

Modeling-CNN-and-Transfer-Learning

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1 Author Information

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Github: <https://github.com/miladshiraniUCB/Emotion-Detection-in-Speech.git>

2 Introduction

In this section, we will use the spectrograms made in the EDA notebook to train CNN models and we will present different models including transfer learning.

3 Importing Libraries

```
[2]: from google.colab import drive
drive.mount('/content/drive')
```

Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).

```
[14]: import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np
import os

from sklearn.preprocessing import LabelEncoder
from sklearn.metrics import confusion_matrix, plot_confusion_matrix, \
    classification_report

import tensorflow as tf
from tensorflow.keras import layers
```

```

from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten, Dense,
↳Dropout
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.optimizers import RMSprop, Adam
from tensorflow.keras.models import Sequential

import warnings
warnings.filterwarnings('ignore')

print("GPU is", "available" if tf.config.list_physical_devices('GPU') else "NOT_
↳AVAILABLE")

```

GPU is available

[4]: !nvidia-smi

Thu Jul 28 06:21:28 2022

```

+-----+
| NVIDIA-SMI 460.32.03      Driver Version: 460.32.03      CUDA Version: 11.2      |
+-----+-----+-----+
| GPU  Name           Persistence-M| Bus-Id        Disp.A | Volatile Uncorr. ECC |
| Fan  Temp  Perf  Pwr:Usage/Cap|      Memory-Usage | GPU-Util  Compute M. |
|                                       MIG M. |
+-----+-----+-----+
|   0   Tesla T4              Off | 00000000:00:04:0 Off |                    0 |
| N/A   66C    P8      12W / 70W |      3MiB / 15109MiB |      0%      Default |
|                                       N/A |
+-----+-----+-----+

+-----+
| Processes:                                                       |
| GPU  GI    CI          PID    Type    Process name                        GPU Memory |
|          ID    ID                                   Usage      |
+-----+-----+
| No running processes found                                     |
+-----+

```

4 Functions

The function `loss_acc` is defined to take the model and returns the loss and accuracy diagrams of the model.

```

[5]: def loss_acc(model):

    fig , ax = plt.subplots(1,2)

```

```

test_acc = model.history.history["val_accuracy"]
test_loss = model.history.history["val_loss"]
train_acc = model.history.history["accuracy"]
train_loss = model.history.history["loss"]

epochs = range(1, len(test_acc) + 1)

fig.set_size_inches(20,6)
ax[0].plot(epochs , train_loss , label = 'Training Loss')
ax[0].plot(epochs , test_loss , label = 'Testing Loss')
ax[0].set_title('Training & Testing Loss')
ax[0].legend()
ax[0].set_xlabel("Epochs")

ax[1].plot(epochs , train_acc , label = 'Training Accuracy')
ax[1].plot(epochs , test_acc , label = 'Testing Accuracy')
ax[1].set_title('Training & Testing Accuracy')
ax[1].legend()
ax[1].set_xlabel("Epochs")
plt.show()

```

5 Importing Train-Test data sets

```

[6]: base_dir = "/content/drive/MyDrive/Emotion-Detection/mel_spectrogram"

train_dir = os.path.join(base_dir, 'train')
test_dir  = os.path.join(base_dir, 'test')

# Directory with training normal/abnormal spectrograms
train_angry    = os.path.join(train_dir, 'angry')
train_disgust  = os.path.join(train_dir, 'disgust')
train_fear     = os.path.join(train_dir, 'fear')
train_happy    = os.path.join(train_dir, 'happy')
train_neutral  = os.path.join(train_dir, 'neutral')
train_sad      = os.path.join(train_dir, 'sad')
train_surprise = os.path.join(train_dir, 'surprise')

# Directory with test normal/abnormal spectrograms

test_angry     = os.path.join(test_dir, 'angry')
test_disgust   = os.path.join(test_dir, 'disgust')
test_fear      = os.path.join(test_dir, 'fear')
test_happy     = os.path.join(test_dir, 'happy')
test_neutral   = os.path.join(test_dir, 'neutral')
test_sad       = os.path.join(test_dir, 'sad')

```

```
test_surprise = os.path.join(test_dir, 'surprise')
```

```
[ ]: # All images will be rescaled by 1./255.
train_datagen = ImageDataGenerator( rescale = 1.0/255, dtype= tf.float64)
test_datagen  = ImageDataGenerator( rescale = 1.0/255, dtype= tf.float64)

target_size = (150, 150)
train_generator = train_datagen.flow_from_directory(train_dir,
                                                    batch_size=30,
                                                    class_mode="categorical",
                                                    target_size=target_size)

validation_generator = test_datagen.flow_from_directory(test_dir,
                                                        batch_size=20,
                                                        class_mode = "
categorical",
                                                        target_size =
target_size)
```

Found 2240 images belonging to 7 classes.

Found 560 images belonging to 7 classes.

6 Modeling

In this section, we will present some CNN based models and we will use some transfer learning models to be used in this work.

6.1 Convolutional Neural Network

In this section, we will present the CNN based models. As we can see all of the models perform well with the test accuracy around 99%.

6.1.1 First Model

```
[ ]: model_1 = tf.keras.models.Sequential([
    # Note the input shape is the desired size of the image 150x150 with 3
    bytes color
    tf.keras.layers.Conv2D(16, (3,3), activation='relu',
                           input_shape=(target_size[0], target_size[1], 3)),
    tf.keras.layers.MaxPooling2D(2,2),
    tf.keras.layers.Flatten(),
    tf.keras.layers.Dense(64, activation='relu'),
    tf.keras.layers.Dense(7, activation='softmax')
])
model_1.summary()
```

Model: "sequential_10"

Layer (type)	Output Shape	Param #
conv2d_28 (Conv2D)	(None, 148, 148, 16)	448
max_pooling2d_28 (MaxPoolin g2D)	(None, 74, 74, 16)	0
flatten_10 (Flatten)	(None, 87616)	0
dense_36 (Dense)	(None, 64)	5607488
dense_37 (Dense)	(None, 7)	455

=====
 Total params: 5,608,391
 Trainable params: 5,608,391
 Non-trainable params: 0

```
[ ]: model_1.compile(optimizer=Adam(learning_rate=0.001),
                    loss="categorical_crossentropy",
                    metrics = ['accuracy'])

model_1.fit(
    train_generator,
    epochs=10,
    validation_data=validation_generator,
)
print("Fitting Done")
```

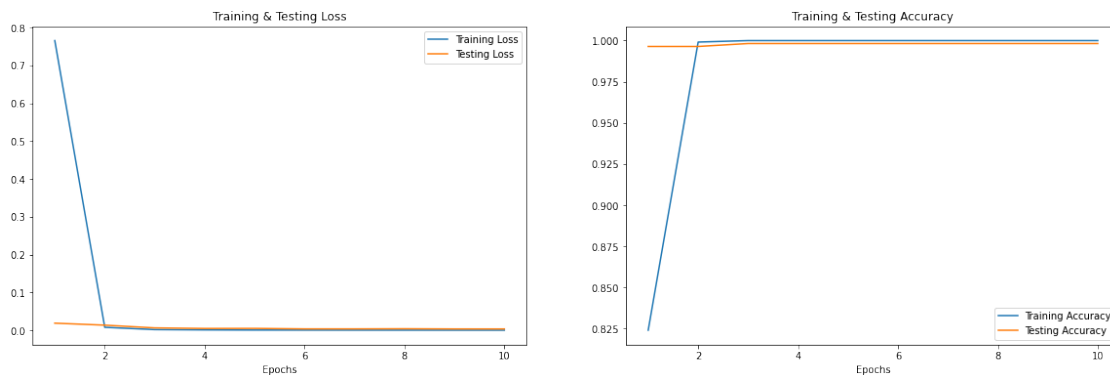
```
Epoch 1/10
75/75 [=====] - 96s 1s/step - loss: 0.7656 - accuracy:
0.8241 - val_loss: 0.0188 - val_accuracy: 0.9964
Epoch 2/10
75/75 [=====] - 93s 1s/step - loss: 0.0078 - accuracy:
0.9991 - val_loss: 0.0135 - val_accuracy: 0.9964
Epoch 3/10
75/75 [=====] - 97s 1s/step - loss: 0.0018 - accuracy:
1.0000 - val_loss: 0.0063 - val_accuracy: 0.9982
Epoch 4/10
75/75 [=====] - 95s 1s/step - loss: 9.9839e-04 -
accuracy: 1.0000 - val_loss: 0.0048 - val_accuracy: 0.9982
Epoch 5/10
75/75 [=====] - 94s 1s/step - loss: 5.5638e-04 -
accuracy: 1.0000 - val_loss: 0.0049 - val_accuracy: 0.9982
Epoch 6/10
75/75 [=====] - 94s 1s/step - loss: 3.9558e-04 -
```

```

accuracy: 1.0000 - val_loss: 0.0036 - val_accuracy: 0.9982
Epoch 7/10
75/75 [=====] - 94s 1s/step - loss: 3.0535e-04 -
accuracy: 1.0000 - val_loss: 0.0036 - val_accuracy: 0.9982
Epoch 8/10
75/75 [=====] - 95s 1s/step - loss: 2.3716e-04 -
accuracy: 1.0000 - val_loss: 0.0040 - val_accuracy: 0.9982
Epoch 9/10
75/75 [=====] - 93s 1s/step - loss: 1.9001e-04 -
accuracy: 1.0000 - val_loss: 0.0035 - val_accuracy: 0.9982
Epoch 10/10
75/75 [=====] - 94s 1s/step - loss: 1.5449e-04 -
accuracy: 1.0000 - val_loss: 0.0035 - val_accuracy: 0.9982
Fitting Done

```

```
[ ]: loss_acc(model_1)
```



6.1.2 Second Model

```

[ ]: # All images will be rescaled by 1./255.
train_datagen = ImageDataGenerator( rescale = 1.0/255, dtype= tf.float64)
test_datagen  = ImageDataGenerator( rescale = 1.0/255, dtype= tf.float64)

target_size = (150, 150)
train_generator = train_datagen.flow_from_directory(train_dir,
                                                    batch_size=30,
                                                    class_mode="categorical",
                                                    target_size=target_size)

# -----
# Flow validation images in batches of 20 using test_datagen generator
# -----
validation_generator = test_datagen.flow_from_directory(test_dir,
                                                         batch_size=20,

```

```

class_mode = "categorical",
target_size = (target_size[0], target_size[1], 3))

```

Found 2240 images belonging to 7 classes.
Found 560 images belonging to 7 classes.

```

[ ]: model_2 = tf.keras.models.Sequential([
    tf.keras.layers.Conv2D(16, (3,3), activation='relu',
                           input_shape=(target_size[0], target_size[1], 3)),
    tf.keras.layers.MaxPooling2D(2,2),
    tf.keras.layers.Conv2D(32, (3,3), activation='relu'),
    tf.keras.layers.MaxPooling2D(2,2),
    tf.keras.layers.Conv2D(64, (3,3), activation='relu'),
    tf.keras.layers.MaxPooling2D(2,2),
    tf.keras.layers.Flatten(),
    tf.keras.layers.Dense(512, activation='relu'),
    tf.keras.layers.Dense(7, activation='softmax')
])
model_2.summary()

```

Model: "sequential_11"

Layer (type)	Output Shape	Param #
conv2d_29 (Conv2D)	(None, 148, 148, 16)	448
max_pooling2d_29 (MaxPooling2D)	(None, 74, 74, 16)	0
conv2d_30 (Conv2D)	(None, 72, 72, 32)	4640
max_pooling2d_30 (MaxPooling2D)	(None, 36, 36, 32)	0
conv2d_31 (Conv2D)	(None, 34, 34, 64)	18496
max_pooling2d_31 (MaxPooling2D)	(None, 17, 17, 64)	0
flatten_11 (Flatten)	(None, 18496)	0
dense_38 (Dense)	(None, 512)	9470464
dense_39 (Dense)	(None, 7)	3591

```
=====
Total params: 9,497,639
Trainable params: 9,497,639
Non-trainable params: 0
-----
```

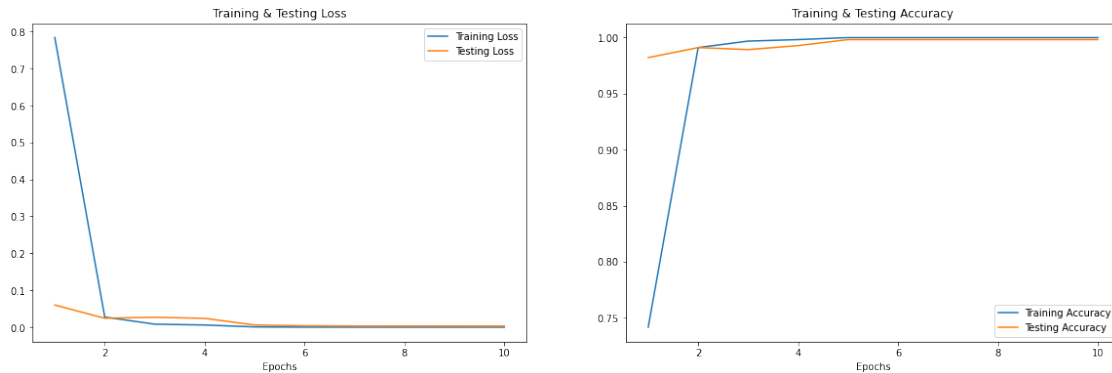
```
[ ]: model_2.compile(optimizer=Adam(learning_rate=0.001),
                    loss="categorical_crossentropy",
                    metrics = ['accuracy'])

model_2.fit(
    train_generator,
    epochs=10,
    validation_data=validation_generator,
)
print("Fitting Done")
```

```
Epoch 1/10
75/75 [=====] - 95s 1s/step - loss: 0.7837 - accuracy:
0.7415 - val_loss: 0.0600 - val_accuracy: 0.9821
Epoch 2/10
75/75 [=====] - 95s 1s/step - loss: 0.0276 - accuracy:
0.9911 - val_loss: 0.0243 - val_accuracy: 0.9911
Epoch 3/10
75/75 [=====] - 97s 1s/step - loss: 0.0083 - accuracy:
0.9969 - val_loss: 0.0270 - val_accuracy: 0.9893
Epoch 4/10
75/75 [=====] - 96s 1s/step - loss: 0.0060 - accuracy:
0.9982 - val_loss: 0.0240 - val_accuracy: 0.9929
Epoch 5/10
75/75 [=====] - 96s 1s/step - loss: 8.4081e-04 -
accuracy: 1.0000 - val_loss: 0.0060 - val_accuracy: 0.9982
Epoch 6/10
75/75 [=====] - 96s 1s/step - loss: 8.2523e-05 -
accuracy: 1.0000 - val_loss: 0.0039 - val_accuracy: 0.9982
Epoch 7/10
75/75 [=====] - 95s 1s/step - loss: 5.8467e-05 -
accuracy: 1.0000 - val_loss: 0.0033 - val_accuracy: 0.9982
Epoch 8/10
75/75 [=====] - 96s 1s/step - loss: 4.4353e-05 -
accuracy: 1.0000 - val_loss: 0.0033 - val_accuracy: 0.9982
Epoch 9/10
75/75 [=====] - 96s 1s/step - loss: 3.6370e-05 -
accuracy: 1.0000 - val_loss: 0.0033 - val_accuracy: 0.9982
Epoch 10/10
75/75 [=====] - 94s 1s/step - loss: 3.0320e-05 -
accuracy: 1.0000 - val_loss: 0.0031 - val_accuracy: 0.9982
```


