None, 12, 12, 160)  0
['batch_normalization_78[0][0]']

 conv2d_76 (Conv2D)             (None, 12, 12, 192)  208896
['mixed_6a[0][0]']

 conv2d_79 (Conv2D)             (None, 12, 12, 192)  215040
['activation_78[0][0]']

 batch_normalization_76 (BatchN  (None, 12, 12, 192)  576
['conv2d_76[0][0]']
 ormalization)

 batch_normalization_79 (BatchN  (None, 12, 12, 192)  576
['conv2d_79[0][0]']
 ormalization)

 activation_76 (Activation)     (None, 12, 12, 192)  0
['batch_normalization_76[0][0]']

 activation_79 (Activation)     (None, 12, 12, 192)  0
['batch_normalization_79[0][0]']

 block17_1_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_76[0][0]',
'activation_79[0][0]']
```

```
 block17_1_conv (Conv2D)        (None, 12, 12, 1088  418880
['block17_1_mixed[0][0]']
                                )

 block17_1 (Lambda)             (None, 12, 12, 1088  0
['mixed_6a[0][0]',
                                )
'block17_1_conv[0][0]']

 block17_1_ac (Activation)      (None, 12, 12, 1088  0
['block17_1[0][0]']
                                )

 conv2d_81 (Conv2D)             (None, 12, 12, 128)  139264
['block17_1_ac[0][0]']

 batch_normalization_81 (BatchN  (None, 12, 12, 128)  384
['conv2d_81[0][0]']
 ormalization)

 activation_81 (Activation)     (None, 12, 12, 128)  0
['batch_normalization_81[0][0]']

 conv2d_82 (Conv2D)             (None, 12, 12, 160)  143360
['activation_81[0][0]']

 batch_normalization_82 (BatchN  (None, 12, 12, 160)  480
['conv2d_82[0][0]']
 ormalization)

 activation_82 (Activation)     (None, 12, 12, 160)  0
['batch_normalization_82[0][0]']

 conv2d_80 (Conv2D)             (None, 12, 12, 192)  208896
['block17_1_ac[0][0]']

 conv2d_83 (Conv2D)             (None, 12, 12, 192)  215040
['activation_82[0][0]']

 batch_normalization_80 (BatchN  (None, 12, 12, 192)  576
['conv2d_80[0][0]']
 ormalization)

 batch_normalization_83 (BatchN  (None, 12, 12, 192)  576
['conv2d_83[0][0]']
 ormalization)

 activation_80 (Activation)     (None, 12, 12, 192)  0
```

```
['batch_normalization_80[0][0]']

 activation_83 (Activation)     (None, 12, 12, 192)  0
['batch_normalization_83[0][0]']

 block17_2_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_80[0][0]',
'activation_83[0][0]']

 block17_2_conv (Conv2D)        (None, 12, 12, 1088  418880
['block17_2_mixed[0][0]']
                                )

 block17_2 (Lambda)             (None, 12, 12, 1088  0
['block17_1_ac[0][0]',
                                )
'block17_2_conv[0][0]']

 block17_2_ac (Activation)      (None, 12, 12, 1088  0
['block17_2[0][0]']
                                )

 conv2d_85 (Conv2D)             (None, 12, 12, 128)  139264
['block17_2_ac[0][0]']

 batch_normalization_85 (BatchN  (None, 12, 12, 128)  384
['conv2d_85[0][0]']
 ormalization)

 activation_85 (Activation)     (None, 12, 12, 128)  0
['batch_normalization_85[0][0]']

 conv2d_86 (Conv2D)             (None, 12, 12, 160)  143360
['activation_85[0][0]']

 batch_normalization_86 (BatchN  (None, 12, 12, 160)  480
['conv2d_86[0][0]']
 ormalization)

 activation_86 (Activation)     (None, 12, 12, 160)  0
['batch_normalization_86[0][0]']

 conv2d_84 (Conv2D)             (None, 12, 12, 192)  208896
['block17_2_ac[0][0]']

 conv2d_87 (Conv2D)             (None, 12, 12, 192)  215040
['activation_86[0][0]']
```

```
 batch_normalization_84 (BatchN  (None, 12, 12, 192)  576
['conv2d_84[0][0]']
 ormalization)

 batch_normalization_87 (BatchN  (None, 12, 12, 192)  576
['conv2d_87[0][0]']
 ormalization)

 activation_84 (Activation)     (None, 12, 12, 192)  0
['batch_normalization_84[0][0]']

 activation_87 (Activation)     (None, 12, 12, 192)  0
['batch_normalization_87[0][0]']

 block17_3_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_84[0][0]',
'activation_87[0][0]']

 block17_3_conv (Conv2D)        (None, 12, 12, 1088  418880
['block17_3_mixed[0][0]']
                                )

 block17_3 (Lambda)             (None, 12, 12, 1088  0
['block17_2_ac[0][0]',
                                )
'block17_3_conv[0][0]']

 block17_3_ac (Activation)      (None, 12, 12, 1088  0
['block17_3[0][0]']
                                )

 conv2d_89 (Conv2D)             (None, 12, 12, 128)  139264
['block17_3_ac[0][0]']

 batch_normalization_89 (BatchN  (None, 12, 12, 128)  384
['conv2d_89[0][0]']
 ormalization)

 activation_89 (Activation)     (None, 12, 12, 128)  0
['batch_normalization_89[0][0]']

 conv2d_90 (Conv2D)             (None, 12, 12, 160)  143360
['activation_89[0][0]']

 batch_normalization_90 (BatchN  (None, 12, 12, 160)  480
['conv2d_90[0][0]']
 ormalization)
```

```
 activation_90 (Activation)     (None, 12, 12, 160)  0
['batch_normalization_90[0][0]']

 conv2d_88 (Conv2D)             (None, 12, 12, 192)  208896
['block17_3_ac[0][0]']

 conv2d_91 (Conv2D)             (None, 12, 12, 192)  215040
['activation_90[0][0]']

 batch_normalization_88 (BatchN  (None, 12, 12, 192)  576
['conv2d_88[0][0]']
 ormalization)

 batch_normalization_91 (BatchN  (None, 12, 12, 192)  576
['conv2d_91[0][0]']
 ormalization)

 activation_88 (Activation)     (None, 12, 12, 192)  0
['batch_normalization_88[0][0]']

 activation_91 (Activation)     (None, 12, 12, 192)  0
['batch_normalization_91[0][0]']

 block17_4_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_88[0][0]',
'activation_91[0][0]']

 block17_4_conv (Conv2D)        (None, 12, 12, 1088  418880
['block17_4_mixed[0][0]']
                                )

 block17_4 (Lambda)             (None, 12, 12, 1088  0
['block17_3_ac[0][0]',
                                )
'block17_4_conv[0][0]']

 block17_4_ac (Activation)      (None, 12, 12, 1088  0
['block17_4[0][0]']
                                )

 conv2d_93 (Conv2D)             (None, 12, 12, 128)  139264
['block17_4_ac[0][0]']

 batch_normalization_93 (BatchN  (None, 12, 12, 128)  384
['conv2d_93[0][0]']
 ormalization)

 activation_93 (Activation)     (None, 12, 12, 128)  0
```

```
['batch_normalization_93[0][0]']

 conv2d_94 (Conv2D)             (None, 12, 12, 160)  143360
['activation_93[0][0]']

 batch_normalization_94 (BatchN  (None, 12, 12, 160)  480
['conv2d_94[0][0]']
 ormalization)

 activation_94 (Activation)     (None, 12, 12, 160)  0
['batch_normalization_94[0][0]']

 conv2d_92 (Conv2D)             (None, 12, 12, 192)  208896
['block17_4_ac[0][0]']

 conv2d_95 (Conv2D)             (None, 12, 12, 192)  215040
['activation_94[0][0]']

 batch_normalization_92 (BatchN  (None, 12, 12, 192)  576
['conv2d_92[0][0]']
 ormalization)

 batch_normalization_95 (BatchN  (None, 12, 12, 192)  576
['conv2d_95[0][0]']
 ormalization)

 activation_92 (Activation)     (None, 12, 12, 192)  0
['batch_normalization_92[0][0]']

 activation_95 (Activation)     (None, 12, 12, 192)  0
['batch_normalization_95[0][0]']

 block17_5_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_92[0][0]',
'activation_95[0][0]']

 block17_5_conv (Conv2D)        (None, 12, 12, 1088  418880
['block17_5_mixed[0][0]']
                                )

 block17_5 (Lambda)             (None, 12, 12, 1088  0
['block17_4_ac[0][0]',
                                )
'block17_5_conv[0][0]']

 block17_5_ac (Activation)      (None, 12, 12, 1088  0
['block17_5[0][0]']
                                )
```