Fitting Done

```
[ ]: loss_acc(model_2)
```



6.1.3 Third Model

```
[ ]: model_3 = tf.keras.models.Sequential([
    # Note the input shape is the desired size of the image 150x150 with 3
    # bytes color
    tf.keras.layers.Conv2D(16, (3,3), activation='relu',
                           input_shape=(target_size[0], target_size[1], 3)),
    tf.keras.layers.MaxPooling2D(2,2),
    tf.keras.layers.Conv2D(32, (3,3), activation='relu'),
    tf.keras.layers.MaxPooling2D(2,2),
    tf.keras.layers.Conv2D(64, (3,3), activation='relu'),
    tf.keras.layers.MaxPooling2D(2,2),
    tf.keras.layers.Flatten(),
    tf.keras.layers.Dense(256, activation='relu'),
    tf.keras.layers.Dense(7, activation='softmax')
])
model_3.summary()
```

Model: "sequential_9"

Layer (type)	Output Shape	Param #
conv2d_25 (Conv2D)	(None, 148, 148, 16)	448
max_pooling2d_25 (MaxPooling2D)	(None, 74, 74, 16)	0
conv2d_26 (Conv2D)	(None, 72, 72, 32)	4640
max_pooling2d_26 (MaxPooling2D)	(None, 36, 36, 32)	0

g2D)

conv2d_27 (Conv2D) (None, 34, 34, 64) 18496

max_pooling2d_27 (MaxPoolin (None, 17, 17, 64) 0
g2D)

flatten_9 (Flatten) (None, 18496) 0

dense_34 (Dense) (None, 256) 4735232

dense_35 (Dense) (None, 7) 1799

=====
Total params: 4,760,615
Trainable params: 4,760,615
Non-trainable params: 0

```
[ ]: model_3.compile(optimizer=Adam(learning_rate=0.0001),  
                    loss="categorical_crossentropy",  
                    metrics = ['accuracy'])
```

```
model_3.fit(  
    train_generator,  
    epochs=10,  
    validation_data=validation_generator,  
)  
print("Fitting Done")
```

Epoch 1/10

75/75 [=====] - 98s 1s/step - loss: 1.3414 - accuracy:
0.6089 - val_loss: 0.5181 - val_accuracy: 0.8982

Epoch 2/10

75/75 [=====] - 98s 1s/step - loss: 0.2679 - accuracy:
0.9527 - val_loss: 0.1200 - val_accuracy: 0.9804

Epoch 3/10

75/75 [=====] - 99s 1s/step - loss: 0.0874 - accuracy:
0.9835 - val_loss: 0.0748 - val_accuracy: 0.9839

Epoch 4/10

75/75 [=====] - 99s 1s/step - loss: 0.0425 - accuracy:
0.9933 - val_loss: 0.0389 - val_accuracy: 0.9911

Epoch 5/10

75/75 [=====] - 98s 1s/step - loss: 0.0247 - accuracy:
0.9982 - val_loss: 0.0402 - val_accuracy: 0.9839

Epoch 6/10

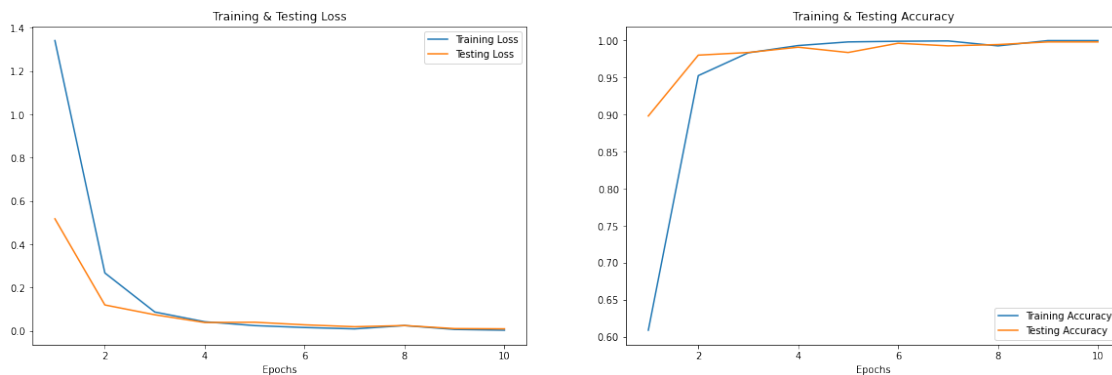
75/75 [=====] - 96s 1s/step - loss: 0.0158 - accuracy:

```

0.9991 - val_loss: 0.0282 - val_accuracy: 0.9964
Epoch 7/10
75/75 [=====] - 96s 1s/step - loss: 0.0096 - accuracy:
0.9996 - val_loss: 0.0195 - val_accuracy: 0.9929
Epoch 8/10
75/75 [=====] - 95s 1s/step - loss: 0.0249 - accuracy:
0.9929 - val_loss: 0.0249 - val_accuracy: 0.9946
Epoch 9/10
75/75 [=====] - 95s 1s/step - loss: 0.0070 - accuracy:
1.0000 - val_loss: 0.0109 - val_accuracy: 0.9982
Epoch 10/10
75/75 [=====] - 94s 1s/step - loss: 0.0034 - accuracy:
1.0000 - val_loss: 0.0098 - val_accuracy: 0.9982
Fitting Done

```

```
[ ]: loss_acc(model_3)
```



6.1.4 Forth Model

```

[ ]: model_4 = tf.keras.models.Sequential([
    # Note the input shape is the desired size of the image 150x150 with 3
    # bytes color
    tf.keras.layers.Conv2D(16, (3,3), activation='relu',
                           input_shape=(target_size[0], target_size[1], 3)),
    tf.keras.layers.MaxPooling2D(2,2),
    tf.keras.layers.Conv2D(32, (3,3), activation='relu'),
    tf.keras.layers.MaxPooling2D(2,2),
    tf.keras.layers.Flatten(),
    tf.keras.layers.Dense(128, activation='relu'),
    # tf.keras.layers.Dense(64, activation='relu'),
    tf.keras.layers.Dense(7, activation='softmax')
])
model_4.summary()

```

Model: "sequential_8"

Layer (type)	Output Shape	Param #
conv2d_23 (Conv2D)	(None, 148, 148, 16)	448
max_pooling2d_23 (MaxPooling2D)	(None, 74, 74, 16)	0
conv2d_24 (Conv2D)	(None, 72, 72, 32)	4640
max_pooling2d_24 (MaxPooling2D)	(None, 36, 36, 32)	0
flatten_8 (Flatten)	(None, 41472)	0
dense_32 (Dense)	(None, 128)	5308544
dense_33 (Dense)	(None, 7)	903

=====
Total params: 5,314,535
Trainable params: 5,314,535
Non-trainable params: 0
=====

```
[ ]: model_4.compile(optimizer=Adam(learning_rate=0.001),
                    loss="categorical_crossentropy",
                    metrics = ['accuracy'])

model_4.fit(
    train_generator,
    epochs=15,
    validation_data=validation_generator,
)
print("Fitting Done")
```

Epoch 1/15

75/75 [=====] - 97s 1s/step - loss: 0.6970 - accuracy: 0.8228 - val_loss: 0.0247 - val_accuracy: 0.9982

Epoch 2/15

75/75 [=====] - 94s 1s/step - loss: 0.0111 - accuracy: 0.9987 - val_loss: 0.0264 - val_accuracy: 0.9893

Epoch 3/15

75/75 [=====] - 95s 1s/step - loss: 0.0026 - accuracy: 0.9996 - val_loss: 0.0037 - val_accuracy: 1.0000

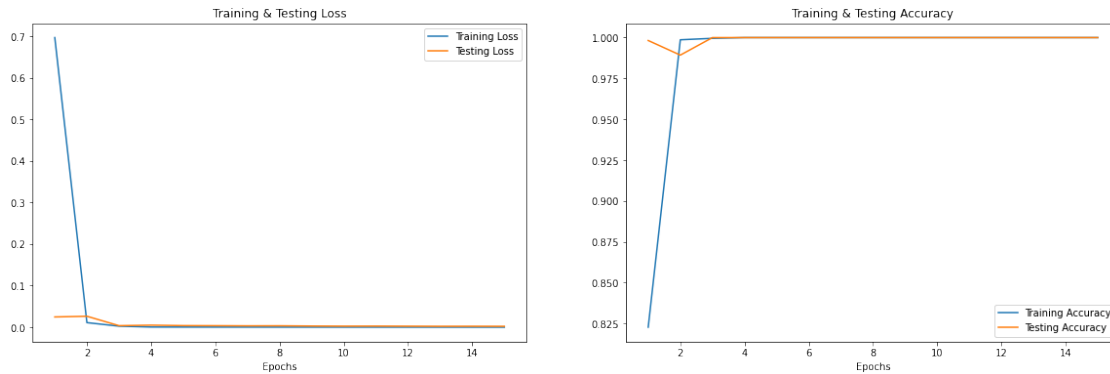
Epoch 4/15

```

75/75 [=====] - 95s 1s/step - loss: 4.7405e-04 -
accuracy: 1.0000 - val_loss: 0.0050 - val_accuracy: 1.0000
Epoch 5/15
75/75 [=====] - 95s 1s/step - loss: 3.1395e-04 -
accuracy: 1.0000 - val_loss: 0.0039 - val_accuracy: 1.0000
Epoch 6/15
75/75 [=====] - 95s 1s/step - loss: 2.3623e-04 -
accuracy: 1.0000 - val_loss: 0.0036 - val_accuracy: 1.0000
Epoch 7/15
75/75 [=====] - 96s 1s/step - loss: 1.8212e-04 -
accuracy: 1.0000 - val_loss: 0.0033 - val_accuracy: 1.0000
Epoch 8/15
75/75 [=====] - 95s 1s/step - loss: 1.4578e-04 -
accuracy: 1.0000 - val_loss: 0.0034 - val_accuracy: 1.0000
Epoch 9/15
75/75 [=====] - 94s 1s/step - loss: 1.1763e-04 -
accuracy: 1.0000 - val_loss: 0.0029 - val_accuracy: 1.0000
Epoch 10/15
75/75 [=====] - 96s 1s/step - loss: 9.5066e-05 -
accuracy: 1.0000 - val_loss: 0.0026 - val_accuracy: 1.0000
Epoch 11/15
75/75 [=====] - 96s 1s/step - loss: 8.2466e-05 -
accuracy: 1.0000 - val_loss: 0.0027 - val_accuracy: 1.0000
Epoch 12/15
75/75 [=====] - 95s 1s/step - loss: 6.9156e-05 -
accuracy: 1.0000 - val_loss: 0.0025 - val_accuracy: 1.0000
Epoch 13/15
75/75 [=====] - 95s 1s/step - loss: 5.8775e-05 -
accuracy: 1.0000 - val_loss: 0.0022 - val_accuracy: 1.0000
Epoch 14/15
75/75 [=====] - 95s 1s/step - loss: 5.1096e-05 -
accuracy: 1.0000 - val_loss: 0.0023 - val_accuracy: 1.0000
Epoch 15/15
75/75 [=====] - 94s 1s/step - loss: 4.4390e-05 -
accuracy: 1.0000 - val_loss: 0.0022 - val_accuracy: 1.0000
Fitting Done

```

```
[ ]: loss_acc(model_4)
```



6.2 Transfer Learning

In this section, we will use transfer learning models `EfficientNetB3` and `EfficientNetB7` to train a neural network.

6.2.1 EfficientNetB3

```
[ ]: # All images will be rescaled by 1./255.
train_datagen = ImageDataGenerator( rescale = 1.0/255, dtype= tf.float64)
test_datagen  = ImageDataGenerator( rescale = 1.0/255, dtype= tf.float64)

target_size = (150, 150)
train_generator = train_datagen.flow_from_directory(train_dir,
                                                    batch_size=50,
                                                    class_mode="categorical",
                                                    target_size=target_size)

# -----
# Flow validation images in batches of 20 using test_datagen generator
# -----
validation_generator = test_datagen.flow_from_directory(test_dir,
                                                        batch_size=25,
                                                        class_mode =
↳ "categorical",
                                                        target_size =
↳ target_size)
```

Found 2240 images belonging to 7 classes.

Found 560 images belonging to 7 classes.

```
[ ]: model_name='EfficientNetB3'
efficient_model=tf.keras.applications.EfficientNetB3(
                                                    include_top=False,
                                                    weights="imagenet",
```

```

                                input_shape=(target_size[0],
↪target_size[1], 3),
                                pooling='max')

x=efficient_model.output

x=tf.keras.layers.BatchNormalization(axis=-1,
                                momentum=0.99,
                                epsilon=0.001 )(x)

x = Dense(256,
        kernel_regularizer = tf.keras.regularizers.l2(1 = 0.05),
        activity_regularizer = tf.keras.regularizers.l1(0.05),
        bias_regularizer = tf.keras.regularizers.l1(0.05),
        activation='relu')(x)

x=tf.keras.layers.Dropout(rate=.45, seed=123)(x)

output=Dense(7, activation='softmax')(x)

eff_model=tf.keras.models.Model(inputs=efficient_model.input, outputs=output)

eff_model.compile(tf.keras.optimizers.Adamax(learning_rate=.001),
        loss='categorical_crossentropy',
        metrics=['accuracy'])

# eff_model.summary()

```

```

[ ]: eff_model.fit(
        train_generator,
        epochs=25,
        validation_data=validation_generator,
    )
print("Fitting Done")

```

```

Epoch 1/25
45/45 [=====] - 112s 2s/step - loss: 22.1103 -
accuracy: 0.7415 - val_loss: 17.6656 - val_accuracy: 0.1429
Epoch 2/25
45/45 [=====] - 94s 2s/step - loss: 13.3407 - accuracy:
0.9580 - val_loss: 12.4169 - val_accuracy: 0.1429
Epoch 3/25
45/45 [=====] - 94s 2s/step - loss: 9.3593 - accuracy:
0.9781 - val_loss: 8.9780 - val_accuracy: 0.1429
Epoch 4/25
45/45 [=====] - 97s 2s/step - loss: 6.6729 - accuracy:
0.9915 - val_loss: 6.7828 - val_accuracy: 0.1429

```

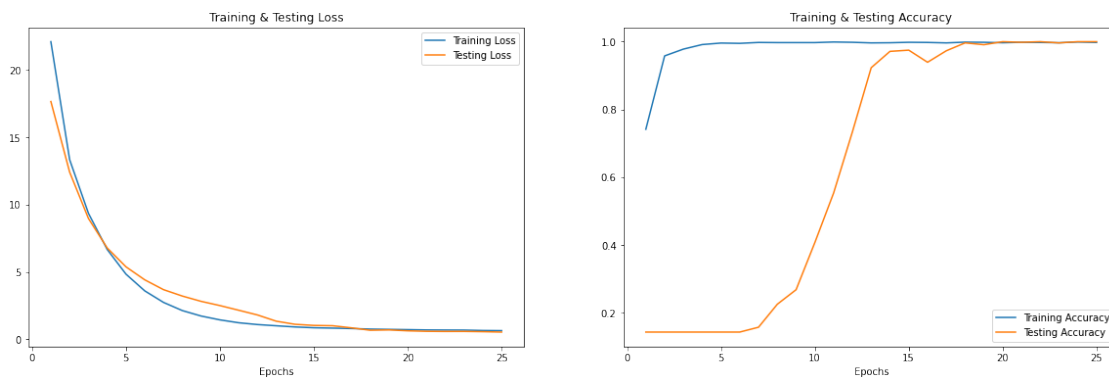
Epoch 5/25
45/45 [=====] - 104s 2s/step - loss: 4.8382 - accuracy: 0.9960 - val_loss: 5.3822 - val_accuracy: 0.1429
Epoch 6/25
45/45 [=====] - 102s 2s/step - loss: 3.5955 - accuracy: 0.9951 - val_loss: 4.4163 - val_accuracy: 0.1429
Epoch 7/25
45/45 [=====] - 98s 2s/step - loss: 2.7382 - accuracy: 0.9978 - val_loss: 3.6858 - val_accuracy: 0.1571
Epoch 8/25
45/45 [=====] - 96s 2s/step - loss: 2.1322 - accuracy: 0.9973 - val_loss: 3.2119 - val_accuracy: 0.2250
Epoch 9/25
45/45 [=====] - 95s 2s/step - loss: 1.7276 - accuracy: 0.9973 - val_loss: 2.8182 - val_accuracy: 0.2679
Epoch 10/25
45/45 [=====] - 96s 2s/step - loss: 1.4420 - accuracy: 0.9973 - val_loss: 2.5049 - val_accuracy: 0.4071
Epoch 11/25
45/45 [=====] - 97s 2s/step - loss: 1.2283 - accuracy: 0.9991 - val_loss: 2.1579 - val_accuracy: 0.5536
Epoch 12/25
45/45 [=====] - 98s 2s/step - loss: 1.0947 - accuracy: 0.9982 - val_loss: 1.8073 - val_accuracy: 0.7339
Epoch 13/25
45/45 [=====] - 100s 2s/step - loss: 1.0040 - accuracy: 0.9964 - val_loss: 1.3436 - val_accuracy: 0.9232
Epoch 14/25
45/45 [=====] - 100s 2s/step - loss: 0.9166 - accuracy: 0.9969 - val_loss: 1.1130 - val_accuracy: 0.9714
Epoch 15/25
45/45 [=====] - 100s 2s/step - loss: 0.8564 - accuracy: 0.9982 - val_loss: 1.0300 - val_accuracy: 0.9750
Epoch 16/25
45/45 [=====] - 100s 2s/step - loss: 0.8295 - accuracy: 0.9978 - val_loss: 1.0069 - val_accuracy: 0.9393
Epoch 17/25
45/45 [=====] - 100s 2s/step - loss: 0.7996 - accuracy: 0.9964 - val_loss: 0.8502 - val_accuracy: 0.9732
Epoch 18/25
45/45 [=====] - 98s 2s/step - loss: 0.7569 - accuracy: 0.9987 - val_loss: 0.6719 - val_accuracy: 0.9964
Epoch 19/25
45/45 [=====] - 99s 2s/step - loss: 0.7363 - accuracy: 0.9982 - val_loss: 0.6954 - val_accuracy: 0.9911
Epoch 20/25
45/45 [=====] - 98s 2s/step - loss: 0.7172 - accuracy: 0.9969 - val_loss: 0.6294 - val_accuracy: 1.0000


```

Epoch 21/25
45/45 [=====] - 95s 2s/step - loss: 0.6949 - accuracy:
0.9982 - val_loss: 0.5916 - val_accuracy: 0.9982
Epoch 22/25
45/45 [=====] - 96s 2s/step - loss: 0.6884 - accuracy:
0.9978 - val_loss: 0.5821 - val_accuracy: 1.0000
Epoch 23/25
45/45 [=====] - 97s 2s/step - loss: 0.6833 - accuracy:
0.9969 - val_loss: 0.5843 - val_accuracy: 0.9964
Epoch 24/25
45/45 [=====] - 96s 2s/step - loss: 0.6533 - accuracy:
0.9991 - val_loss: 0.5655 - val_accuracy: 1.0000
Epoch 25/25
45/45 [=====] - 95s 2s/step - loss: 0.6424 - accuracy:
0.9978 - val_loss: 0.5359 - val_accuracy: 1.0000
Fitting Done

```

```
[ ]: loss_acc(eff_model)
```



6.2.2 EfficientNetB7

```

[7]: # All images will be rescaled by 1./255.
datagen = ImageDataGenerator( rescale = 1.0/255, dtype= tf.float64)
batch_size = 30
target_size = (150, 150)
input_shape = (target_size[0], target_size[1], 3)

```

```

[8]: model_name='EfficientNetB7'

efficient_7=tf.keras.applications.EfficientNetB7(
                                include_top=False,
                                weights="imagenet",
                                input_shape=input_shape,
                                classes=7,

```

```

classifier_activation='softmax',
pooling='max')

```

```

efficient_7.summary()

```

Downloading data from https://storage.googleapis.com/keras-applications/efficientnetb7_notop.h5

258080768/258076736 [=====] - 1s 0us/step

258088960/258076736 [=====] - 1s 0us/step

Model: "efficientnetb7"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_1 (InputLayer)	[(None, 150, 150, 3)]	0	[]
rescaling (Rescaling) ['input_1[0][0]']	(None, 150, 150, 3)	0	
normalization (Normalization) ['rescaling[0][0]']	(None, 150, 150, 3)	7	
stem_conv_pad (ZeroPadding2D) ['normalization[0][0]']	(None, 151, 151, 3)	0	
stem_conv (Conv2D) ['stem_conv_pad[0][0]']	(None, 75, 75, 64)	1728	
stem_bn (BatchNormalization) ['stem_conv[0][0]']	(None, 75, 75, 64)	256	
stem_activation (Activation) ['stem_bn[0][0]']	(None, 75, 75, 64)	0	
block1a_dwconv (DepthwiseConv2D) ['stem_activation[0][0]']	(None, 75, 75, 64)	576	
block1a_bn (BatchNormalization) ['block1a_dwconv[0][0]']	(None, 75, 75, 64)	256	
block1a_activation (Activation) ['block1a_bn[0][0]']	(None, 75, 75, 64)	0	

block1a_se_squeeze (GlobalAveragePooling2D)	(None, 64)	0
['block1a_activation[0][0]']		
block1a_se_reshape (Reshape)	(None, 1, 1, 64)	0
['block1a_se_squeeze[0][0]']		
block1a_se_reduce (Conv2D)	(None, 1, 1, 16)	1040
['block1a_se_reshape[0][0]']		
block1a_se_expand (Conv2D)	(None, 1, 1, 64)	1088
['block1a_se_reduce[0][0]']		
block1a_se_excite (Multiply)	(None, 75, 75, 64)	0
['block1a_activation[0][0]', 'block1a_se_expand[0][0]']		
block1a_project_conv (Conv2D)	(None, 75, 75, 32)	2048
['block1a_se_excite[0][0]']		
block1a_project_bn (BatchNormalization)	(None, 75, 75, 32)	128
['block1a_project_conv[0][0]']		
block1b_dwconv (DepthwiseConv2D)	(None, 75, 75, 32)	288
['block1a_project_bn[0][0]']		
block1b_bn (BatchNormalization)	(None, 75, 75, 32)	128
['block1b_dwconv[0][0]']		
block1b_activation (Activation)	(None, 75, 75, 32)	0
['block1b_bn[0][0]']		
block1b_se_squeeze (GlobalAveragePooling2D)	(None, 32)	0
['block1b_activation[0][0]']		
block1b_se_reshape (Reshape)	(None, 1, 1, 32)	0
['block1b_se_squeeze[0][0]']		
block1b_se_reduce (Conv2D)	(None, 1, 1, 8)	264
['block1b_se_reshape[0][0]']		
block1b_se_expand (Conv2D)	(None, 1, 1, 32)	288

```

['block1b_se_reduce[0][0]']

block1b_se_excite (Multiply) (None, 75, 75, 32) 0
['block1b_activation[0][0]',
'block1b_se_expand[0][0]']

block1b_project_conv (Conv2D) (None, 75, 75, 32) 1024
['block1b_se_excite[0][0]']

block1b_project_bn (BatchNormaliza (None, 75, 75, 32) 128
['block1b_project_conv[0][0]']
lization)

block1b_drop (Dropout) (None, 75, 75, 32) 0
['block1b_project_bn[0][0]']

block1b_add (Add) (None, 75, 75, 32) 0
['block1b_drop[0][0]',
'block1a_project_bn[0][0]']

block1c_dwconv (DepthwiseConv2 (None, 75, 75, 32) 288
['block1b_add[0][0]']
D)

block1c_bn (BatchNormalization (None, 75, 75, 32) 128
['block1c_dwconv[0][0]']
)

block1c_activation (Activation (None, 75, 75, 32) 0
['block1c_bn[0][0]']
)

block1c_se_squeeze (GlobalAver (None, 32) 0
['block1c_activation[0][0]']
agePooling2D)

block1c_se_reshape (Reshape) (None, 1, 1, 32) 0
['block1c_se_squeeze[0][0]']

block1c_se_reduce (Conv2D) (None, 1, 1, 8) 264
['block1c_se_reshape[0][0]']

block1c_se_expand (Conv2D) (None, 1, 1, 32) 288
['block1c_se_reduce[0][0]']

block1c_se_excite (Multiply) (None, 75, 75, 32) 0
['block1c_activation[0][0]',
'block1c_se_expand[0][0]']

```

block1c_project_conv (Conv2D)	(None, 75, 75, 32)	1024
['block1c_se_excite[0][0]']		
block1c_project_bn (BatchNormalization)	(None, 75, 75, 32)	128
['block1c_project_conv[0][0]']		
block1c_drop (Dropout)	(None, 75, 75, 32)	0
['block1c_project_bn[0][0]']		
block1c_add (Add)	(None, 75, 75, 32)	0
['block1c_drop[0][0]', 'block1b_add[0][0]']		
block1d_dwconv (DepthwiseConv2D)	(None, 75, 75, 32)	288
['block1c_add[0][0]']		
block1d_bn (BatchNormalization)	(None, 75, 75, 32)	128
['block1d_dwconv[0][0]']		
block1d_activation (Activation)	(None, 75, 75, 32)	0
['block1d_bn[0][0]']		
block1d_se_squeeze (GlobalAveragePooling2D)	(None, 32)	0
['block1d_activation[0][0]']		
block1d_se_reshape (Reshape)	(None, 1, 1, 32)	0
['block1d_se_squeeze[0][0]']		
block1d_se_reduce (Conv2D)	(None, 1, 1, 8)	264
['block1d_se_reshape[0][0]']		
block1d_se_expand (Conv2D)	(None, 1, 1, 32)	288
['block1d_se_reduce[0][0]']		
block1d_se_excite (Multiply)	(None, 75, 75, 32)	0
['block1d_activation[0][0]', 'block1d_se_expand[0][0]']		
block1d_project_conv (Conv2D)	(None, 75, 75, 32)	1024
['block1d_se_excite[0][0]']		
block1d_project_bn (BatchNormalization)	(None, 75, 75, 32)	128

```

['block1d_project_conv[0][0]']
lization)

block1d_drop (Dropout)          (None, 75, 75, 32)    0
['block1d_project_bn[0][0]']

block1d_add (Add)                (None, 75, 75, 32)    0
['block1d_drop[0][0]',
'block1c_add[0][0]']

block2a_expand_conv (Conv2D)     (None, 75, 75, 192)  6144
['block1d_add[0][0]']

block2a_expand_bn (BatchNormal   (None, 75, 75, 192)  768
['block2a_expand_conv[0][0]']
ization)

block2a_expand_activation (Act   (None, 75, 75, 192)  0
['block2a_expand_bn[0][0]']
ivation)

block2a_dwconv_pad (ZeroPaddin   (None, 77, 77, 192)  0
['block2a_expand_activation[0][0]
g2D)                                ']'

block2a_dwconv (DepthwiseConv2   (None, 38, 38, 192)  1728
['block2a_dwconv_pad[0][0]']
D)

block2a_bn (BatchNormalization   (None, 38, 38, 192)  768
['block2a_dwconv[0][0]']
)

block2a_activation (Activation   (None, 38, 38, 192)  0
['block2a_bn[0][0]']
)

block2a_se_squeeze (GlobalAver   (None, 192)          0
['block2a_activation[0][0]']
agePooling2D)

block2a_se_reshape (Reshape)     (None, 1, 1, 192)    0
['block2a_se_squeeze[0][0]']

block2a_se_reduce (Conv2D)       (None, 1, 1, 8)      1544
['block2a_se_reshape[0][0]']

block2a_se_expand (Conv2D)       (None, 1, 1, 192)    1728