```
 conv2d_97 (Conv2D)             (None, 12, 12, 128)  139264
['block17_5_ac[0][0]']

 batch_normalization_97 (BatchN  (None, 12, 12, 128)  384
['conv2d_97[0][0]']
 ormalization)

 activation_97 (Activation)     (None, 12, 12, 128)  0
['batch_normalization_97[0][0]']

 conv2d_98 (Conv2D)             (None, 12, 12, 160)  143360
['activation_97[0][0]']

 batch_normalization_98 (BatchN  (None, 12, 12, 160)  480
['conv2d_98[0][0]']
 ormalization)

 activation_98 (Activation)     (None, 12, 12, 160)  0
['batch_normalization_98[0][0]']

 conv2d_96 (Conv2D)             (None, 12, 12, 192)  208896
['block17_5_ac[0][0]']

 conv2d_99 (Conv2D)             (None, 12, 12, 192)  215040
['activation_98[0][0]']

 batch_normalization_96 (BatchN  (None, 12, 12, 192)  576
['conv2d_96[0][0]']
 ormalization)

 batch_normalization_99 (BatchN  (None, 12, 12, 192)  576
['conv2d_99[0][0]']
 ormalization)

 activation_96 (Activation)     (None, 12, 12, 192)  0
['batch_normalization_96[0][0]']

 activation_99 (Activation)     (None, 12, 12, 192)  0
['batch_normalization_99[0][0]']

 block17_6_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_96[0][0]',
'activation_99[0][0]']

 block17_6_conv (Conv2D)        (None, 12, 12, 1088  418880
['block17_6_mixed[0][0]']
                                )
```

```
 block17_6 (Lambda)             (None, 12, 12, 1088  0
['block17_5_ac[0][0]',
                                )
'block17_6_conv[0][0]']

 block17_6_ac (Activation)      (None, 12, 12, 1088  0
['block17_6[0][0]']
                                )

 conv2d_101 (Conv2D)            (None, 12, 12, 128)  139264
['block17_6_ac[0][0]']

 batch_normalization_101 (Batch  (None, 12, 12, 128)  384
['conv2d_101[0][0]']
 Normalization)

 activation_101 (Activation)    (None, 12, 12, 128)  0
['batch_normalization_101[0][0]']

 conv2d_102 (Conv2D)            (None, 12, 12, 160)  143360
['activation_101[0][0]']

 batch_normalization_102 (Batch  (None, 12, 12, 160)  480
['conv2d_102[0][0]']
 Normalization)

 activation_102 (Activation)    (None, 12, 12, 160)  0
['batch_normalization_102[0][0]']

 conv2d_100 (Conv2D)            (None, 12, 12, 192)  208896
['block17_6_ac[0][0]']

 conv2d_103 (Conv2D)            (None, 12, 12, 192)  215040
['activation_102[0][0]']

 batch_normalization_100 (Batch  (None, 12, 12, 192)  576
['conv2d_100[0][0]']
 Normalization)

 batch_normalization_103 (Batch  (None, 12, 12, 192)  576
['conv2d_103[0][0]']
 Normalization)

 activation_100 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_100[0][0]']

 activation_103 (Activation)    (None, 12, 12, 192)  0
```

```
['batch_normalization_103[0][0]']

 block17_7_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_100[0][0]',
'activation_103[0][0]']

 block17_7_conv (Conv2D)        (None, 12, 12, 1088  418880
['block17_7_mixed[0][0]']
                                )

 block17_7 (Lambda)             (None, 12, 12, 1088  0
['block17_6_ac[0][0]',
                                )
'block17_7_conv[0][0]']

 block17_7_ac (Activation)      (None, 12, 12, 1088  0
['block17_7[0][0]']
                                )

 conv2d_105 (Conv2D)            (None, 12, 12, 128)  139264
['block17_7_ac[0][0]']

 batch_normalization_105 (Batch  (None, 12, 12, 128)  384
['conv2d_105[0][0]']
 Normalization)

 activation_105 (Activation)    (None, 12, 12, 128)  0
['batch_normalization_105[0][0]']

 conv2d_106 (Conv2D)            (None, 12, 12, 160)  143360
['activation_105[0][0]']

 batch_normalization_106 (Batch  (None, 12, 12, 160)  480
['conv2d_106[0][0]']
 Normalization)

 activation_106 (Activation)    (None, 12, 12, 160)  0
['batch_normalization_106[0][0]']

 conv2d_104 (Conv2D)            (None, 12, 12, 192)  208896
['block17_7_ac[0][0]']

 conv2d_107 (Conv2D)            (None, 12, 12, 192)  215040
['activation_106[0][0]']

 batch_normalization_104 (Batch  (None, 12, 12, 192)  576
['conv2d_104[0][0]']
 Normalization)
```

```
 batch_normalization_107 (Batch  (None, 12, 12, 192)  576
['conv2d_107[0][0]']
 Normalization)

 activation_104 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_104[0][0]']

 activation_107 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_107[0][0]']

 block17_8_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_104[0][0]',
'activation_107[0][0]']

 block17_8_conv (Conv2D)        (None, 12, 12, 1088  418880
['block17_8_mixed[0][0]']
                                )

 block17_8 (Lambda)             (None, 12, 12, 1088  0
['block17_7_ac[0][0]',
                                )
'block17_8_conv[0][0]']

 block17_8_ac (Activation)      (None, 12, 12, 1088  0
['block17_8[0][0]']
                                )

 conv2d_109 (Conv2D)            (None, 12, 12, 128)  139264
['block17_8_ac[0][0]']

 batch_normalization_109 (Batch  (None, 12, 12, 128)  384
['conv2d_109[0][0]']
 Normalization)

 activation_109 (Activation)    (None, 12, 12, 128)  0
['batch_normalization_109[0][0]']

 conv2d_110 (Conv2D)            (None, 12, 12, 160)  143360
['activation_109[0][0]']

 batch_normalization_110 (Batch  (None, 12, 12, 160)  480
['conv2d_110[0][0]']
 Normalization)

 activation_110 (Activation)    (None, 12, 12, 160)  0
['batch_normalization_110[0][0]']
```

```
 conv2d_108 (Conv2D)            (None, 12, 12, 192)  208896
['block17_8_ac[0][0]']

 conv2d_111 (Conv2D)            (None, 12, 12, 192)  215040
['activation_110[0][0]']

 batch_normalization_108 (Batch  (None, 12, 12, 192)  576
['conv2d_108[0][0]']
 Normalization)

 batch_normalization_111 (Batch  (None, 12, 12, 192)  576
['conv2d_111[0][0]']
 Normalization)

 activation_108 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_108[0][0]']

 activation_111 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_111[0][0]']

 block17_9_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_108[0][0]',
'activation_111[0][0]']

 block17_9_conv (Conv2D)        (None, 12, 12, 1088  418880
['block17_9_mixed[0][0]']
                                )

 block17_9 (Lambda)             (None, 12, 12, 1088  0
['block17_8_ac[0][0]',
                                )
'block17_9_conv[0][0]']

 block17_9_ac (Activation)      (None, 12, 12, 1088  0
['block17_9[0][0]']
                                )

 conv2d_113 (Conv2D)            (None, 12, 12, 128)  139264
['block17_9_ac[0][0]']

 batch_normalization_113 (Batch  (None, 12, 12, 128)  384
['conv2d_113[0][0]']
 Normalization)

 activation_113 (Activation)    (None, 12, 12, 128)  0
['batch_normalization_113[0][0]']

 conv2d_114 (Conv2D)            (None, 12, 12, 160)  143360
```

```
['activation_113[0][0]']

 batch_normalization_114 (Batch  (None, 12, 12, 160)  480
['conv2d_114[0][0]']
 Normalization)

 activation_114 (Activation)    (None, 12, 12, 160)  0
['batch_normalization_114[0][0]']

 conv2d_112 (Conv2D)            (None, 12, 12, 192)  208896
['block17_9_ac[0][0]']

 conv2d_115 (Conv2D)            (None, 12, 12, 192)  215040
['activation_114[0][0]']

 batch_normalization_112 (Batch  (None, 12, 12, 192)  576
['conv2d_112[0][0]']
 Normalization)

 batch_normalization_115 (Batch  (None, 12, 12, 192)  576
['conv2d_115[0][0]']
 Normalization)

 activation_112 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_112[0][0]']

 activation_115 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_115[0][0]']

 block17_10_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_112[0][0]',
'activation_115[0][0]']

 block17_10_conv (Conv2D)       (None, 12, 12, 1088  418880
['block17_10_mixed[0][0]']
                                )

 block17_10 (Lambda)            (None, 12, 12, 1088  0
['block17_9_ac[0][0]',
                                )
'block17_10_conv[0][0]']

 block17_10_ac (Activation)     (None, 12, 12, 1088  0
['block17_10[0][0]']
                                )

 conv2d_117 (Conv2D)            (None, 12, 12, 128)  139264
['block17_10_ac[0][0]']
```

```
 batch_normalization_117 (Batch  (None, 12, 12, 128)  384
['conv2d_117[0][0]']
 Normalization)

 activation_117 (Activation)    (None, 12, 12, 128)  0
['batch_normalization_117[0][0]']

 conv2d_118 (Conv2D)            (None, 12, 12, 160)  143360
['activation_117[0][0]']

 batch_normalization_118 (Batch  (None, 12, 12, 160)  480
['conv2d_118[0][0]']
 Normalization)

 activation_118 (Activation)    (None, 12, 12, 160)  0
['batch_normalization_118[0][0]']

 conv2d_116 (Conv2D)            (None, 12, 12, 192)  208896
['block17_10_ac[0][0]']

 conv2d_119 (Conv2D)            (None, 12, 12, 192)  215040
['activation_118[0][0]']

 batch_normalization_116 (Batch  (None, 12, 12, 192)  576
['conv2d_116[0][0]']
 Normalization)

 batch_normalization_119 (Batch  (None, 12, 12, 192)  576
['conv2d_119[0][0]']
 Normalization)

 activation_116 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_116[0][0]']

 activation_119 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_119[0][0]']

 block17_11_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_116[0][0]',
'activation_119[0][0]']

 block17_11_conv (Conv2D)       (None, 12, 12, 1088  418880
['block17_11_mixed[0][0]']
                                )

 block17_11 (Lambda)            (None, 12, 12, 1088  0
['block17_10_ac[0][0]',
```

```
                                )
'block17_11_conv[0][0]']

 block17_11_ac (Activation)     (None, 12, 12, 1088  0
['block17_11[0][0]']
                                )

 conv2d_121 (Conv2D)            (None, 12, 12, 128)  139264
['block17_11_ac[0][0]']

 batch_normalization_121 (Batch  (None, 12, 12, 128)  384
['conv2d_121[0][0]']
 Normalization)

 activation_121 (Activation)    (None, 12, 12, 128)  0
['batch_normalization_121[0][0]']

 conv2d_122 (Conv2D)            (None, 12, 12, 160)  143360
['activation_121[0][0]']

 batch_normalization_122 (Batch  (None, 12, 12, 160)  480
['conv2d_122[0][0]']
 Normalization)

 activation_122 (Activation)    (None, 12, 12, 160)  0
['batch_normalization_122[0][0]']

 conv2d_120 (Conv2D)            (None, 12, 12, 192)  208896
['block17_11_ac[0][0]']

 conv2d_123 (Conv2D)            (None, 12, 12, 192)  215040
['activation_122[0][0]']

 batch_normalization_120 (Batch  (None, 12, 12, 192)  576
['conv2d_120[0][0]']
 Normalization)

 batch_normalization_123 (Batch  (None, 12, 12, 192)  576
['conv2d_123[0][0]']
 Normalization)

 activation_120 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_120[0][0]']

 activation_123 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_123[0][0]']

 block17_12_mixed (Concatenate)  (None, 12, 12, 384)  0
```

```
['activation_120[0][0]',
'activation_123[0][0]']

 block17_12_conv (Conv2D)       (None, 12, 12, 1088  418880
['block17_12_mixed[0][0]']
                                )

 block17_12 (Lambda)            (None, 12, 12, 1088  0
['block17_11_ac[0][0]',
                                )
'block17_12_conv[0][0]']

 block17_12_ac (Activation)     (None, 12, 12, 1088  0
['block17_12[0][0]']
                                )

 conv2d_125 (Conv2D)            (None, 12, 12, 128)  139264
['block17_12_ac[0][0]']

 batch_normalization_125 (Batch  (None, 12, 12, 128)  384
['conv2d_125[0][0]']
 Normalization)

 activation_125 (Activation)    (None, 12, 12, 128)  0
['batch_normalization_125[0][0]']

 conv2d_126 (Conv2D)            (None, 12, 12, 160)  143360
['activation_125[0][0]']

 batch_normalization_126 (Batch  (None, 12, 12, 160)  480
['conv2d_126[0][0]']
 Normalization)

 activation_126 (Activation)    (None, 12, 12, 160)  0
['batch_normalization_126[0][0]']

 conv2d_124 (Conv2D)            (None, 12, 12, 192)  208896
['block17_12_ac[0][0]']

 conv2d_127 (Conv2D)            (None, 12, 12, 192)  215040
['activation_126[0][0]']

 batch_normalization_124 (Batch  (None, 12, 12, 192)  576
['conv2d_124[0][0]']
 Normalization)

 batch_normalization_127 (Batch  (None, 12, 12, 192)  576
['conv2d_127[0][0]']
```

```
 Normalization)

 activation_124 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_124[0][0]']

 activation_127 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_127[0][0]']

 block17_13_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_124[0][0]',
'activation_127[0][0]']

 block17_13_conv (Conv2D)       (None, 12, 12, 1088  418880
['block17_13_mixed[0][0]']
                                )

 block17_13 (Lambda)            (None, 12, 12, 1088  0
['block17_12_ac[0][0]',
                                )
'block17_13_conv[0][0]']

 block17_13_ac (Activation)     (None, 12, 12, 1088  0
['block17_13[0][0]']
                                )

 conv2d_129 (Conv2D)            (None, 12, 12, 128)  139264
['block17_13_ac[0][0]']

 batch_normalization_129 (Batch  (None, 12, 12, 128)  384
['conv2d_129[0][0]']
 Normalization)

 activation_129 (Activation)    (None, 12, 12, 128)  0
['batch_normalization_129[0][0]']

 conv2d_130 (Conv2D)            (None, 12, 12, 160)  143360
['activation_129[0][0]']

 batch_normalization_130 (Batch  (None, 12, 12, 160)  480
['conv2d_130[0][0]']
 Normalization)

 activation_130 (Activation)    (None, 12, 12, 160)  0
['batch_normalization_130[0][0]']

 conv2d_128 (Conv2D)            (None, 12, 12, 192)  208896
['block17_13_ac[0][0]']
```

```
 conv2d_131 (Conv2D)            (None, 12, 12, 192)  215040
['activation_130[0][0]']

 batch_normalization_128 (Batch  (None, 12, 12, 192)  576
['conv2d_128[0][0]']
 Normalization)

 batch_normalization_131 (Batch  (None, 12, 12, 192)  576
['conv2d_131[0][0]']
 Normalization)

 activation_128 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_128[0][0]']

 activation_131 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_131[0][0]']

 block17_14_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_128[0][0]',
'activation_131[0][0]']

 block17_14_conv (Conv2D)       (None, 12, 12, 1088  418880
['block17_14_mixed[0][0]']
                                )

 block17_14 (Lambda)            (None, 12, 12, 1088  0
['block17_13_ac[0][0]',
                                )
'block17_14_conv[0][0]']

 block17_14_ac (Activation)     (None, 12, 12, 1088  0
['block17_14[0][0]']
                                )

 conv2d_133 (Conv2D)            (None, 12, 12, 128)  139264
['block17_14_ac[0][0]']

 batch_normalization_133 (Batch  (None, 12, 12, 128)  384
['conv2d_133[0][0]']
 Normalization)

 activation_133 (Activation)    (None, 12, 12, 128)  0
['batch_normalization_133[0][0]']

 conv2d_134 (Conv2D)            (None, 12, 12, 160)  143360
['activation_133[0][0]']

 batch_normalization_134 (Batch  (None, 12, 12, 160)  480
```

```
['conv2d_134[0][0]']
 Normalization)

 activation_134 (Activation)    (None, 12, 12, 160)  0
['batch_normalization_134[0][0]']

 conv2d_132 (Conv2D)            (None, 12, 12, 192)  208896
['block17_14_ac[0][0]']

 conv2d_135 (Conv2D)            (None, 12, 12, 192)  215040
['activation_134[0][0]']

 batch_normalization_132 (Batch  (None, 12, 12, 192)  576
['conv2d_132[0][0]']
 Normalization)

 batch_normalization_135 (Batch  (None, 12, 12, 192)  576
['conv2d_135[0][0]']
 Normalization)

 activation_132 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_132[0][0]']

 activation_135 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_135[0][0]']

 block17_15_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_132[0][0]',
'activation_135[0][0]']

 block17_15_conv (Conv2D)       (None, 12, 12, 1088  418880
['block17_15_mixed[0][0]']
                                )

 block17_15 (Lambda)            (None, 12, 12, 1088  0
['block17_14_ac[0][0]',
                                )
'block17_15_conv[0][0]']

 block17_15_ac (Activation)     (None, 12, 12, 1088  0
['block17_15[0][0]']
                                )

 conv2d_137 (Conv2D)            (None, 12, 12, 128)  139264
['block17_15_ac[0][0]']

 batch_normalization_137 (Batch  (None, 12, 12, 128)  384
['conv2d_137[0][0]']
```