```

```

['block2a_se_reduce[0][0]']

block2a_se_excite (Multiply) (None, 38, 38, 192) 0
['block2a_activation[0][0]',
'block2a_se_expand[0][0]']

block2a_project_conv (Conv2D) (None, 38, 38, 48) 9216
['block2a_se_excite[0][0]']

block2a_project_bn (BatchNormal (None, 38, 38, 48) 192
['block2a_project_conv[0][0]']
lization)

block2b_expand_conv (Conv2D) (None, 38, 38, 288) 13824
['block2a_project_bn[0][0]']

block2b_expand_bn (BatchNormal (None, 38, 38, 288) 1152
['block2b_expand_conv[0][0]']
ization)

block2b_expand_activation (Act (None, 38, 38, 288) 0
['block2b_expand_bn[0][0]']
ivation)

block2b_dwconv (DepthwiseConv2 (None, 38, 38, 288) 2592
['block2b_expand_activation[0][0]
D)

block2b_bn (BatchNormalization (None, 38, 38, 288) 1152
['block2b_dwconv[0][0]']
)

block2b_activation (Activation (None, 38, 38, 288) 0
['block2b_bn[0][0]']
)

block2b_se_squeeze (GlobalAver (None, 288) 0
['block2b_activation[0][0]']
agePooling2D)

block2b_se_reshape (Reshape) (None, 1, 1, 288) 0
['block2b_se_squeeze[0][0]']

block2b_se_reduce (Conv2D) (None, 1, 1, 12) 3468
['block2b_se_reshape[0][0]']

block2b_se_expand (Conv2D) (None, 1, 1, 288) 3744
['block2b_se_reduce[0][0]']

```

```

    block2b_se_excite (Multiply)    (None, 38, 38, 288)  0
['block2b_activation[0][0]',
'block2b_se_expand[0][0]']

    block2b_project_conv (Conv2D)   (None, 38, 38, 48)  13824
['block2b_se_excite[0][0]']

    block2b_project_bn (BatchNormal (None, 38, 38, 48)  192
['block2b_project_conv[0][0]']
    ization)

    block2b_drop (Dropout)          (None, 38, 38, 48)  0
['block2b_project_bn[0][0]']

    block2b_add (Add)               (None, 38, 38, 48)  0
['block2b_drop[0][0]',
'block2a_project_bn[0][0]']

    block2c_expand_conv (Conv2D)    (None, 38, 38, 288)  13824
['block2b_add[0][0]']

    block2c_expand_bn (BatchNormal (None, 38, 38, 288)  1152
['block2c_expand_conv[0][0]']
    ization)

    block2c_expand_activation (Act (None, 38, 38, 288)  0
['block2c_expand_bn[0][0]']
    ivation)

    block2c_dwconv (DepthwiseConv2 (None, 38, 38, 288)  2592
['block2c_expand_activation[0][0]
    D)

    block2c_bn (BatchNormalization (None, 38, 38, 288)  1152
['block2c_dwconv[0][0]']
    )

    block2c_activation (Activation (None, 38, 38, 288)  0
['block2c_bn[0][0]']
    )

    block2c_se_squeeze (GlobalAver (None, 288)          0
['block2c_activation[0][0]']
    agePooling2D)

    block2c_se_reshape (Reshape)    (None, 1, 1, 288)  0
['block2c_se_squeeze[0][0]']

```


block2c_se_reduce (Conv2D) ['block2c_se_reshape[0][0]']	(None, 1, 1, 12)	3468
block2c_se_expand (Conv2D) ['block2c_se_reduce[0][0]']	(None, 1, 1, 288)	3744
block2c_se_excite (Multiply) ['block2c_activation[0][0]', 'block2c_se_expand[0][0]']	(None, 38, 38, 288)	0
block2c_project_conv (Conv2D) ['block2c_se_excite[0][0]']	(None, 38, 38, 48)	13824
block2c_project_bn (BatchNormal lization) ['block2c_project_conv[0][0]']	(None, 38, 38, 48)	192
block2c_drop (Dropout) ['block2c_project_bn[0][0]']	(None, 38, 38, 48)	0
block2c_add (Add) ['block2c_drop[0][0]', 'block2b_add[0][0]']	(None, 38, 38, 48)	0
block2d_expand_conv (Conv2D) ['block2c_add[0][0]']	(None, 38, 38, 288)	13824
block2d_expand_bn (BatchNormal lization) ['block2d_expand_conv[0][0]']	(None, 38, 38, 288)	1152
block2d_expand_activation (Act ivation) ['block2d_expand_bn[0][0]']	(None, 38, 38, 288)	0
block2d_dwconv (DepthwiseConv2 D) ['block2d_expand_activation[0][0]']	(None, 38, 38, 288)	2592
block2d_bn (BatchNormalization) ['block2d_dwconv[0][0]']	(None, 38, 38, 288)	1152
block2d_activation (Activation) ['block2d_bn[0][0]']	(None, 38, 38, 288)	0

block2d_se_squeeze (GlobalAveragePooling2D)	(None, 288)	0	
['block2d_activation[0][0]']			
block2d_se_reshape (Reshape)	(None, 1, 1, 288)	0	
['block2d_se_squeeze[0][0]']			
block2d_se_reduce (Conv2D)	(None, 1, 1, 12)	3468	
['block2d_se_reshape[0][0]']			
block2d_se_expand (Conv2D)	(None, 1, 1, 288)	3744	
['block2d_se_reduce[0][0]']			
block2d_se_excite (Multiply)	(None, 38, 38, 288)	0	
['block2d_activation[0][0]', 'block2d_se_expand[0][0]']			
block2d_project_conv (Conv2D)	(None, 38, 38, 48)	13824	
['block2d_se_excite[0][0]']			
block2d_project_bn (BatchNormalization)	(None, 38, 38, 48)	192	
['block2d_project_conv[0][0]']			
block2d_drop (Dropout)	(None, 38, 38, 48)	0	
['block2d_project_bn[0][0]']			
block2d_add (Add)	(None, 38, 38, 48)	0	
['block2d_drop[0][0]', 'block2c_add[0][0]']			
block2e_expand_conv (Conv2D)	(None, 38, 38, 288)	13824	
['block2d_add[0][0]']			
block2e_expand_bn (BatchNormalization)	(None, 38, 38, 288)	1152	
['block2e_expand_conv[0][0]']			
block2e_expand_activation (Activation)	(None, 38, 38, 288)	0	
['block2e_expand_bn[0][0]']			
block2e_dwconv (DepthwiseConv2D)	(None, 38, 38, 288)	2592	
['block2e_expand_activation[0][0]']			
block2e_bn (BatchNormalization)	(None, 38, 38, 288)	1152	
['block2e_dwconv[0][0]']			

```

)

block2e_activation (Activation (None, 38, 38, 288) 0
['block2e_bn[0][0]']
)

block2e_se_squeeze (GlobalAveragePooling2D) (None, 288) 0
['block2e_activation[0][0]']

block2e_se_reshape (Reshape) (None, 1, 1, 288) 0
['block2e_se_squeeze[0][0]']

block2e_se_reduce (Conv2D) (None, 1, 1, 12) 3468
['block2e_se_reshape[0][0]']

block2e_se_expand (Conv2D) (None, 1, 1, 288) 3744
['block2e_se_reduce[0][0]']

block2e_se_excite (Multiply) (None, 38, 38, 288) 0
['block2e_activation[0][0]',
'block2e_se_expand[0][0]']

block2e_project_conv (Conv2D) (None, 38, 38, 48) 13824
['block2e_se_excite[0][0]']

block2e_project_bn (BatchNormalization) (None, 38, 38, 48) 192
['block2e_project_conv[0][0]']

block2e_drop (Dropout) (None, 38, 38, 48) 0
['block2e_project_bn[0][0]']

block2e_add (Add) (None, 38, 38, 48) 0
['block2e_drop[0][0]',
'block2d_add[0][0]']

block2f_expand_conv (Conv2D) (None, 38, 38, 288) 13824
['block2e_add[0][0]']

block2f_expand_bn (BatchNormalization) (None, 38, 38, 288) 1152
['block2f_expand_conv[0][0]']

block2f_expand_activation (Activation) (None, 38, 38, 288) 0
['block2f_expand_bn[0][0]']

```

```

    block2f_dwconv (DepthwiseConv2 (None, 38, 38, 288) 2592
['block2f_expand_activation[0][0]
D)

    block2f_bn (BatchNormalization (None, 38, 38, 288) 1152
['block2f_dwconv[0][0]']
)

    block2f_activation (Activation (None, 38, 38, 288) 0
['block2f_bn[0][0]']
)

    block2f_se_squeeze (GlobalAver (None, 288) 0
['block2f_activation[0][0]']
agePooling2D)

    block2f_se_reshape (Reshape) (None, 1, 1, 288) 0
['block2f_se_squeeze[0][0]']

    block2f_se_reduce (Conv2D) (None, 1, 1, 12) 3468
['block2f_se_reshape[0][0]']

    block2f_se_expand (Conv2D) (None, 1, 1, 288) 3744
['block2f_se_reduce[0][0]']

    block2f_se_excite (Multiply) (None, 38, 38, 288) 0
['block2f_activation[0][0]',
'block2f_se_expand[0][0]']

    block2f_project_conv (Conv2D) (None, 38, 38, 48) 13824
['block2f_se_excite[0][0]']

    block2f_project_bn (BatchNorma (None, 38, 38, 48) 192
['block2f_project_conv[0][0]']
lization)

    block2f_drop (Dropout) (None, 38, 38, 48) 0
['block2f_project_bn[0][0]']

    block2f_add (Add) (None, 38, 38, 48) 0
['block2f_drop[0][0]',
'block2e_add[0][0]']

    block2g_expand_conv (Conv2D) (None, 38, 38, 288) 13824
['block2f_add[0][0]']

    block2g_expand_bn (BatchNormal (None, 38, 38, 288) 1152
['block2g_expand_conv[0][0]']

```

```

ization)

block2g_expand_activation (Act (None, 38, 38, 288) 0
['block2g_expand_bn[0][0]']
ivation)

block2g_dwconv (DepthwiseConv2 (None, 38, 38, 288) 2592
['block2g_expand_activation[0][0]
D)

block2g_bn (BatchNormalization (None, 38, 38, 288) 1152
['block2g_dwconv[0][0]']
)

block2g_activation (Activation (None, 38, 38, 288) 0
['block2g_bn[0][0]']
)

block2g_se_squeeze (GlobalAver (None, 288) 0
['block2g_activation[0][0]']
agePooling2D)

block2g_se_reshape (Reshape) (None, 1, 1, 288) 0
['block2g_se_squeeze[0][0]']

block2g_se_reduce (Conv2D) (None, 1, 1, 12) 3468
['block2g_se_reshape[0][0]']

block2g_se_expand (Conv2D) (None, 1, 1, 288) 3744
['block2g_se_reduce[0][0]']

block2g_se_excite (Multiply) (None, 38, 38, 288) 0
['block2g_activation[0][0]',
'block2g_se_expand[0][0]']

block2g_project_conv (Conv2D) (None, 38, 38, 48) 13824
['block2g_se_excite[0][0]']

block2g_project_bn (BatchNorma (None, 38, 38, 48) 192
['block2g_project_conv[0][0]']
lization)

block2g_drop (Dropout) (None, 38, 38, 48) 0
['block2g_project_bn[0][0]']

block2g_add (Add) (None, 38, 38, 48) 0
['block2g_drop[0][0]',
'block2f_add[0][0]']

```

```

block3a_expand_conv (Conv2D)    (None, 38, 38, 288) 13824
['block2g_add[0][0]']

block3a_expand_bn (BatchNormal (None, 38, 38, 288) 1152
['block3a_expand_conv[0][0]']
ization)

block3a_expand_activation (Act (None, 38, 38, 288) 0
['block3a_expand_bn[0][0]']
ivation)

block3a_dwconv_pad (ZeroPaddin (None, 41, 41, 288) 0
['block3a_expand_activation[0][0]
g2D)

block3a_dwconv (DepthwiseConv2 (None, 19, 19, 288) 7200
['block3a_dwconv_pad[0][0]']
D)

block3a_bn (BatchNormalization (None, 19, 19, 288) 1152
['block3a_dwconv[0][0]']
)

block3a_activation (Activation (None, 19, 19, 288) 0
['block3a_bn[0][0]']
)

block3a_se_squeeze (GlobalAver (None, 288) 0
['block3a_activation[0][0]']
agePooling2D)

block3a_se_reshape (Reshape)    (None, 1, 1, 288) 0
['block3a_se_squeeze[0][0]']

block3a_se_reduce (Conv2D)      (None, 1, 1, 12) 3468
['block3a_se_reshape[0][0]']

block3a_se_expand (Conv2D)      (None, 1, 1, 288) 3744
['block3a_se_reduce[0][0]']

block3a_se_excite (Multiply)    (None, 19, 19, 288) 0
['block3a_activation[0][0]',
'block3a_se_expand[0][0]']

block3a_project_conv (Conv2D)   (None, 19, 19, 80) 23040
['block3a_se_excite[0][0]']

```

```

    block3a_project_bn (BatchNormal (None, 19, 19, 80) 320
['block3a_project_conv[0][0]']
    lization)

    block3b_expand_conv (Conv2D) (None, 19, 19, 480) 38400
['block3a_project_bn[0][0]']

    block3b_expand_bn (BatchNormal (None, 19, 19, 480) 1920
['block3b_expand_conv[0][0]']
    ization)

    block3b_expand_activation (Act (None, 19, 19, 480) 0
['block3b_expand_bn[0][0]']
    ivation)

    block3b_dwconv (DepthwiseConv2 (None, 19, 19, 480) 12000
['block3b_expand_activation[0][0]
    D)

    block3b_bn (BatchNormalization (None, 19, 19, 480) 1920
['block3b_dwconv[0][0]']
    )

    block3b_activation (Activation (None, 19, 19, 480) 0
['block3b_bn[0][0]']
    )

    block3b_se_squeeze (GlobalAver (None, 480) 0
['block3b_activation[0][0]']
    agePooling2D)

    block3b_se_reshape (Reshape) (None, 1, 1, 480) 0
['block3b_se_squeeze[0][0]']

    block3b_se_reduce (Conv2D) (None, 1, 1, 20) 9620
['block3b_se_reshape[0][0]']

    block3b_se_expand (Conv2D) (None, 1, 1, 480) 10080
['block3b_se_reduce[0][0]']

    block3b_se_excite (Multiply) (None, 19, 19, 480) 0
['block3b_activation[0][0]',
    'block3b_se_expand[0][0]']

    block3b_project_conv (Conv2D) (None, 19, 19, 80) 38400
['block3b_se_excite[0][0]']

    block3b_project_bn (BatchNorma (None, 19, 19, 80) 320