```
 Normalization)

 activation_137 (Activation)    (None, 12, 12, 128)  0
['batch_normalization_137[0][0]']

 conv2d_138 (Conv2D)            (None, 12, 12, 160)  143360
['activation_137[0][0]']

 batch_normalization_138 (Batch  (None, 12, 12, 160)  480
['conv2d_138[0][0]']
 Normalization)

 activation_138 (Activation)    (None, 12, 12, 160)  0
['batch_normalization_138[0][0]']

 conv2d_136 (Conv2D)            (None, 12, 12, 192)  208896
['block17_15_ac[0][0]']

 conv2d_139 (Conv2D)            (None, 12, 12, 192)  215040
['activation_138[0][0]']

 batch_normalization_136 (Batch  (None, 12, 12, 192)  576
['conv2d_136[0][0]']
 Normalization)

 batch_normalization_139 (Batch  (None, 12, 12, 192)  576
['conv2d_139[0][0]']
 Normalization)

 activation_136 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_136[0][0]']

 activation_139 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_139[0][0]']

 block17_16_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_136[0][0]',
'activation_139[0][0]']

 block17_16_conv (Conv2D)       (None, 12, 12, 1088  418880
['block17_16_mixed[0][0]']
                                )

 block17_16 (Lambda)            (None, 12, 12, 1088  0
['block17_15_ac[0][0]',
                                )
'block17_16_conv[0][0]']
```

```
 block17_16_ac (Activation)     (None, 12, 12, 1088  0
['block17_16[0][0]']
                                )

 conv2d_141 (Conv2D)            (None, 12, 12, 128)  139264
['block17_16_ac[0][0]']

 batch_normalization_141 (Batch  (None, 12, 12, 128)  384
['conv2d_141[0][0]']
 Normalization)

 activation_141 (Activation)    (None, 12, 12, 128)  0
['batch_normalization_141[0][0]']

 conv2d_142 (Conv2D)            (None, 12, 12, 160)  143360
['activation_141[0][0]']

 batch_normalization_142 (Batch  (None, 12, 12, 160)  480
['conv2d_142[0][0]']
 Normalization)

 activation_142 (Activation)    (None, 12, 12, 160)  0
['batch_normalization_142[0][0]']

 conv2d_140 (Conv2D)            (None, 12, 12, 192)  208896
['block17_16_ac[0][0]']

 conv2d_143 (Conv2D)            (None, 12, 12, 192)  215040
['activation_142[0][0]']

 batch_normalization_140 (Batch  (None, 12, 12, 192)  576
['conv2d_140[0][0]']
 Normalization)

 batch_normalization_143 (Batch  (None, 12, 12, 192)  576
['conv2d_143[0][0]']
 Normalization)

 activation_140 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_140[0][0]']

 activation_143 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_143[0][0]']

 block17_17_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_140[0][0]',
'activation_143[0][0]']
```

```
 block17_17_conv (Conv2D)       (None, 12, 12, 1088  418880
['block17_17_mixed[0][0]']
                                )

 block17_17 (Lambda)            (None, 12, 12, 1088  0
['block17_16_ac[0][0]',
                                )
'block17_17_conv[0][0]']

 block17_17_ac (Activation)     (None, 12, 12, 1088  0
['block17_17[0][0]']
                                )

 conv2d_145 (Conv2D)            (None, 12, 12, 128)  139264
['block17_17_ac[0][0]']

 batch_normalization_145 (Batch  (None, 12, 12, 128)  384
['conv2d_145[0][0]']
 Normalization)

 activation_145 (Activation)    (None, 12, 12, 128)  0
['batch_normalization_145[0][0]']

 conv2d_146 (Conv2D)            (None, 12, 12, 160)  143360
['activation_145[0][0]']

 batch_normalization_146 (Batch  (None, 12, 12, 160)  480
['conv2d_146[0][0]']
 Normalization)

 activation_146 (Activation)    (None, 12, 12, 160)  0
['batch_normalization_146[0][0]']

 conv2d_144 (Conv2D)            (None, 12, 12, 192)  208896
['block17_17_ac[0][0]']

 conv2d_147 (Conv2D)            (None, 12, 12, 192)  215040
['activation_146[0][0]']

 batch_normalization_144 (Batch  (None, 12, 12, 192)  576
['conv2d_144[0][0]']
 Normalization)

 batch_normalization_147 (Batch  (None, 12, 12, 192)  576
['conv2d_147[0][0]']
 Normalization)

 activation_144 (Activation)    (None, 12, 12, 192)  0
```

```
['batch_normalization_144[0][0]']

 activation_147 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_147[0][0]']

 block17_18_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_144[0][0]',
'activation_147[0][0]']

 block17_18_conv (Conv2D)       (None, 12, 12, 1088  418880
['block17_18_mixed[0][0]']
                                )

 block17_18 (Lambda)            (None, 12, 12, 1088  0
['block17_17_ac[0][0]',
                                )
'block17_18_conv[0][0]']

 block17_18_ac (Activation)     (None, 12, 12, 1088  0
['block17_18[0][0]']
                                )

 conv2d_149 (Conv2D)            (None, 12, 12, 128)  139264
['block17_18_ac[0][0]']

 batch_normalization_149 (Batch  (None, 12, 12, 128)  384
['conv2d_149[0][0]']
 Normalization)

 activation_149 (Activation)    (None, 12, 12, 128)  0
['batch_normalization_149[0][0]']

 conv2d_150 (Conv2D)            (None, 12, 12, 160)  143360
['activation_149[0][0]']

 batch_normalization_150 (Batch  (None, 12, 12, 160)  480
['conv2d_150[0][0]']
 Normalization)

 activation_150 (Activation)    (None, 12, 12, 160)  0
['batch_normalization_150[0][0]']

 conv2d_148 (Conv2D)            (None, 12, 12, 192)  208896
['block17_18_ac[0][0]']

 conv2d_151 (Conv2D)            (None, 12, 12, 192)  215040
['activation_150[0][0]']
```

```
 batch_normalization_148 (Batch  (None, 12, 12, 192)  576
['conv2d_148[0][0]']
 Normalization)

 batch_normalization_151 (Batch  (None, 12, 12, 192)  576
['conv2d_151[0][0]']
 Normalization)

 activation_148 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_148[0][0]']

 activation_151 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_151[0][0]']

 block17_19_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_148[0][0]',
'activation_151[0][0]']

 block17_19_conv (Conv2D)       (None, 12, 12, 1088  418880
['block17_19_mixed[0][0]']
                                )

 block17_19 (Lambda)            (None, 12, 12, 1088  0
['block17_18_ac[0][0]',
                                )
'block17_19_conv[0][0]']

 block17_19_ac (Activation)     (None, 12, 12, 1088  0
['block17_19[0][0]']
                                )

 conv2d_153 (Conv2D)            (None, 12, 12, 128)  139264
['block17_19_ac[0][0]']

 batch_normalization_153 (Batch  (None, 12, 12, 128)  384
['conv2d_153[0][0]']
 Normalization)

 activation_153 (Activation)    (None, 12, 12, 128)  0
['batch_normalization_153[0][0]']

 conv2d_154 (Conv2D)            (None, 12, 12, 160)  143360
['activation_153[0][0]']

 batch_normalization_154 (Batch  (None, 12, 12, 160)  480
['conv2d_154[0][0]']
 Normalization)
```