```

```

['block3b_project_conv[0][0]']
lization)

block3b_drop (Dropout)          (None, 19, 19, 80)    0
['block3b_project_bn[0][0]']

block3b_add (Add)                (None, 19, 19, 80)    0
['block3b_drop[0][0]',
'block3a_project_bn[0][0]']

block3c_expand_conv (Conv2D)     (None, 19, 19, 480)  38400
['block3b_add[0][0]']

block3c_expand_bn (BatchNormal   (None, 19, 19, 480)  1920
['block3c_expand_conv[0][0]']
ization)

block3c_expand_activation (Act   (None, 19, 19, 480)  0
['block3c_expand_bn[0][0]']
ivation)

block3c_dwconv (DepthwiseConv2   (None, 19, 19, 480)  12000
['block3c_expand_activation[0][0]
D)

block3c_bn (BatchNormalization   (None, 19, 19, 480)  1920
['block3c_dwconv[0][0]']
)

block3c_activation (Activation   (None, 19, 19, 480)  0
['block3c_bn[0][0]']
)

block3c_se_squeeze (GlobalAver   (None, 480)          0
['block3c_activation[0][0]']
agePooling2D)

block3c_se_reshape (Reshape)     (None, 1, 1, 480)    0
['block3c_se_squeeze[0][0]']

block3c_se_reduce (Conv2D)       (None, 1, 1, 20)     9620
['block3c_se_reshape[0][0]']

block3c_se_expand (Conv2D)       (None, 1, 1, 480)    10080
['block3c_se_reduce[0][0]']

block3c_se_excite (Multiply)     (None, 19, 19, 480)  0
['block3c_activation[0][0]',

```



```

'block3c_se_expand[0][0]']

block3c_project_conv (Conv2D) (None, 19, 19, 80) 38400
['block3c_se_excite[0][0]']

block3c_project_bn (BatchNormal (None, 19, 19, 80) 320
['block3c_project_conv[0][0]']
ization)

block3c_drop (Dropout) (None, 19, 19, 80) 0
['block3c_project_bn[0][0]']

block3c_add (Add) (None, 19, 19, 80) 0
['block3c_drop[0][0]',
'block3b_add[0][0]']

block3d_expand_conv (Conv2D) (None, 19, 19, 480) 38400
['block3c_add[0][0]']

block3d_expand_bn (BatchNormal (None, 19, 19, 480) 1920
['block3d_expand_conv[0][0]']
ization)

block3d_expand_activation (Act (None, 19, 19, 480) 0
['block3d_expand_bn[0][0]']
ivation)

block3d_dwconv (DepthwiseConv2 (None, 19, 19, 480) 12000
['block3d_expand_activation[0][0]
D)

block3d_bn (BatchNormalization (None, 19, 19, 480) 1920
['block3d_dwconv[0][0]']
)

block3d_activation (Activation (None, 19, 19, 480) 0
['block3d_bn[0][0]']
)

block3d_se_squeeze (GlobalAver (None, 480) 0
['block3d_activation[0][0]']
agePooling2D)

block3d_se_reshape (Reshape) (None, 1, 1, 480) 0
['block3d_se_squeeze[0][0]']

block3d_se_reduce (Conv2D) (None, 1, 1, 20) 9620
['block3d_se_reshape[0][0]']

```

```

    block3d_se_expand (Conv2D)      (None, 1, 1, 480)    10080
['block3d_se_reduce[0][0]']

    block3d_se_excite (Multiply)    (None, 19, 19, 480)  0
['block3d_activation[0][0]',
'block3d_se_expand[0][0]']

    block3d_project_conv (Conv2D)   (None, 19, 19, 80)   38400
['block3d_se_excite[0][0]']

    block3d_project_bn (BatchNorma  (None, 19, 19, 80)   320
['block3d_project_conv[0][0]']
lization)

    block3d_drop (Dropout)          (None, 19, 19, 80)   0
['block3d_project_bn[0][0]']

    block3d_add (Add)               (None, 19, 19, 80)   0
['block3d_drop[0][0]',
'block3c_add[0][0]']

    block3e_expand_conv (Conv2D)    (None, 19, 19, 480)  38400
['block3d_add[0][0]']

    block3e_expand_bn (BatchNormal  (None, 19, 19, 480)  1920
['block3e_expand_conv[0][0]']
lization)

    block3e_expand_activation (Act  (None, 19, 19, 480)  0
['block3e_expand_bn[0][0]']
ivation)

    block3e_dwconv (DepthwiseConv2  (None, 19, 19, 480)  12000
['block3e_expand_activation[0][0]
D)

    block3e_bn (BatchNormalization  (None, 19, 19, 480)  1920
['block3e_dwconv[0][0]']
)

    block3e_activation (Activation  (None, 19, 19, 480)  0
['block3e_bn[0][0]']
)

    block3e_se_squeeze (GlobalAver  (None, 480)          0
['block3e_activation[0][0]']
agePooling2D)

```

block3e_se_reshape (Reshape)	(None, 1, 1, 480)	0
['block3e_se_squeeze[0][0]']		
block3e_se_reduce (Conv2D)	(None, 1, 1, 20)	9620
['block3e_se_reshape[0][0]']		
block3e_se_expand (Conv2D)	(None, 1, 1, 480)	10080
['block3e_se_reduce[0][0]']		
block3e_se_excite (Multiply)	(None, 19, 19, 480)	0
['block3e_activation[0][0]', 'block3e_se_expand[0][0]']		
block3e_project_conv (Conv2D)	(None, 19, 19, 80)	38400
['block3e_se_excite[0][0]']		
block3e_project_bn (BatchNormal	(None, 19, 19, 80)	320
['block3e_project_conv[0][0]'] lization)		
block3e_drop (Dropout)	(None, 19, 19, 80)	0
['block3e_project_bn[0][0]']		
block3e_add (Add)	(None, 19, 19, 80)	0
['block3e_drop[0][0]', 'block3d_add[0][0]']		
block3f_expand_conv (Conv2D)	(None, 19, 19, 480)	38400
['block3e_add[0][0]']		
block3f_expand_bn (BatchNormal	(None, 19, 19, 480)	1920
['block3f_expand_conv[0][0]'] lization)		
block3f_expand_activation (Act	(None, 19, 19, 480)	0
['block3f_expand_bn[0][0]'] ivation)		
block3f_dwconv (DepthwiseConv2	(None, 19, 19, 480)	12000
['block3f_expand_activation[0][0]' D)		
block3f_bn (BatchNormalization	(None, 19, 19, 480)	1920
['block3f_dwconv[0][0]'])		
block3f_activation (Activation	(None, 19, 19, 480)	0

```

['block3f_bn[0][0]']
)

block3f_se_squeeze (GlobalAveragePooling2D) (None, 480) 0
['block3f_activation[0][0]']

block3f_se_reshape (Reshape) (None, 1, 1, 480) 0
['block3f_se_squeeze[0][0]']

block3f_se_reduce (Conv2D) (None, 1, 1, 20) 9620
['block3f_se_reshape[0][0]']

block3f_se_expand (Conv2D) (None, 1, 1, 480) 10080
['block3f_se_reduce[0][0]']

block3f_se_excite (Multiply) (None, 19, 19, 480) 0
['block3f_activation[0][0]',
'block3f_se_expand[0][0]']

block3f_project_conv (Conv2D) (None, 19, 19, 80) 38400
['block3f_se_excite[0][0]']

block3f_project_bn (BatchNormalization) (None, 19, 19, 80) 320
['block3f_project_conv[0][0]']

block3f_drop (Dropout) (None, 19, 19, 80) 0
['block3f_project_bn[0][0]']

block3f_add (Add) (None, 19, 19, 80) 0
['block3f_drop[0][0]',
'block3e_add[0][0]']

block3g_expand_conv (Conv2D) (None, 19, 19, 480) 38400
['block3f_add[0][0]']

block3g_expand_bn (BatchNormalization) (None, 19, 19, 480) 1920
['block3g_expand_conv[0][0]']

block3g_expand_activation (Activation) (None, 19, 19, 480) 0
['block3g_expand_bn[0][0]']

block3g_dwconv (DepthwiseConv2D) (None, 19, 19, 480) 12000
['block3g_expand_activation[0][0]']
D)
']

```

```

    block3g_bn (BatchNormalization (None, 19, 19, 480) 1920
['block3g_dwconv[0][0]']
)

    block3g_activation (Activation (None, 19, 19, 480) 0
['block3g_bn[0][0]']
)

    block3g_se_squeeze (GlobalAveragePooling2D) (None, 480) 0
['block3g_activation[0][0]']

    block3g_se_reshape (Reshape) (None, 1, 1, 480) 0
['block3g_se_squeeze[0][0]']

    block3g_se_reduce (Conv2D) (None, 1, 1, 20) 9620
['block3g_se_reshape[0][0]']

    block3g_se_expand (Conv2D) (None, 1, 1, 480) 10080
['block3g_se_reduce[0][0]']

    block3g_se_excite (Multiply) (None, 19, 19, 480) 0
['block3g_activation[0][0]',
'block3g_se_expand[0][0]']

    block3g_project_conv (Conv2D) (None, 19, 19, 80) 38400
['block3g_se_excite[0][0]']

    block3g_project_bn (BatchNormalization) (None, 19, 19, 80) 320
['block3g_project_conv[0][0]']

    block3g_drop (Dropout) (None, 19, 19, 80) 0
['block3g_project_bn[0][0]']

    block3g_add (Add) (None, 19, 19, 80) 0
['block3g_drop[0][0]',
'block3f_add[0][0]']

    block4a_expand_conv (Conv2D) (None, 19, 19, 480) 38400
['block3g_add[0][0]']

    block4a_expand_bn (BatchNormalization) (None, 19, 19, 480) 1920
['block4a_expand_conv[0][0]']

    block4a_expand_activation (Activation) (None, 19, 19, 480) 0

```

```

['block4a_expand_bn[0][0]']
ivation)

block4a_dwconv_pad (ZeroPaddin (None, 21, 21, 480) 0
['block4a_expand_activation[0][0]
g2D)

block4a_dwconv (DepthwiseConv2 (None, 10, 10, 480) 4320
['block4a_dwconv_pad[0][0]']
D)

block4a_bn (BatchNormalization (None, 10, 10, 480) 1920
['block4a_dwconv[0][0]']
)

block4a_activation (Activation (None, 10, 10, 480) 0
['block4a_bn[0][0]']
)

block4a_se_squeeze (GlobalAver (None, 480) 0
['block4a_activation[0][0]']
agePooling2D)

block4a_se_reshape (Reshape) (None, 1, 1, 480) 0
['block4a_se_squeeze[0][0]']

block4a_se_reduce (Conv2D) (None, 1, 1, 20) 9620
['block4a_se_reshape[0][0]']

block4a_se_expand (Conv2D) (None, 1, 1, 480) 10080
['block4a_se_reduce[0][0]']

block4a_se_excite (Multiply) (None, 10, 10, 480) 0
['block4a_activation[0][0]'],
['block4a_se_expand[0][0]']

block4a_project_conv (Conv2D) (None, 10, 10, 160) 76800
['block4a_se_excite[0][0]']

block4a_project_bn (BatchNorma (None, 10, 10, 160) 640
['block4a_project_conv[0][0]']
lization)

block4b_expand_conv (Conv2D) (None, 10, 10, 960) 153600
['block4a_project_bn[0][0]']

block4b_expand_bn (BatchNormal (None, 10, 10, 960) 3840
['block4b_expand_conv[0][0]']

```

```

ization)

block4b_expand_activation (Act (None, 10, 10, 960) 0
['block4b_expand_bn[0][0]']
ivation)

block4b_dwconv (DepthwiseConv2 (None, 10, 10, 960) 8640
['block4b_expand_activation[0][0]
D)

block4b_bn (BatchNormalization (None, 10, 10, 960) 3840
['block4b_dwconv[0][0]']
)

block4b_activation (Activation (None, 10, 10, 960) 0
['block4b_bn[0][0]']
)

block4b_se_squeeze (GlobalAver (None, 960) 0
['block4b_activation[0][0]']
agePooling2D)

block4b_se_reshape (Reshape) (None, 1, 1, 960) 0
['block4b_se_squeeze[0][0]']

block4b_se_reduce (Conv2D) (None, 1, 1, 40) 38440
['block4b_se_reshape[0][0]']

block4b_se_expand (Conv2D) (None, 1, 1, 960) 39360
['block4b_se_reduce[0][0]']

block4b_se_excite (Multiply) (None, 10, 10, 960) 0
['block4b_activation[0][0]',
'block4b_se_expand[0][0]']

block4b_project_conv (Conv2D) (None, 10, 10, 160) 153600
['block4b_se_excite[0][0]']

block4b_project_bn (BatchNorma (None, 10, 10, 160) 640
['block4b_project_conv[0][0]']
lization)

block4b_drop (Dropout) (None, 10, 10, 160) 0
['block4b_project_bn[0][0]']

block4b_add (Add) (None, 10, 10, 160) 0
['block4b_drop[0][0]',
'block4a_project_bn[0][0]']

```

```

    block4c_expand_conv (Conv2D)    (None, 10, 10, 960) 153600
['block4b_add[0][0]']

    block4c_expand_bn (BatchNormal (None, 10, 10, 960) 3840
['block4c_expand_conv[0][0]']
    ization)

    block4c_expand_activation (Act (None, 10, 10, 960) 0
['block4c_expand_bn[0][0]']
    ivation)

    block4c_dwconv (DepthwiseConv2 (None, 10, 10, 960) 8640
['block4c_expand_activation[0][0]
    D)

    block4c_bn (BatchNormalization (None, 10, 10, 960) 3840
['block4c_dwconv[0][0]']
    )

    block4c_activation (Activation (None, 10, 10, 960) 0
['block4c_bn[0][0]']
    )

    block4c_se_squeeze (GlobalAver (None, 960) 0
['block4c_activation[0][0]']
    agePooling2D)

    block4c_se_reshape (Reshape)    (None, 1, 1, 960) 0
['block4c_se_squeeze[0][0]']

    block4c_se_reduce (Conv2D)      (None, 1, 1, 40) 38440
['block4c_se_reshape[0][0]']

    block4c_se_expand (Conv2D)      (None, 1, 1, 960) 39360
['block4c_se_reduce[0][0]']

    block4c_se_excite (Multiply)    (None, 10, 10, 960) 0
['block4c_activation[0][0]',
'block4c_se_expand[0][0]']

    block4c_project_conv (Conv2D)   (None, 10, 10, 160) 153600
['block4c_se_excite[0][0]']

    block4c_project_bn (BatchNorma (None, 10, 10, 160) 640
['block4c_project_conv[0][0]']
    lization)

```



```

    block4c_drop (Dropout)          (None, 10, 10, 160)  0
['block4c_project_bn[0][0]']

    block4c_add (Add)                (None, 10, 10, 160)  0
['block4c_drop[0][0]',
'block4b_add[0][0]']

    block4d_expand_conv (Conv2D)     (None, 10, 10, 960) 153600
['block4c_add[0][0]']

    block4d_expand_bn (BatchNormal   (None, 10, 10, 960)  3840
['block4d_expand_conv[0][0]']
ization)

    block4d_expand_activation (Act    (None, 10, 10, 960)  0
['block4d_expand_bn[0][0]']
ivation)

    block4d_dwconv (DepthwiseConv2   (None, 10, 10, 960)  8640
['block4d_expand_activation[0][0]
D)

    block4d_bn (BatchNormalization   (None, 10, 10, 960)  3840
['block4d_dwconv[0][0]']
)

    block4d_activation (Activation    (None, 10, 10, 960)  0
['block4d_bn[0][0]']
)

    block4d_se_squeeze (GlobalAver    (None, 960)          0
['block4d_activation[0][0]']
agePooling2D)

    block4d_se_reshape (Reshape)      (None, 1, 1, 960)    0
['block4d_se_squeeze[0][0]']

    block4d_se_reduce (Conv2D)        (None, 1, 1, 40)     38440
['block4d_se_reshape[0][0]']

    block4d_se_expand (Conv2D)        (None, 1, 1, 960)    39360
['block4d_se_reduce[0][0]']

    block4d_se_excite (Multiply)      (None, 10, 10, 960)  0
['block4d_activation[0][0]',
'block4d_se_expand[0][0]']

    block4d_project_conv (Conv2D)     (None, 10, 10, 160) 153600

```

```

['block4d_se_excite[0][0]']

block4d_project_bn (BatchNormal (None, 10, 10, 160) 640
['block4d_project_conv[0][0]']
lization)

block4d_drop (Dropout) (None, 10, 10, 160) 0
['block4d_project_bn[0][0]']

block4d_add (Add) (None, 10, 10, 160) 0
['block4d_drop[0][0]',
'block4c_add[0][0]']

block4e_expand_conv (Conv2D) (None, 10, 10, 960) 153600
['block4d_add[0][0]']

block4e_expand_bn (BatchNormal (None, 10, 10, 960) 3840
['block4e_expand_conv[0][0]']
ization)

block4e_expand_activation (Act (None, 10, 10, 960) 0
['block4e_expand_bn[0][0]']
ivation)

block4e_dwconv (DepthwiseConv2 (None, 10, 10, 960) 8640
['block4e_expand_activation[0][0]
D)

block4e_bn (BatchNormalization (None, 10, 10, 960) 3840
['block4e_dwconv[0][0]']
)

block4e_activation (Activation (None, 10, 10, 960) 0
['block4e_bn[0][0]']
)

block4e_se_squeeze (GlobalAver (None, 960) 0
['block4e_activation[0][0]']
agePooling2D)

block4e_se_reshape (Reshape) (None, 1, 1, 960) 0
['block4e_se_squeeze[0][0]']

block4e_se_reduce (Conv2D) (None, 1, 1, 40) 38440
['block4e_se_reshape[0][0]']

block4e_se_expand (Conv2D) (None, 1, 1, 960) 39360
['block4e_se_reduce[0][0]']

```

```

    block4e_se_excite (Multiply)      (None, 10, 10, 960)  0
['block4e_activation[0][0]',
'block4e_se_expand[0][0]']

    block4e_project_conv (Conv2D)    (None, 10, 10, 160) 153600
['block4e_se_excite[0][0]']

    block4e_project_bn (BatchNormal (None, 10, 10, 160)  640
['block4e_project_conv[0][0]']
    ization)

    block4e_drop (Dropout)           (None, 10, 10, 160)  0
['block4e_project_bn[0][0]']

    block4e_add (Add)                (None, 10, 10, 160)  0
['block4e_drop[0][0]',
'block4d_add[0][0]']

    block4f_expand_conv (Conv2D)     (None, 10, 10, 960) 153600
['block4e_add[0][0]']

    block4f_expand_bn (BatchNormal (None, 10, 10, 960)  3840
['block4f_expand_conv[0][0]']
    ization)

    block4f_expand_activation (Act (None, 10, 10, 960)  0
['block4f_expand_bn[0][0]']
    ivation)

    block4f_dwconv (DepthwiseConv2 (None, 10, 10, 960)  8640
['block4f_expand_activation[0][0]
D)

    block4f_bn (BatchNormalization (None, 10, 10, 960)  3840
['block4f_dwconv[0][0]']
    )

    block4f_activation (Activation (None, 10, 10, 960)  0
['block4f_bn[0][0]']
    )

    block4f_se_squeeze (GlobalAver (None, 960)          0
['block4f_activation[0][0]']
    agePooling2D)

    block4f_se_reshape (Reshape)     (None, 1, 1, 960)  0
['block4f_se_squeeze[0][0]']

```

```

    block4f_se_reduce (Conv2D)      (None, 1, 1, 40)      38440
['block4f_se_reshape[0][0]']

    block4f_se_expand (Conv2D)      (None, 1, 1, 960)     39360
['block4f_se_reduce[0][0]']

    block4f_se_excite (Multiply)    (None, 10, 10, 960)  0
['block4f_activation[0][0]',
'block4f_se_expand[0][0]']

    block4f_project_conv (Conv2D)   (None, 10, 10, 160)  153600
['block4f_se_excite[0][0]']

    block4f_project_bn (BatchNorma  (None, 10, 10, 160)  640
['block4f_project_conv[0][0]']
lization)

    block4f_drop (Dropout)          (None, 10, 10, 160)  0
['block4f_project_bn[0][0]']

    block4f_add (Add)               (None, 10, 10, 160)  0
['block4f_drop[0][0]',
'block4e_add[0][0]']

    block4g_expand_conv (Conv2D)    (None, 10, 10, 960)  153600
['block4f_add[0][0]']

    block4g_expand_bn (BatchNormal  (None, 10, 10, 960)  3840
['block4g_expand_conv[0][0]']
lization)

    block4g_expand_activation (Act  (None, 10, 10, 960)  0
['block4g_expand_bn[0][0]']
ivation)

    block4g_dwconv (DepthwiseConv2  (None, 10, 10, 960)  8640
['block4g_expand_activation[0][0]
D)

    block4g_bn (BatchNormalization  (None, 10, 10, 960)  3840
['block4g_dwconv[0][0]']
)

    block4g_activation (Activation  (None, 10, 10, 960)  0
['block4g_bn[0][0]']
)

```

block4g_se_squeeze (GlobalAveragePooling2D)	(None, 960)	0
['block4g_activation[0][0]']		
block4g_se_reshape (Reshape)	(None, 1, 1, 960)	0
['block4g_se_squeeze[0][0]']		
block4g_se_reduce (Conv2D)	(None, 1, 1, 40)	38440
['block4g_se_reshape[0][0]']		
block4g_se_expand (Conv2D)	(None, 1, 1, 960)	39360
['block4g_se_reduce[0][0]']		
block4g_se_excite (Multiply)	(None, 10, 10, 960)	0
['block4g_activation[0][0]', 'block4g_se_expand[0][0]']		
block4g_project_conv (Conv2D)	(None, 10, 10, 160)	153600
['block4g_se_excite[0][0]']		
block4g_project_bn (BatchNormalization)	(None, 10, 10, 160)	640
['block4g_project_conv[0][0]']		
block4g_drop (Dropout)	(None, 10, 10, 160)	0
['block4g_project_bn[0][0]']		
block4g_add (Add)	(None, 10, 10, 160)	0
['block4g_drop[0][0]', 'block4f_add[0][0]']		
block4h_expand_conv (Conv2D)	(None, 10, 10, 960)	153600
['block4g_add[0][0]']		
block4h_expand_bn (BatchNormalization)	(None, 10, 10, 960)	3840
['block4h_expand_conv[0][0]']		
block4h_expand_activation (Activation)	(None, 10, 10, 960)	0
['block4h_expand_bn[0][0]']		
block4h_dwconv (DepthwiseConv2D)	(None, 10, 10, 960)	8640
['block4h_expand_activation[0][0]']		
block4h_bn (BatchNormalization)	(None, 10, 10, 960)	3840
['block4h_dwconv[0][0]']		

```

)

block4h_activation (Activation (None, 10, 10, 960) 0
['block4h_bn[0][0]'])
)

block4h_se_squeeze (GlobalAveragePooling2D) (None, 960) 0
['block4h_activation[0][0]']

block4h_se_reshape (Reshape) (None, 1, 1, 960) 0
['block4h_se_squeeze[0][0]']

block4h_se_reduce (Conv2D) (None, 1, 1, 40) 38440
['block4h_se_reshape[0][0]']

block4h_se_expand (Conv2D) (None, 1, 1, 960) 39360
['block4h_se_reduce[0][0]']

block4h_se_excite (Multiply) (None, 10, 10, 960) 0
['block4h_activation[0][0]',
'block4h_se_expand[0][0]']

block4h_project_conv (Conv2D) (None, 10, 10, 160) 153600
['block4h_se_excite[0][0]']

block4h_project_bn (BatchNormalization) (None, 10, 10, 160) 640
['block4h_project_conv[0][0]']

block4h_drop (Dropout) (None, 10, 10, 160) 0
['block4h_project_bn[0][0]']

block4h_add (Add) (None, 10, 10, 160) 0
['block4h_drop[0][0]',
'block4g_add[0][0]']

block4i_expand_conv (Conv2D) (None, 10, 10, 960) 153600
['block4h_add[0][0]']

block4i_expand_bn (BatchNormalization) (None, 10, 10, 960) 3840
['block4i_expand_conv[0][0]']

block4i_expand_activation (Activation) (None, 10, 10, 960) 0
['block4i_expand_bn[0][0]']

```

```

    block4i_dwconv (DepthwiseConv2 (None, 10, 10, 960) 8640
['block4i_expand_activation[0][0]
D)

    block4i_bn (BatchNormalization (None, 10, 10, 960) 3840
['block4i_dwconv[0][0]')

    block4i_activation (Activation (None, 10, 10, 960) 0
['block4i_bn[0][0]')

    block4i_se_squeeze (GlobalAveragePooling2D) (None, 960) 0
['block4i_activation[0][0]']

    block4i_se_reshape (Reshape) (None, 1, 1, 960) 0
['block4i_se_squeeze[0][0]']

    block4i_se_reduce (Conv2D) (None, 1, 1, 40) 38440
['block4i_se_reshape[0][0]']

    block4i_se_expand (Conv2D) (None, 1, 1, 960) 39360
['block4i_se_reduce[0][0]']

    block4i_se_excite (Multiply) (None, 10, 10, 960) 0
['block4i_activation[0][0]',
'block4i_se_expand[0][0]']

    block4i_project_conv (Conv2D) (None, 10, 10, 160) 153600
['block4i_se_excite[0][0]']

    block4i_project_bn (BatchNormalization) (None, 10, 10, 160) 640
['block4i_project_conv[0][0]']

    block4i_drop (Dropout) (None, 10, 10, 160) 0
['block4i_project_bn[0][0]']

    block4i_add (Add) (None, 10, 10, 160) 0
['block4i_drop[0][0]',
'block4h_add[0][0]']

    block4j_expand_conv (Conv2D) (None, 10, 10, 960) 153600
['block4i_add[0][0]']

    block4j_expand_bn (BatchNormalization) (None, 10, 10, 960) 3840
['block4j_expand_conv[0][0]']

```

```

ization)

block4j_expand_activation (Activation (None, 10, 10, 960) 0
['block4j_expand_bn[0][0]'])
ivation)

block4j_dwconv (DepthwiseConv2D (None, 10, 10, 960) 8640
['block4j_expand_activation[0][0]
D)

block4j_bn (BatchNormalization (None, 10, 10, 960) 3840
['block4j_dwconv[0][0]'])
)

block4j_activation (Activation (None, 10, 10, 960) 0
['block4j_bn[0][0]'])
)

block4j_se_squeeze (GlobalAveragePooling2D (None, 960) 0
['block4j_activation[0][0]'])
agePooling2D)

block4j_se_reshape (Reshape (None, 1, 1, 960) 0
['block4j_se_squeeze[0][0]'])

block4j_se_reduce (Conv2D (None, 1, 1, 40) 38440
['block4j_se_reshape[0][0]'])

block4j_se_expand (Conv2D (None, 1, 1, 960) 39360
['block4j_se_reduce[0][0]'])

block4j_se_excite (Multiply (None, 10, 10, 960) 0
['block4j_activation[0][0]',
'block4j_se_expand[0][0]'])

block4j_project_conv (Conv2D (None, 10, 10, 160) 153600
['block4j_se_excite[0][0]'])

block4j_project_bn (BatchNormalization (None, 10, 10, 160) 640
['block4j_project_conv[0][0]'])
lization)

block4j_drop (Dropout (None, 10, 10, 160) 0
['block4j_project_bn[0][0]'])

block4j_add (Add (None, 10, 10, 160) 0
['block4j_drop[0][0]',
'block4i_add[0][0]'])

```



```

    block5a_expand_conv (Conv2D)    (None, 10, 10, 960) 153600
['block4j_add[0][0]']

    block5a_expand_bn (BatchNormal (None, 10, 10, 960) 3840
['block5a_expand_conv[0][0]']
    ization)

    block5a_expand_activation (Act (None, 10, 10, 960) 0
['block5a_expand_bn[0][0]']
    ivation)

    block5a_dwconv (DepthwiseConv2 (None, 10, 10, 960) 24000
['block5a_expand_activation[0][0]
    D)

    block5a_bn (BatchNormalization (None, 10, 10, 960) 3840
['block5a_dwconv[0][0]']
    )

    block5a_activation (Activation (None, 10, 10, 960) 0
['block5a_bn[0][0]']
    )

    block5a_se_squeeze (GlobalAver (None, 960) 0
['block5a_activation[0][0]']
    agePooling2D)

    block5a_se_reshape (Reshape)    (None, 1, 1, 960) 0
['block5a_se_squeeze[0][0]']

    block5a_se_reduce (Conv2D)      (None, 1, 1, 40) 38440
['block5a_se_reshape[0][0]']

    block5a_se_expand (Conv2D)      (None, 1, 1, 960) 39360
['block5a_se_reduce[0][0]']

    block5a_se_excite (Multiply)    (None, 10, 10, 960) 0
['block5a_activation[0][0]',
'block5a_se_expand[0][0]']

    block5a_project_conv (Conv2D)   (None, 10, 10, 224) 215040
['block5a_se_excite[0][0]']

    block5a_project_bn (BatchNorma (None, 10, 10, 224) 896
['block5a_project_conv[0][0]']
    lization)