```
 activation_154 (Activation)    (None, 12, 12, 160)  0
['batch_normalization_154[0][0]']

 conv2d_152 (Conv2D)            (None, 12, 12, 192)  208896
['block17_19_ac[0][0]']

 conv2d_155 (Conv2D)            (None, 12, 12, 192)  215040
['activation_154[0][0]']

 batch_normalization_152 (Batch  (None, 12, 12, 192)  576
['conv2d_152[0][0]']
 Normalization)

 batch_normalization_155 (Batch  (None, 12, 12, 192)  576
['conv2d_155[0][0]']
 Normalization)

 activation_152 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_152[0][0]']

 activation_155 (Activation)    (None, 12, 12, 192)  0
['batch_normalization_155[0][0]']

 block17_20_mixed (Concatenate)  (None, 12, 12, 384)  0
['activation_152[0][0]',
'activation_155[0][0]']

 block17_20_conv (Conv2D)       (None, 12, 12, 1088  418880
['block17_20_mixed[0][0]']
                                )

 block17_20 (Lambda)            (None, 12, 12, 1088  0
['block17_19_ac[0][0]',
                                )
'block17_20_conv[0][0]']

 block17_20_ac (Activation)     (None, 12, 12, 1088  0
['block17_20[0][0]']
                                )

 conv2d_160 (Conv2D)            (None, 12, 12, 256)  278528
['block17_20_ac[0][0]']

 batch_normalization_160 (Batch  (None, 12, 12, 256)  768
['conv2d_160[0][0]']
 Normalization)

 activation_160 (Activation)    (None, 12, 12, 256)  0
```

```
['batch_normalization_160[0][0]']

 conv2d_156 (Conv2D)            (None, 12, 12, 256)  278528
['block17_20_ac[0][0]']

 conv2d_158 (Conv2D)            (None, 12, 12, 256)  278528
['block17_20_ac[0][0]']

 conv2d_161 (Conv2D)            (None, 12, 12, 288)  663552
['activation_160[0][0]']

 batch_normalization_156 (Batch  (None, 12, 12, 256)  768
['conv2d_156[0][0]']
 Normalization)

 batch_normalization_158 (Batch  (None, 12, 12, 256)  768
['conv2d_158[0][0]']
 Normalization)

 batch_normalization_161 (Batch  (None, 12, 12, 288)  864
['conv2d_161[0][0]']
 Normalization)

 activation_156 (Activation)    (None, 12, 12, 256)  0
['batch_normalization_156[0][0]']

 activation_158 (Activation)    (None, 12, 12, 256)  0
['batch_normalization_158[0][0]']

 activation_161 (Activation)    (None, 12, 12, 288)  0
['batch_normalization_161[0][0]']

 conv2d_157 (Conv2D)            (None, 5, 5, 384)    884736
['activation_156[0][0]']

 conv2d_159 (Conv2D)            (None, 5, 5, 288)    663552
['activation_158[0][0]']

 conv2d_162 (Conv2D)            (None, 5, 5, 320)    829440
['activation_161[0][0]']

 batch_normalization_157 (Batch  (None, 5, 5, 384)   1152
['conv2d_157[0][0]']
 Normalization)

 batch_normalization_159 (Batch  (None, 5, 5, 288)   864
['conv2d_159[0][0]']
 Normalization)
```

```
 batch_normalization_162 (Batch  (None, 5, 5, 320)   960
['conv2d_162[0][0]']
 Normalization)

 activation_157 (Activation)    (None, 5, 5, 384)    0
['batch_normalization_157[0][0]']

 activation_159 (Activation)    (None, 5, 5, 288)    0
['batch_normalization_159[0][0]']

 activation_162 (Activation)    (None, 5, 5, 320)    0
['batch_normalization_162[0][0]']

 max_pooling2d_3 (MaxPooling2D)  (None, 5, 5, 1088)  0
['block17_20_ac[0][0]']

 mixed_7a (Concatenate)         (None, 5, 5, 2080)   0
['activation_157[0][0]',
'activation_159[0][0]',
'activation_162[0][0]',
'max_pooling2d_3[0][0]']

 conv2d_164 (Conv2D)            (None, 5, 5, 192)    399360
['mixed_7a[0][0]']

 batch_normalization_164 (Batch  (None, 5, 5, 192)   576
['conv2d_164[0][0]']
 Normalization)

 activation_164 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_164[0][0]']

 conv2d_165 (Conv2D)            (None, 5, 5, 224)    129024
['activation_164[0][0]']

 batch_normalization_165 (Batch  (None, 5, 5, 224)   672
['conv2d_165[0][0]']
 Normalization)

 activation_165 (Activation)    (None, 5, 5, 224)    0
['batch_normalization_165[0][0]']

 conv2d_163 (Conv2D)            (None, 5, 5, 192)    399360
['mixed_7a[0][0]']

 conv2d_166 (Conv2D)            (None, 5, 5, 256)    172032
['activation_165[0][0]']
```

```
 batch_normalization_163 (Batch  (None, 5, 5, 192)   576
['conv2d_163[0][0]']
 Normalization)

 batch_normalization_166 (Batch  (None, 5, 5, 256)   768
['conv2d_166[0][0]']
 Normalization)

 activation_163 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_163[0][0]']

 activation_166 (Activation)    (None, 5, 5, 256)    0
['batch_normalization_166[0][0]']

 block8_1_mixed (Concatenate)   (None, 5, 5, 448)    0
['activation_163[0][0]',
'activation_166[0][0]']

 block8_1_conv (Conv2D)         (None, 5, 5, 2080)   933920
['block8_1_mixed[0][0]']

 block8_1 (Lambda)              (None, 5, 5, 2080)   0
['mixed_7a[0][0]',
'block8_1_conv[0][0]']

 block8_1_ac (Activation)       (None, 5, 5, 2080)   0
['block8_1[0][0]']

 conv2d_168 (Conv2D)            (None, 5, 5, 192)    399360
['block8_1_ac[0][0]']

 batch_normalization_168 (Batch  (None, 5, 5, 192)   576
['conv2d_168[0][0]']
 Normalization)

 activation_168 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_168[0][0]']

 conv2d_169 (Conv2D)            (None, 5, 5, 224)    129024
['activation_168[0][0]']

 batch_normalization_169 (Batch  (None, 5, 5, 224)   672
['conv2d_169[0][0]']
 Normalization)

 activation_169 (Activation)    (None, 5, 5, 224)    0
['batch_normalization_169[0][0]']
```

```
 conv2d_167 (Conv2D)            (None, 5, 5, 192)    399360
['block8_1_ac[0][0]']

 conv2d_170 (Conv2D)            (None, 5, 5, 256)    172032
['activation_169[0][0]']

 batch_normalization_167 (Batch  (None, 5, 5, 192)   576
['conv2d_167[0][0]']
 Normalization)

 batch_normalization_170 (Batch  (None, 5, 5, 256)   768
['conv2d_170[0][0]']
 Normalization)

 activation_167 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_167[0][0]']

 activation_170 (Activation)    (None, 5, 5, 256)    0
['batch_normalization_170[0][0]']

 block8_2_mixed (Concatenate)   (None, 5, 5, 448)    0
['activation_167[0][0]',
'activation_170[0][0]']

 block8_2_conv (Conv2D)         (None, 5, 5, 2080)   933920
['block8_2_mixed[0][0]']

 block8_2 (Lambda)              (None, 5, 5, 2080)   0
['block8_1_ac[0][0]',
'block8_2_conv[0][0]']

 block8_2_ac (Activation)       (None, 5, 5, 2080)   0
['block8_2[0][0]']

 conv2d_172 (Conv2D)            (None, 5, 5, 192)    399360
['block8_2_ac[0][0]']

 batch_normalization_172 (Batch  (None, 5, 5, 192)   576
['conv2d_172[0][0]']
 Normalization)

 activation_172 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_172[0][0]']

 conv2d_173 (Conv2D)            (None, 5, 5, 224)    129024
['activation_172[0][0]']
```

```
 batch_normalization_173 (Batch  (None, 5, 5, 224)   672
['conv2d_173[0][0]']
 Normalization)

 activation_173 (Activation)    (None, 5, 5, 224)    0
['batch_normalization_173[0][0]']

 conv2d_171 (Conv2D)            (None, 5, 5, 192)    399360
['block8_2_ac[0][0]']

 conv2d_174 (Conv2D)            (None, 5, 5, 256)    172032
['activation_173[0][0]']

 batch_normalization_171 (Batch  (None, 5, 5, 192)   576
['conv2d_171[0][0]']
 Normalization)

 batch_normalization_174 (Batch  (None, 5, 5, 256)   768
['conv2d_174[0][0]']
 Normalization)

 activation_171 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_171[0][0]']

 activation_174 (Activation)    (None, 5, 5, 256)    0
['batch_normalization_174[0][0]']

 block8_3_mixed (Concatenate)   (None, 5, 5, 448)    0
['activation_171[0][0]',
'activation_174[0][0]']

 block8_3_conv (Conv2D)         (None, 5, 5, 2080)   933920
['block8_3_mixed[0][0]']

 block8_3 (Lambda)              (None, 5, 5, 2080)   0
['block8_2_ac[0][0]',
'block8_3_conv[0][0]']

 block8_3_ac (Activation)       (None, 5, 5, 2080)   0
['block8_3[0][0]']

 conv2d_176 (Conv2D)            (None, 5, 5, 192)    399360
['block8_3_ac[0][0]']

 batch_normalization_176 (Batch  (None, 5, 5, 192)   576
['conv2d_176[0][0]']
 Normalization)
```