```

```

    block5b_expand_conv (Conv2D)      (None, 10, 10, 1344  301056
['block5a_project_bn[0][0]']
    )

    block5b_expand_bn (BatchNormal    (None, 10, 10, 1344  5376
['block5b_expand_conv[0][0]']
    ization)
    )

    block5b_expand_activation (Act     (None, 10, 10, 1344  0
['block5b_expand_bn[0][0]']
    ivation)
    )

    block5b_dwconv (DepthwiseConv2    (None, 10, 10, 1344  33600
['block5b_expand_activation[0][0]
    D)
    )

    block5b_bn (BatchNormalization    (None, 10, 10, 1344  5376
['block5b_dwconv[0][0]']
    )
    )

    block5b_activation (Activation     (None, 10, 10, 1344  0
['block5b_bn[0][0]']
    )
    )

    block5b_se_squeeze (GlobalAver     (None, 1344)          0
['block5b_activation[0][0]']
    agePooling2D)

    block5b_se_reshape (Reshape)       (None, 1, 1, 1344)    0
['block5b_se_squeeze[0][0]']

    block5b_se_reduce (Conv2D)         (None, 1, 1, 56)      75320
['block5b_se_reshape[0][0]']

    block5b_se_expand (Conv2D)         (None, 1, 1, 1344)    76608
['block5b_se_reduce[0][0]']

    block5b_se_excite (Multiply)       (None, 10, 10, 1344  0
['block5b_activation[0][0]',
    )
    'block5b_se_expand[0][0]']

    block5b_project_conv (Conv2D)      (None, 10, 10, 224)   301056
['block5b_se_excite[0][0]']

    block5b_project_bn (BatchNorma     (None, 10, 10, 224)   896
['block5b_project_conv[0][0]']
    lization)

```

```

    block5b_drop (Dropout)          (None, 10, 10, 224)  0
['block5b_project_bn[0][0]']

    block5b_add (Add)                (None, 10, 10, 224)  0
['block5b_drop[0][0]',
'block5a_project_bn[0][0]']

    block5c_expand_conv (Conv2D)     (None, 10, 10, 1344  301056
['block5b_add[0][0]']
)

    block5c_expand_bn (BatchNormal   (None, 10, 10, 1344  5376
['block5c_expand_conv[0][0]']
ization)
)

    block5c_expand_activation (Act   (None, 10, 10, 1344  0
['block5c_expand_bn[0][0]']
ivation)
)

    block5c_dwconv (DepthwiseConv2   (None, 10, 10, 1344  33600
['block5c_expand_activation[0][0]
D)
)

    block5c_bn (BatchNormalization   (None, 10, 10, 1344  5376
['block5c_dwconv[0][0]']
)
)

    block5c_activation (Activation   (None, 10, 10, 1344  0
['block5c_bn[0][0]']
)
)

    block5c_se_squeeze (GlobalAver    (None, 1344)      0
['block5c_activation[0][0]']
agePooling2D)

    block5c_se_reshape (Reshape)     (None, 1, 1, 1344)  0
['block5c_se_squeeze[0][0]']

    block5c_se_reduce (Conv2D)       (None, 1, 1, 56)    75320
['block5c_se_reshape[0][0]']

    block5c_se_expand (Conv2D)       (None, 1, 1, 1344)  76608
['block5c_se_reduce[0][0]']

    block5c_se_excite (Multiply)     (None, 10, 10, 1344  0
['block5c_activation[0][0]',
)

```

```

'block5c_se_expand[0][0]']

block5c_project_conv (Conv2D) (None, 10, 10, 224) 301056
['block5c_se_excite[0][0]']

block5c_project_bn (BatchNormal (None, 10, 10, 224) 896
['block5c_project_conv[0][0]']
lization)

block5c_drop (Dropout) (None, 10, 10, 224) 0
['block5c_project_bn[0][0]']

block5c_add (Add) (None, 10, 10, 224) 0
['block5c_drop[0][0]',
'block5b_add[0][0]']

block5d_expand_conv (Conv2D) (None, 10, 10, 1344 301056
['block5c_add[0][0]']
)

block5d_expand_bn (BatchNormal (None, 10, 10, 1344 5376
['block5d_expand_conv[0][0]']
lization)
)

block5d_expand_activation (Act (None, 10, 10, 1344 0
['block5d_expand_bn[0][0]']
ivation)
)

block5d_dwconv (DepthwiseConv2 (None, 10, 10, 1344 33600
['block5d_expand_activation[0][0]
D)
)

'

block5d_bn (BatchNormalization (None, 10, 10, 1344 5376
['block5d_dwconv[0][0]']
)
)

block5d_activation (Activation (None, 10, 10, 1344 0
['block5d_bn[0][0]']
)
)

block5d_se_squeeze (GlobalAver (None, 1344) 0
['block5d_activation[0][0]']
agePooling2D)

block5d_se_reshape (Reshape) (None, 1, 1, 1344) 0
['block5d_se_squeeze[0][0]']

block5d_se_reduce (Conv2D) (None, 1, 1, 56) 75320

```

```

['block5d_se_reshape[0][0]']

    block5d_se_expand (Conv2D)      (None, 1, 1, 1344)    76608
['block5d_se_reduce[0][0]']

    block5d_se_excite (Multiply)    (None, 10, 10, 1344)  0
['block5d_activation[0][0]',
    )
'block5d_se_expand[0][0]']

    block5d_project_conv (Conv2D)   (None, 10, 10, 224)   301056
['block5d_se_excite[0][0]']

    block5d_project_bn (BatchNorma  (None, 10, 10, 224)   896
['block5d_project_conv[0][0]']
    lization)

    block5d_drop (Dropout)          (None, 10, 10, 224)   0
['block5d_project_bn[0][0]']

    block5d_add (Add)               (None, 10, 10, 224)   0
['block5d_drop[0][0]',
'block5c_add[0][0]']

    block5e_expand_conv (Conv2D)    (None, 10, 10, 1344)  301056
['block5d_add[0][0]']
    )

    block5e_expand_bn (BatchNormal  (None, 10, 10, 1344)  5376
['block5e_expand_conv[0][0]']
    ization)
    )

    block5e_expand_activation (Act   (None, 10, 10, 1344)  0
['block5e_expand_bn[0][0]']
    ivation)
    )

    block5e_dwconv (DepthwiseConv2  (None, 10, 10, 1344)  33600
['block5e_expand_activation[0][0]
D)
    )
    ']'

    block5e_bn (BatchNormalization  (None, 10, 10, 1344)  5376
['block5e_dwconv[0][0]']
    )
    )

    block5e_activation (Activation  (None, 10, 10, 1344)  0
['block5e_bn[0][0]']
    )
    )

```

```

    block5e_se_squeeze (GlobalAveragePooling2D) (None, 1344) 0
['block5e_activation[0][0]']

    block5e_se_reshape (Reshape) (None, 1, 1, 1344) 0
['block5e_se_squeeze[0][0]']

    block5e_se_reduce (Conv2D) (None, 1, 1, 56) 75320
['block5e_se_reshape[0][0]']

    block5e_se_expand (Conv2D) (None, 1, 1, 1344) 76608
['block5e_se_reduce[0][0]']

    block5e_se_excite (Multiply) (None, 10, 10, 1344) 0
['block5e_activation[0][0]',
)
['block5e_se_expand[0][0]']

    block5e_project_conv (Conv2D) (None, 10, 10, 224) 301056
['block5e_se_excite[0][0]']

    block5e_project_bn (BatchNormalization) (None, 10, 10, 224) 896
['block5e_project_conv[0][0]']

    block5e_drop (Dropout) (None, 10, 10, 224) 0
['block5e_project_bn[0][0]']

    block5e_add (Add) (None, 10, 10, 224) 0
['block5e_drop[0][0]',
'block5d_add[0][0]']

    block5f_expand_conv (Conv2D) (None, 10, 10, 1344) 301056
['block5e_add[0][0]']
)

    block5f_expand_bn (BatchNormalization) (None, 10, 10, 1344) 5376
['block5f_expand_conv[0][0]']
)

    block5f_expand_activation (Activation) (None, 10, 10, 1344) 0
['block5f_expand_bn[0][0]']
)

    block5f_dwconv (DepthwiseConv2D) (None, 10, 10, 1344) 33600
['block5f_expand_activation[0][0]']
D)
)
']

```

```

    block5f_bn (BatchNormalization (None, 10, 10, 1344 5376
['block5f_dwconv[0][0]']
    )
    )

    block5f_activation (Activation (None, 10, 10, 1344 0
['block5f_bn[0][0]']
    )
    )

    block5f_se_squeeze (GlobalAveragePooling2D) (None, 1344) 0
['block5f_activation[0][0]']

    block5f_se_reshape (Reshape) (None, 1, 1, 1344) 0
['block5f_se_squeeze[0][0]']

    block5f_se_reduce (Conv2D) (None, 1, 1, 56) 75320
['block5f_se_reshape[0][0]']

    block5f_se_expand (Conv2D) (None, 1, 1, 1344) 76608
['block5f_se_reduce[0][0]']

    block5f_se_excite (Multiply) (None, 10, 10, 1344 0
['block5f_activation[0][0]',
    )
    ['block5f_se_expand[0][0]']

    block5f_project_conv (Conv2D) (None, 10, 10, 224) 301056
['block5f_se_excite[0][0]']

    block5f_project_bn (BatchNormalization) (None, 10, 10, 224) 896
['block5f_project_conv[0][0]']

    block5f_drop (Dropout) (None, 10, 10, 224) 0
['block5f_project_bn[0][0]']

    block5f_add (Add) (None, 10, 10, 224) 0
['block5f_drop[0][0]',
    'block5e_add[0][0]']

    block5g_expand_conv (Conv2D) (None, 10, 10, 1344 301056
['block5f_add[0][0]']
    )

    block5g_expand_bn (BatchNormalization) (None, 10, 10, 1344 5376
['block5g_expand_conv[0][0]']
    )

```

```

block5g_expand_activation (Activation) (None, 10, 10, 1344) 0
['block5g_expand_bn[0][0]']
ivation)

block5g_dwconv (DepthwiseConv2D) (None, 10, 10, 1344) 33600
['block5g_expand_activation[0][0]']
D)

block5g_bn (BatchNormalization) (None, 10, 10, 1344) 5376
['block5g_dwconv[0][0]']
)

block5g_activation (Activation) (None, 10, 10, 1344) 0
['block5g_bn[0][0]']
)

block5g_se_squeeze (GlobalAveragePooling2D) (None, 1344) 0
['block5g_activation[0][0]']
agePooling2D)

block5g_se_reshape (Reshape) (None, 1, 1, 1344) 0
['block5g_se_squeeze[0][0]']

block5g_se_reduce (Conv2D) (None, 1, 1, 56) 75320
['block5g_se_reshape[0][0]']

block5g_se_expand (Conv2D) (None, 1, 1, 1344) 76608
['block5g_se_reduce[0][0]']

block5g_se_excite (Multiply) (None, 10, 10, 1344) 0
['block5g_activation[0][0]',
)
'block5g_se_expand[0][0]']

block5g_project_conv (Conv2D) (None, 10, 10, 224) 301056
['block5g_se_excite[0][0]']

block5g_project_bn (BatchNormalization) (None, 10, 10, 224) 896
['block5g_project_conv[0][0]']
lization)

block5g_drop (Dropout) (None, 10, 10, 224) 0
['block5g_project_bn[0][0]']

block5g_add (Add) (None, 10, 10, 224) 0
['block5g_drop[0][0]',
'block5f_add[0][0]']

```



```

    block5h_expand_conv (Conv2D)      (None, 10, 10, 1344  301056
['block5g_add[0][0]']
    )

    block5h_expand_bn (BatchNormal    (None, 10, 10, 1344  5376
['block5h_expand_conv[0][0]']
    ization)
    )

    block5h_expand_activation (Act    (None, 10, 10, 1344  0
['block5h_expand_bn[0][0]']
    ivation)
    )

    block5h_dwconv (DepthwiseConv2    (None, 10, 10, 1344  33600
['block5h_expand_activation[0][0]
    D)
    )

    block5h_bn (BatchNormalization    (None, 10, 10, 1344  5376
['block5h_dwconv[0][0]']
    )
    )

    block5h_activation (Activation    (None, 10, 10, 1344  0
['block5h_bn[0][0]']
    )
    )

    block5h_se_squeeze (GlobalAver    (None, 1344)          0
['block5h_activation[0][0]']
    agePooling2D)

    block5h_se_reshape (Reshape)      (None, 1, 1, 1344)    0
['block5h_se_squeeze[0][0]']

    block5h_se_reduce (Conv2D)        (None, 1, 1, 56)      75320
['block5h_se_reshape[0][0]']

    block5h_se_expand (Conv2D)        (None, 1, 1, 1344)    76608
['block5h_se_reduce[0][0]']

    block5h_se_excite (Multiply)      (None, 10, 10, 1344  0
['block5h_activation[0][0]',
    )
    'block5h_se_expand[0][0]']

    block5h_project_conv (Conv2D)     (None, 10, 10, 224)   301056
['block5h_se_excite[0][0]']

    block5h_project_bn (BatchNorma    (None, 10, 10, 224)   896
['block5h_project_conv[0][0]']
    lization)

```

```

    block5h_drop (Dropout)          (None, 10, 10, 224)  0
['block5h_project_bn[0][0]']

    block5h_add (Add)                (None, 10, 10, 224)  0
['block5h_drop[0][0]',
'block5g_add[0][0]']

    block5i_expand_conv (Conv2D)     (None, 10, 10, 1344  301056
['block5h_add[0][0]']
)

    block5i_expand_bn (BatchNormal   (None, 10, 10, 1344  5376
['block5i_expand_conv[0][0]']
ization)
)

    block5i_expand_activation (Act   (None, 10, 10, 1344  0
['block5i_expand_bn[0][0]']
ivation)
)

    block5i_dwconv (DepthwiseConv2   (None, 10, 10, 1344  33600
['block5i_expand_activation[0][0]
D)
)

    block5i_bn (BatchNormalization   (None, 10, 10, 1344  5376
['block5i_dwconv[0][0]']
)
)

    block5i_activation (Activation   (None, 10, 10, 1344  0
['block5i_bn[0][0]']
)
)

    block5i_se_squeeze (GlobalAver    (None, 1344)      0
['block5i_activation[0][0]']
agePooling2D)

    block5i_se_reshape (Reshape)     (None, 1, 1, 1344)  0
['block5i_se_squeeze[0][0]']

    block5i_se_reduce (Conv2D)       (None, 1, 1, 56)    75320
['block5i_se_reshape[0][0]']

    block5i_se_expand (Conv2D)       (None, 1, 1, 1344)  76608
['block5i_se_reduce[0][0]']

    block5i_se_excite (Multiply)     (None, 10, 10, 1344  0
['block5i_activation[0][0]',
)