```
 activation_176 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_176[0][0]']

 conv2d_177 (Conv2D)            (None, 5, 5, 224)    129024
['activation_176[0][0]']

 batch_normalization_177 (Batch  (None, 5, 5, 224)   672
['conv2d_177[0][0]']
 Normalization)

 activation_177 (Activation)    (None, 5, 5, 224)    0
['batch_normalization_177[0][0]']

 conv2d_175 (Conv2D)            (None, 5, 5, 192)    399360
['block8_3_ac[0][0]']

 conv2d_178 (Conv2D)            (None, 5, 5, 256)    172032
['activation_177[0][0]']

 batch_normalization_175 (Batch  (None, 5, 5, 192)   576
['conv2d_175[0][0]']
 Normalization)

 batch_normalization_178 (Batch  (None, 5, 5, 256)   768
['conv2d_178[0][0]']
 Normalization)

 activation_175 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_175[0][0]']

 activation_178 (Activation)    (None, 5, 5, 256)    0
['batch_normalization_178[0][0]']

 block8_4_mixed (Concatenate)   (None, 5, 5, 448)    0
['activation_175[0][0]',
'activation_178[0][0]']

 block8_4_conv (Conv2D)         (None, 5, 5, 2080)   933920
['block8_4_mixed[0][0]']

 block8_4 (Lambda)              (None, 5, 5, 2080)   0
['block8_3_ac[0][0]',
'block8_4_conv[0][0]']

 block8_4_ac (Activation)       (None, 5, 5, 2080)   0
['block8_4[0][0]']

 conv2d_180 (Conv2D)            (None, 5, 5, 192)    399360
```

```
['block8_4_ac[0][0]']

 batch_normalization_180 (Batch  (None, 5, 5, 192)   576
['conv2d_180[0][0]']
 Normalization)

 activation_180 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_180[0][0]']

 conv2d_181 (Conv2D)            (None, 5, 5, 224)    129024
['activation_180[0][0]']

 batch_normalization_181 (Batch  (None, 5, 5, 224)   672
['conv2d_181[0][0]']
 Normalization)

 activation_181 (Activation)    (None, 5, 5, 224)    0
['batch_normalization_181[0][0]']

 conv2d_179 (Conv2D)            (None, 5, 5, 192)    399360
['block8_4_ac[0][0]']

 conv2d_182 (Conv2D)            (None, 5, 5, 256)    172032
['activation_181[0][0]']

 batch_normalization_179 (Batch  (None, 5, 5, 192)   576
['conv2d_179[0][0]']
 Normalization)

 batch_normalization_182 (Batch  (None, 5, 5, 256)   768
['conv2d_182[0][0]']
 Normalization)

 activation_179 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_179[0][0]']

 activation_182 (Activation)    (None, 5, 5, 256)    0
['batch_normalization_182[0][0]']

 block8_5_mixed (Concatenate)   (None, 5, 5, 448)    0
['activation_179[0][0]',
'activation_182[0][0]']

 block8_5_conv (Conv2D)         (None, 5, 5, 2080)   933920
['block8_5_mixed[0][0]']

 block8_5 (Lambda)              (None, 5, 5, 2080)   0
['block8_4_ac[0][0]',
```

```
'block8_5_conv[0][0]']

 block8_5_ac (Activation)       (None, 5, 5, 2080)   0
['block8_5[0][0]']

 conv2d_184 (Conv2D)            (None, 5, 5, 192)    399360
['block8_5_ac[0][0]']

 batch_normalization_184 (Batch  (None, 5, 5, 192)   576
['conv2d_184[0][0]']
 Normalization)

 activation_184 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_184[0][0]']

 conv2d_185 (Conv2D)            (None, 5, 5, 224)    129024
['activation_184[0][0]']

 batch_normalization_185 (Batch  (None, 5, 5, 224)   672
['conv2d_185[0][0]']
 Normalization)

 activation_185 (Activation)    (None, 5, 5, 224)    0
['batch_normalization_185[0][0]']

 conv2d_183 (Conv2D)            (None, 5, 5, 192)    399360
['block8_5_ac[0][0]']

 conv2d_186 (Conv2D)            (None, 5, 5, 256)    172032
['activation_185[0][0]']

 batch_normalization_183 (Batch  (None, 5, 5, 192)   576
['conv2d_183[0][0]']
 Normalization)

 batch_normalization_186 (Batch  (None, 5, 5, 256)   768
['conv2d_186[0][0]']
 Normalization)

 activation_183 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_183[0][0]']

 activation_186 (Activation)    (None, 5, 5, 256)    0
['batch_normalization_186[0][0]']

 block8_6_mixed (Concatenate)   (None, 5, 5, 448)    0
['activation_183[0][0]',
'activation_186[0][0]']
```

```
 block8_6_conv (Conv2D)         (None, 5, 5, 2080)   933920
['block8_6_mixed[0][0]']

 block8_6 (Lambda)              (None, 5, 5, 2080)   0
['block8_5_ac[0][0]',
'block8_6_conv[0][0]']

 block8_6_ac (Activation)       (None, 5, 5, 2080)   0
['block8_6[0][0]']

 conv2d_188 (Conv2D)            (None, 5, 5, 192)    399360
['block8_6_ac[0][0]']

 batch_normalization_188 (Batch  (None, 5, 5, 192)   576
['conv2d_188[0][0]']
 Normalization)

 activation_188 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_188[0][0]']

 conv2d_189 (Conv2D)            (None, 5, 5, 224)    129024
['activation_188[0][0]']

 batch_normalization_189 (Batch  (None, 5, 5, 224)   672
['conv2d_189[0][0]']
 Normalization)

 activation_189 (Activation)    (None, 5, 5, 224)    0
['batch_normalization_189[0][0]']

 conv2d_187 (Conv2D)            (None, 5, 5, 192)    399360
['block8_6_ac[0][0]']

 conv2d_190 (Conv2D)            (None, 5, 5, 256)    172032
['activation_189[0][0]']

 batch_normalization_187 (Batch  (None, 5, 5, 192)   576
['conv2d_187[0][0]']
 Normalization)

 batch_normalization_190 (Batch  (None, 5, 5, 256)   768
['conv2d_190[0][0]']
 Normalization)

 activation_187 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_187[0][0]']
```

```
 activation_190 (Activation)    (None, 5, 5, 256)    0
['batch_normalization_190[0][0]']

 block8_7_mixed (Concatenate)   (None, 5, 5, 448)    0
['activation_187[0][0]',
'activation_190[0][0]']

 block8_7_conv (Conv2D)         (None, 5, 5, 2080)   933920
['block8_7_mixed[0][0]']

 block8_7 (Lambda)              (None, 5, 5, 2080)   0
['block8_6_ac[0][0]',
'block8_7_conv[0][0]']

 block8_7_ac (Activation)       (None, 5, 5, 2080)   0
['block8_7[0][0]']

 conv2d_192 (Conv2D)            (None, 5, 5, 192)    399360
['block8_7_ac[0][0]']

 batch_normalization_192 (Batch  (None, 5, 5, 192)   576
['conv2d_192[0][0]']
 Normalization)

 activation_192 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_192[0][0]']

 conv2d_193 (Conv2D)            (None, 5, 5, 224)    129024
['activation_192[0][0]']

 batch_normalization_193 (Batch  (None, 5, 5, 224)   672
['conv2d_193[0][0]']
 Normalization)

 activation_193 (Activation)    (None, 5, 5, 224)    0
['batch_normalization_193[0][0]']

 conv2d_191 (Conv2D)            (None, 5, 5, 192)    399360
['block8_7_ac[0][0]']

 conv2d_194 (Conv2D)            (None, 5, 5, 256)    172032
['activation_193[0][0]']

 batch_normalization_191 (Batch  (None, 5, 5, 192)   576
['conv2d_191[0][0]']
 Normalization)

 batch_normalization_194 (Batch  (None, 5, 5, 256)   768
```

```
['conv2d_194[0][0]']
 Normalization)

 activation_191 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_191[0][0]']

 activation_194 (Activation)    (None, 5, 5, 256)    0
['batch_normalization_194[0][0]']

 block8_8_mixed (Concatenate)   (None, 5, 5, 448)    0
['activation_191[0][0]',
'activation_194[0][0]']

 block8_8_conv (Conv2D)         (None, 5, 5, 2080)   933920
['block8_8_mixed[0][0]']

 block8_8 (Lambda)              (None, 5, 5, 2080)   0
['block8_7_ac[0][0]',
'block8_8_conv[0][0]']

 block8_8_ac (Activation)       (None, 5, 5, 2080)   0
['block8_8[0][0]']

 conv2d_196 (Conv2D)            (None, 5, 5, 192)    399360
['block8_8_ac[0][0]']

 batch_normalization_196 (Batch  (None, 5, 5, 192)   576
['conv2d_196[0][0]']
 Normalization)

 activation_196 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_196[0][0]']

 conv2d_197 (Conv2D)            (None, 5, 5, 224)    129024
['activation_196[0][0]']

 batch_normalization_197 (Batch  (None, 5, 5, 224)   672
['conv2d_197[0][0]']
 Normalization)

 activation_197 (Activation)    (None, 5, 5, 224)    0
['batch_normalization_197[0][0]']

 conv2d_195 (Conv2D)            (None, 5, 5, 192)    399360
['block8_8_ac[0][0]']

 conv2d_198 (Conv2D)            (None, 5, 5, 256)    172032
['activation_197[0][0]']
```

```
 batch_normalization_195 (Batch  (None, 5, 5, 192)   576
['conv2d_195[0][0]']
 Normalization)

 batch_normalization_198 (Batch  (None, 5, 5, 256)   768
['conv2d_198[0][0]']
 Normalization)

 activation_195 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_195[0][0]']

 activation_198 (Activation)    (None, 5, 5, 256)    0
['batch_normalization_198[0][0]']

 block8_9_mixed (Concatenate)   (None, 5, 5, 448)    0
['activation_195[0][0]',
'activation_198[0][0]']

 block8_9_conv (Conv2D)         (None, 5, 5, 2080)   933920
['block8_9_mixed[0][0]']

 block8_9 (Lambda)              (None, 5, 5, 2080)   0
['block8_8_ac[0][0]',
'block8_9_conv[0][0]']

 block8_9_ac (Activation)       (None, 5, 5, 2080)   0
['block8_9[0][0]']

 conv2d_200 (Conv2D)            (None, 5, 5, 192)    399360
['block8_9_ac[0][0]']

 batch_normalization_200 (Batch  (None, 5, 5, 192)   576
['conv2d_200[0][0]']
 Normalization)

 activation_200 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_200[0][0]']

 conv2d_201 (Conv2D)            (None, 5, 5, 224)    129024
['activation_200[0][0]']

 batch_normalization_201 (Batch  (None, 5, 5, 224)   672
['conv2d_201[0][0]']
 Normalization)

 activation_201 (Activation)    (None, 5, 5, 224)    0
['batch_normalization_201[0][0]']
```

```
 conv2d_199 (Conv2D)            (None, 5, 5, 192)    399360
['block8_9_ac[0][0]']

 conv2d_202 (Conv2D)            (None, 5, 5, 256)    172032
['activation_201[0][0]']

 batch_normalization_199 (Batch  (None, 5, 5, 192)   576
['conv2d_199[0][0]']
 Normalization)

 batch_normalization_202 (Batch  (None, 5, 5, 256)   768
['conv2d_202[0][0]']
 Normalization)

 activation_199 (Activation)    (None, 5, 5, 192)    0
['batch_normalization_199[0][0]']

 activation_202 (Activation)    (None, 5, 5, 256)    0
['batch_normalization_202[0][0]']

 block8_10_mixed (Concatenate)  (None, 5, 5, 448)    0
['activation_199[0][0]',
'activation_202[0][0]']

 block8_10_conv (Conv2D)        (None, 5, 5, 2080)   933920
['block8_10_mixed[0][0]']

 block8_10 (Lambda)             (None, 5, 5, 2080)   0
['block8_9_ac[0][0]',
'block8_10_conv[0][0]']

 conv_7b (Conv2D)               (None, 5, 5, 1536)   3194880
['block8_10[0][0]']

 conv_7b_bn (BatchNormalization  (None, 5, 5, 1536)  4608
['conv_7b[0][0]']
 )

 conv_7b_ac (Activation)        (None, 5, 5, 1536)   0
['conv_7b_bn[0][0]']

==========================================================================
==================
Total params: 54,336,736
Trainable params: 54,276,192
Non-trainable params: 60,544
--------------------------------------------------------------------------
```

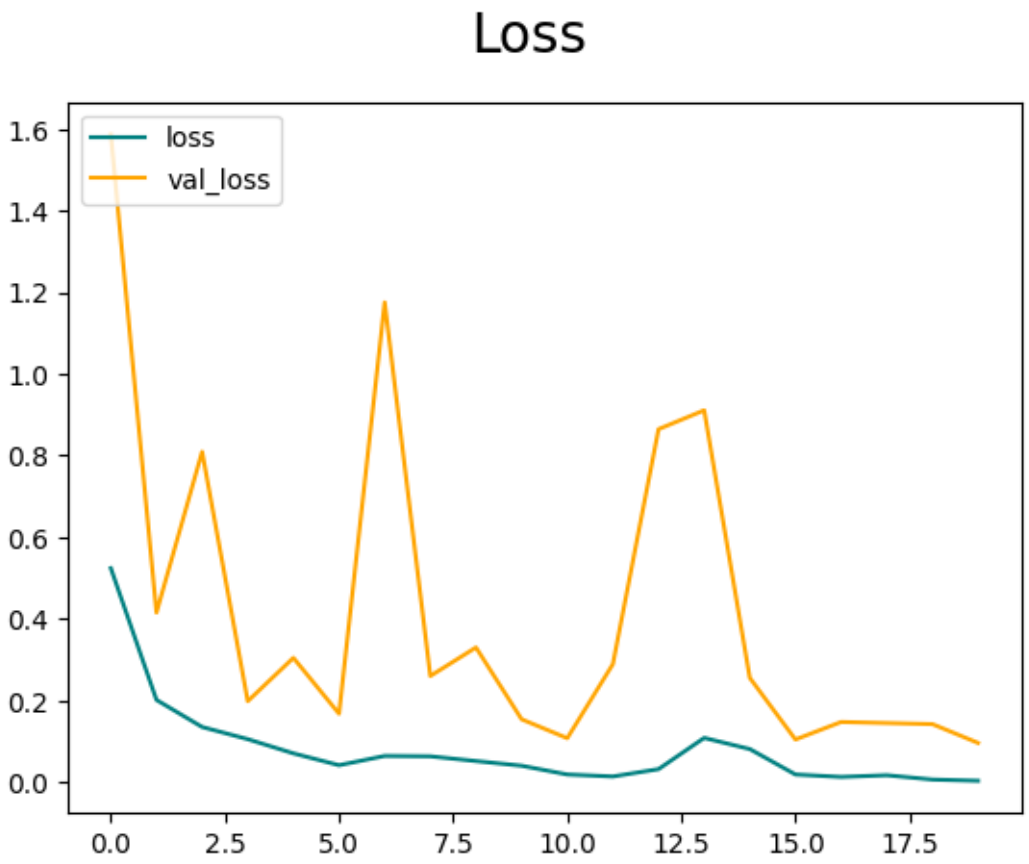
```
------------------
```

[8]:
```
x = base_model.output
x = GlobalAveragePooling2D()(x)
output = Dense(num_classes, activation='softmax')(x)
model = Model(inputs=base_model.input, outputs=output)

model.compile(optimizer='adam',
              loss='sparse_categorical_crossentropy',
              metrics=['accuracy'])

tensorboard_callback = tf.keras.callbacks.TensorBoard(log_dir='logs')

hist = model.fit(train_data, epochs=20, validation_data=val_data,␣
 ↪callbacks=[tensorboard_callback])
```

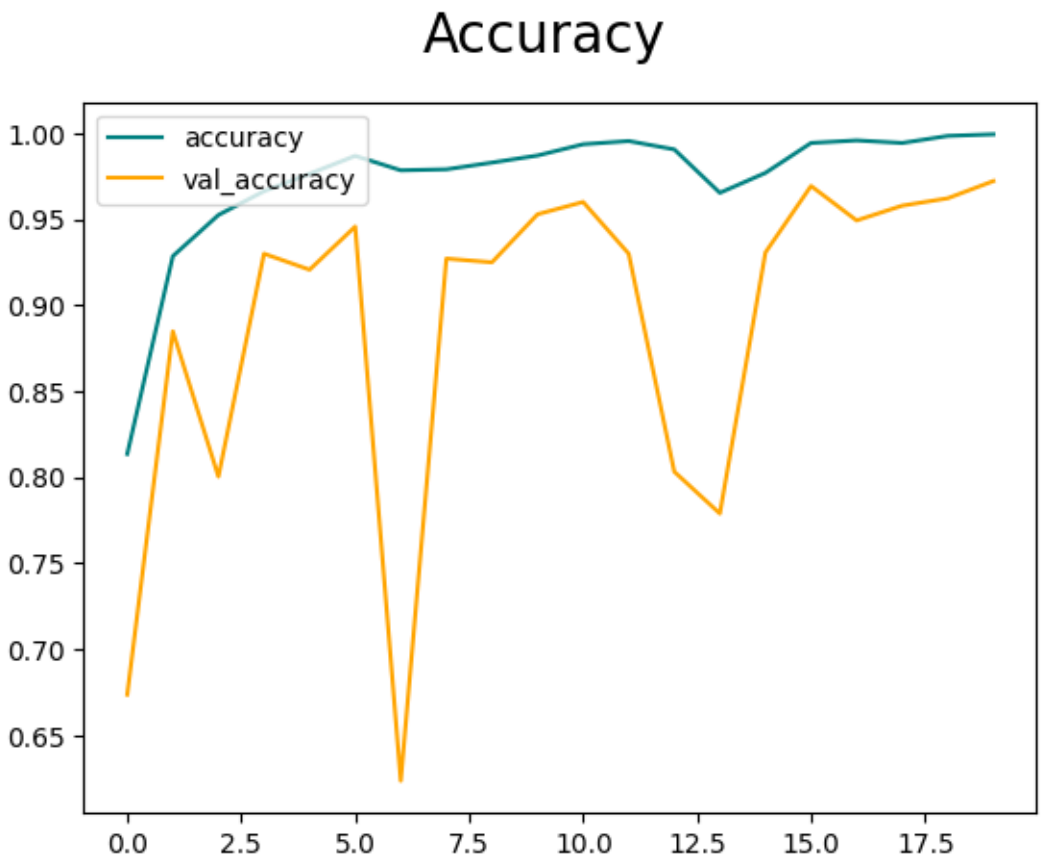
```
Epoch 1/20
168/168 [==============================] - 39s 162ms/step - loss: 0.5240 -
accuracy: 0.8135 - val_loss: 1.5868 - val_accuracy: 0.6736
Epoch 2/20
168/168 [==============================] - 26s 154ms/step - loss: 0.2013 -
accuracy: 0.9284 - val_loss: 0.4151 - val_accuracy: 0.8848
Epoch 3/20
168/168 [==============================] - 26s 154ms/step - loss: 0.1350 -
accuracy: 0.9523 - val_loss: 0.8092 - val_accuracy: 0.8003
Epoch 4/20
168/168 [==============================] - 26s 153ms/step - loss: 0.1052 -
accuracy: 0.9662 - val_loss: 0.1983 - val_accuracy: 0.9298
Epoch 5/20
168/168 [==============================] - 26s 153ms/step - loss: 0.0704 -
accuracy: 0.9763 - val_loss: 0.3044 - val_accuracy: 0.9205
Epoch 6/20
168/168 [==============================] - 26s 153ms/step - loss: 0.0414 -
accuracy: 0.9867 - val_loss: 0.1675 - val_accuracy: 0.9456
Epoch 7/20
168/168 [==============================] - 26s 153ms/step - loss: 0.0641 -
accuracy: 0.9783 - val_loss: 1.1752 - val_accuracy: 0.6235
Epoch 8/20
168/168 [==============================] - 26s 154ms/step - loss: 0.0631 -
accuracy: 0.9789 - val_loss: 0.2599 - val_accuracy: 0.9270
Epoch 9/20
168/168 [==============================] - 26s 154ms/step - loss: 0.0516 -
accuracy: 0.9828 - val_loss: 0.3298 - val_accuracy: 0.9248
Epoch 10/20
168/168 [==============================] - 26s 154ms/step - loss: 0.0401 -
accuracy: 0.9869 - val_loss: 0.1539 - val_accuracy: 0.9528
Epoch 11/20
168/168 [==============================] - 26s 155ms/step - loss: 0.0187 -
```

```
accuracy: 0.9935 - val_loss: 0.1075 - val_accuracy: 0.9599
Epoch 12/20
168/168 [==============================] - 26s 156ms/step - loss: 0.0138 -
accuracy: 0.9953 - val_loss: 0.2891 - val_accuracy: 0.9298
Epoch 13/20
168/168 [==============================] - 27s 158ms/step - loss: 0.0318 -
accuracy: 0.9905 - val_loss: 0.8645 - val_accuracy: 0.8031
Epoch 14/20
168/168 [==============================] - 27s 159ms/step - loss: 0.1083 -
accuracy: 0.9652 - val_loss: 0.9108 - val_accuracy: 0.7788
Epoch 15/20
168/168 [==============================] - 27s 160ms/step - loss: 0.0809 -
accuracy: 0.9768 - val_loss: 0.2553 - val_accuracy: 0.9306
Epoch 16/20
168/168 [==============================] - 27s 161ms/step - loss: 0.0186 -
accuracy: 0.9942 - val_loss: 0.1043 - val_accuracy: 0.9692
Epoch 17/20
168/168 [==============================] - 27s 160ms/step - loss: 0.0127 -
accuracy: 0.9957 - val_loss: 0.1472 - val_accuracy: 0.9492
Epoch 18/20
168/168 [==============================] - 27s 160ms/step - loss: 0.0168 -
accuracy: 0.9942 - val_loss: 0.1447 - val_accuracy: 0.9578
Epoch 19/20
168/168 [==============================] - 27s 160ms/step - loss: 0.0062 -
accuracy: 0.9983 - val_loss: 0.1421 - val_accuracy: 0.9621
Epoch 20/20
168/168 [==============================] - 27s 160ms/step - loss: 0.0032 -
accuracy: 0.9993 - val_loss: 0.0960 - val_accuracy: 0.9721
```

[9]:
```
fig = plt.figure()
plt .plot(hist.history['loss'], color='teal', label='loss')
plt.plot(hist.history['val_loss'], color='orange', label='val_loss')
fig.suptitle('Loss', fontsize=20)
plt.legend(loc="upper left")
plt.show()
```



[10]:
```
fig = plt.figure()
plt.plot(hist.history['accuracy'], color='teal', label='accuracy')
plt.plot(hist.history['val_accuracy'], color='orange', label='val_accuracy')
fig.suptitle('Accuracy', fontsize=20)
plt.legend(loc="upper left")
plt.show()
```



[11]:
```
pre = Precision()
re = Recall()
acc = SparseCategoricalAccuracy()
```

[12]:
```
for batch in test_data.as_numpy_iterator():
    X, y = batch
    yhat = model.predict(X)

    yhat_classes = tf.argmax(yhat, axis=1)

    pre.update_state(y, yhat_classes)
    re.update_state(y, yhat_classes)
    acc.update_state(y, yhat)
```

```
1/1 [==============================] - 1s 1s/step
1/1 [==============================] - 0s 28ms/step
1/1 [==============================] - 0s 29ms/step
1/1 [==============================] - 0s 29ms/step
1/1 [==============================] - 0s 29ms/step
1/1 [==============================] - 0s 29ms/step
```

```
1/1 [==============================] - 0s 29ms/step
1/1 [==============================] - 0s 28ms/step
1/1 [==============================] - 0s 28ms/step
1/1 [==============================] - 0s 29ms/step
1/1 [==============================] - 0s 29ms/step
1/1 [==============================] - 0s 29ms/step
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1/1 [==============================] - 0s 29ms/step
1/1 [==============================] - 0s 29ms/step
1/1 [==============================] - 0s 31ms/step
1/1 [==============================] - 0s 29ms/step
1/1 [==============================] - 0s 28ms/step
1/1 [==============================] - 0s 29ms/step
1/1 [==============================] - 0s 29ms/step
1/1 [==============================] - 0s 30ms/step
1/1 [==============================] - 0s 29ms/step
1/1 [==============================] - 0s 29ms/step
1/1 [==============================] - 0s 30ms/step
1/1 [==============================] - 0s 28ms/step
1/1 [==============================] - 1s 1s/step
```

[13]:
```
print(f"Precision: {pre.result().numpy() * 100 : .2f}%")
print(f"Recall: {re.result().numpy() * 100 : .2f}%")
print(f"Accuracy: {acc.result().numpy() * 100 : .2f}%")
```

```
Precision:  99.52%
Recall:  99.36%
Accuracy:  96.63%
```

[14]:
```
img = cv2.imread('Styles/test/Hatchback/8_jpg.rf.
 ↪c314c1d6777942876503fa1482c82240.jpg')

img_resized = cv2.resize(img, img_size)
img_expanded = np.expand_dims(img_resized, axis=0)

yhat = model.predict(img_expanded)
predicted_class = tf.argmax(yhat, axis=1).numpy()[0]

plt.imshow(img)
plt.title(f'Predicted class: {predicted_class}')
plt.axis('off')
plt.show()
```

```
1/1 [==============================] - 2s 2s/step
```

[15]:
```
print(f'Predicted class is: {class_names[predicted_class]}')
for idx, prob in enumerate(yhat[0]):
    print(f"Model probability for {class_names[idx]} is {prob * 100:.2f}%")
```

```
Predicted class is: Hatchback
Model probability for Convertible is 0.00%
Model probability for Coupe is 0.00%
Model probability for Hatchback is 99.99%
Model probability for Pick-Up is 0.00%
Model probability for SUV is 0.01%
Model probability for Sedan is 0.00%
Model probability for VAN is 0.00%
```

[16]:
```
model_file_name = f"CarStyle{acc.result().numpy() * 100 : .2f}%␣
↪InceptionResNetV2.h5"
model.save(os.path.join('CarBackEnd/models/CarStyles', model_file_name))
```

[ ]:
```

```