```

```

'block5i_se_expand[0][0]']

block5i_project_conv (Conv2D) (None, 10, 10, 224) 301056
['block5i_se_excite[0][0]']

block5i_project_bn (BatchNormal (None, 10, 10, 224) 896
['block5i_project_conv[0][0]']
ization)

block5i_drop (Dropout) (None, 10, 10, 224) 0
['block5i_project_bn[0][0]']

block5i_add (Add) (None, 10, 10, 224) 0
['block5i_drop[0][0]',
'block5h_add[0][0]']

block5j_expand_conv (Conv2D) (None, 10, 10, 1344 301056
['block5i_add[0][0]']
)

block5j_expand_bn (BatchNormal (None, 10, 10, 1344 5376
['block5j_expand_conv[0][0]']
ization)
)

block5j_expand_activation (Act (None, 10, 10, 1344 0
['block5j_expand_bn[0][0]']
ivation)
)

block5j_dwconv (DepthwiseConv2 (None, 10, 10, 1344 33600
['block5j_expand_activation[0][0]
D)
)

'

block5j_bn (BatchNormalization (None, 10, 10, 1344 5376
['block5j_dwconv[0][0]']
)
)

block5j_activation (Activation (None, 10, 10, 1344 0
['block5j_bn[0][0]']
)
)

block5j_se_squeeze (GlobalAver (None, 1344) 0
['block5j_activation[0][0]']
agePooling2D)

block5j_se_reshape (Reshape) (None, 1, 1, 1344) 0
['block5j_se_squeeze[0][0]']

block5j_se_reduce (Conv2D) (None, 1, 1, 56) 75320

```

```

['block5j_se_reshape[0][0]']

    block5j_se_expand (Conv2D)      (None, 1, 1, 1344)    76608
['block5j_se_reduce[0][0]']

    block5j_se_excite (Multiply)    (None, 10, 10, 1344)  0
['block5j_activation[0][0]',
    )
'block5j_se_expand[0][0]']

    block5j_project_conv (Conv2D)   (None, 10, 10, 224)   301056
['block5j_se_excite[0][0]']

    block5j_project_bn (BatchNorma  (None, 10, 10, 224)   896
['block5j_project_conv[0][0]']
    lization)

    block5j_drop (Dropout)          (None, 10, 10, 224)   0
['block5j_project_bn[0][0]']

    block5j_add (Add)               (None, 10, 10, 224)   0
['block5j_drop[0][0]',
'block5i_add[0][0]']

    block6a_expand_conv (Conv2D)    (None, 10, 10, 1344)  301056
['block5j_add[0][0]']
    )

    block6a_expand_bn (BatchNormal  (None, 10, 10, 1344)  5376
['block6a_expand_conv[0][0]']
    ization)
    )

    block6a_expand_activation (Act   (None, 10, 10, 1344)  0
['block6a_expand_bn[0][0]']
    ivation)
    )

    block6a_dwconv_pad (ZeroPaddin  (None, 13, 13, 1344)  0
['block6a_expand_activation[0][0]
    g2D)
    )
    ']'

    block6a_dwconv (DepthwiseConv2  (None, 5, 5, 1344)   33600
['block6a_dwconv_pad[0][0]']
    D)

    block6a_bn (BatchNormalization  (None, 5, 5, 1344)   5376
['block6a_dwconv[0][0]']
    )

```

```

    block6a_activation (Activation (None, 5, 5, 1344) 0
['block6a_bn[0][0]']
)

    block6a_se_squeeze (GlobalAveragePooling2D) (None, 1344) 0
['block6a_activation[0][0]']

    block6a_se_reshape (Reshape) (None, 1, 1, 1344) 0
['block6a_se_squeeze[0][0]']

    block6a_se_reduce (Conv2D) (None, 1, 1, 56) 75320
['block6a_se_reshape[0][0]']

    block6a_se_expand (Conv2D) (None, 1, 1, 1344) 76608
['block6a_se_reduce[0][0]']

    block6a_se_excite (Multiply) (None, 5, 5, 1344) 0
['block6a_activation[0][0]',
'block6a_se_expand[0][0]']

    block6a_project_conv (Conv2D) (None, 5, 5, 384) 516096
['block6a_se_excite[0][0]']

    block6a_project_bn (BatchNormalization) (None, 5, 5, 384) 1536
['block6a_project_conv[0][0]']

    block6b_expand_conv (Conv2D) (None, 5, 5, 2304) 884736
['block6a_project_bn[0][0]']

    block6b_expand_bn (BatchNormalization) (None, 5, 5, 2304) 9216
['block6b_expand_conv[0][0]']

    block6b_expand_activation (Activation) (None, 5, 5, 2304) 0
['block6b_expand_bn[0][0]']

    block6b_dwconv (DepthwiseConv2D) (None, 5, 5, 2304) 57600
['block6b_expand_activation[0][0]']

    block6b_bn (BatchNormalization) (None, 5, 5, 2304) 9216
['block6b_dwconv[0][0]']

    block6b_activation (Activation) (None, 5, 5, 2304) 0

```

```

['block6b_bn[0][0]']
)

block6b_se_squeeze (GlobalAveragePooling2D) (None, 2304) 0
['block6b_activation[0][0]']

block6b_se_reshape (Reshape) (None, 1, 1, 2304) 0
['block6b_se_squeeze[0][0]']

block6b_se_reduce (Conv2D) (None, 1, 1, 96) 221280
['block6b_se_reshape[0][0]']

block6b_se_expand (Conv2D) (None, 1, 1, 2304) 223488
['block6b_se_reduce[0][0]']

block6b_se_excite (Multiply) (None, 5, 5, 2304) 0
['block6b_activation[0][0]',
'block6b_se_expand[0][0]']

block6b_project_conv (Conv2D) (None, 5, 5, 384) 884736
['block6b_se_excite[0][0]']

block6b_project_bn (BatchNormalization) (None, 5, 5, 384) 1536
['block6b_project_conv[0][0]']

block6b_drop (Dropout) (None, 5, 5, 384) 0
['block6b_project_bn[0][0]']

block6b_add (Add) (None, 5, 5, 384) 0
['block6b_drop[0][0]',
'block6a_project_bn[0][0]']

block6c_expand_conv (Conv2D) (None, 5, 5, 2304) 884736
['block6b_add[0][0]']

block6c_expand_bn (BatchNormalization) (None, 5, 5, 2304) 9216
['block6c_expand_conv[0][0]']

block6c_expand_activation (Activation) (None, 5, 5, 2304) 0
['block6c_expand_bn[0][0]']

block6c_dwconv (DepthwiseConv2D) (None, 5, 5, 2304) 57600
['block6c_expand_activation[0][0]']
D)
']

```

```

    block6c_bn (BatchNormalization (None, 5, 5, 2304) 9216
['block6c_dwconv[0][0]']
)

    block6c_activation (Activation (None, 5, 5, 2304) 0
['block6c_bn[0][0]']
)

    block6c_se_squeeze (GlobalAveragePooling2D) (None, 2304) 0
['block6c_activation[0][0]']

    block6c_se_reshape (Reshape) (None, 1, 1, 2304) 0
['block6c_se_squeeze[0][0]']

    block6c_se_reduce (Conv2D) (None, 1, 1, 96) 221280
['block6c_se_reshape[0][0]']

    block6c_se_expand (Conv2D) (None, 1, 1, 2304) 223488
['block6c_se_reduce[0][0]']

    block6c_se_excite (Multiply) (None, 5, 5, 2304) 0
['block6c_activation[0][0]',
'block6c_se_expand[0][0]']

    block6c_project_conv (Conv2D) (None, 5, 5, 384) 884736
['block6c_se_excite[0][0]']

    block6c_project_bn (BatchNormalization) (None, 5, 5, 384) 1536
['block6c_project_conv[0][0]']

    block6c_drop (Dropout) (None, 5, 5, 384) 0
['block6c_project_bn[0][0]']

    block6c_add (Add) (None, 5, 5, 384) 0
['block6c_drop[0][0]',
'block6b_add[0][0]']

    block6d_expand_conv (Conv2D) (None, 5, 5, 2304) 884736
['block6c_add[0][0]']

    block6d_expand_bn (BatchNormalization) (None, 5, 5, 2304) 9216
['block6d_expand_conv[0][0]']

    block6d_expand_activation (Activation) (None, 5, 5, 2304) 0

```

```

['block6d_expand_bn[0][0]']
ivation)

block6d_dwconv (DepthwiseConv2 (None, 5, 5, 2304) 57600
['block6d_expand_activation[0][0]
D)

block6d_bn (BatchNormalization (None, 5, 5, 2304) 9216
['block6d_dwconv[0][0]']
)

block6d_activation (Activation (None, 5, 5, 2304) 0
['block6d_bn[0][0]']
)

block6d_se_squeeze (GlobalAver (None, 2304) 0
['block6d_activation[0][0]']
agePooling2D)

block6d_se_reshape (Reshape) (None, 1, 1, 2304) 0
['block6d_se_squeeze[0][0]']

block6d_se_reduce (Conv2D) (None, 1, 1, 96) 221280
['block6d_se_reshape[0][0]']

block6d_se_expand (Conv2D) (None, 1, 1, 2304) 223488
['block6d_se_reduce[0][0]']

block6d_se_excite (Multiply) (None, 5, 5, 2304) 0
['block6d_activation[0][0]',
'block6d_se_expand[0][0]']

block6d_project_conv (Conv2D) (None, 5, 5, 384) 884736
['block6d_se_excite[0][0]']

block6d_project_bn (BatchNorma (None, 5, 5, 384) 1536
['block6d_project_conv[0][0]']
lization)

block6d_drop (Dropout) (None, 5, 5, 384) 0
['block6d_project_bn[0][0]']

block6d_add (Add) (None, 5, 5, 384) 0
['block6d_drop[0][0]',
'block6c_add[0][0]']

block6e_expand_conv (Conv2D) (None, 5, 5, 2304) 884736
['block6d_add[0][0]']

```



```

block6e_expand_bn (BatchNormal (None, 5, 5, 2304) 9216
['block6e_expand_conv[0][0]']
ization)

block6e_expand_activation (Act (None, 5, 5, 2304) 0
['block6e_expand_bn[0][0]']
ivation)

block6e_dwconv (DepthwiseConv2 (None, 5, 5, 2304) 57600
['block6e_expand_activation[0][0]
D)

block6e_bn (BatchNormalization (None, 5, 5, 2304) 9216
['block6e_dwconv[0][0]']
)

block6e_activation (Activation (None, 5, 5, 2304) 0
['block6e_bn[0][0]']
)

block6e_se_squeeze (GlobalAver (None, 2304) 0
['block6e_activation[0][0]']
agePooling2D)

block6e_se_reshape (Reshape) (None, 1, 1, 2304) 0
['block6e_se_squeeze[0][0]']

block6e_se_reduce (Conv2D) (None, 1, 1, 96) 221280
['block6e_se_reshape[0][0]']

block6e_se_expand (Conv2D) (None, 1, 1, 2304) 223488
['block6e_se_reduce[0][0]']

block6e_se_excite (Multiply) (None, 5, 5, 2304) 0
['block6e_activation[0][0]',
'block6e_se_expand[0][0]']

block6e_project_conv (Conv2D) (None, 5, 5, 384) 884736
['block6e_se_excite[0][0]']

block6e_project_bn (BatchNorma (None, 5, 5, 384) 1536
['block6e_project_conv[0][0]']
lization)

block6e_drop (Dropout) (None, 5, 5, 384) 0
['block6e_project_bn[0][0]']

```

block6e_add (Add)	(None, 5, 5, 384)	0
['block6e_drop[0][0]', 'block6d_add[0][0]']		
block6f_expand_conv (Conv2D)	(None, 5, 5, 2304)	884736
['block6e_add[0][0]']		
block6f_expand_bn (BatchNormal	(None, 5, 5, 2304)	9216
ization)		
block6f_expand_activation (Act	(None, 5, 5, 2304)	0
ivation)		
block6f_dwconv (DepthwiseConv2	(None, 5, 5, 2304)	57600
D)		
block6f_bn (BatchNormalization	(None, 5, 5, 2304)	9216
)		
block6f_activation (Activation	(None, 5, 5, 2304)	0
)		
block6f_se_squeeze (GlobalAver	(None, 2304)	0
agePooling2D)		
block6f_se_reshape (Reshape)	(None, 1, 1, 2304)	0
)		
block6f_se_reduce (Conv2D)	(None, 1, 1, 96)	221280
)		
block6f_se_expand (Conv2D)	(None, 1, 1, 2304)	223488
)		
block6f_se_excite (Multiply)	(None, 5, 5, 2304)	0
)		
block6f_project_conv (Conv2D)	(None, 5, 5, 384)	884736
)		
block6f_project_bn (BatchNorma	(None, 5, 5, 384)	1536

```

['block6f_project_conv[0][0]']
lization)

block6f_drop (Dropout)          (None, 5, 5, 384)    0
['block6f_project_bn[0][0]']

block6f_add (Add)                (None, 5, 5, 384)    0
['block6f_drop[0][0]',
'block6e_add[0][0]']

block6g_expand_conv (Conv2D)     (None, 5, 5, 2304)   884736
['block6f_add[0][0]']

block6g_expand_bn (BatchNormal   (None, 5, 5, 2304)   9216
['block6g_expand_conv[0][0]']
ization)

block6g_expand_activation (Act   (None, 5, 5, 2304)   0
['block6g_expand_bn[0][0]']
ivation)

block6g_dwconv (DepthwiseConv2   (None, 5, 5, 2304)   57600
['block6g_expand_activation[0][0]
D)

block6g_bn (BatchNormalization   (None, 5, 5, 2304)   9216
['block6g_dwconv[0][0]']
)

block6g_activation (Activation   (None, 5, 5, 2304)   0
['block6g_bn[0][0]']
)

block6g_se_squeeze (GlobalAver   (None, 2304)         0
['block6g_activation[0][0]']
agePooling2D)

block6g_se_reshape (Reshape)     (None, 1, 1, 2304)   0
['block6g_se_squeeze[0][0]']

block6g_se_reduce (Conv2D)       (None, 1, 1, 96)     221280
['block6g_se_reshape[0][0]']

block6g_se_expand (Conv2D)       (None, 1, 1, 2304)   223488
['block6g_se_reduce[0][0]']

block6g_se_excite (Multiply)     (None, 5, 5, 2304)   0
['block6g_activation[0][0]',

```

```

'block6g_se_expand[0][0]']

block6g_project_conv (Conv2D) (None, 5, 5, 384) 884736
['block6g_se_excite[0][0]']

block6g_project_bn (BatchNormal (None, 5, 5, 384) 1536
['block6g_project_conv[0][0]']
ization)

block6g_drop (Dropout) (None, 5, 5, 384) 0
['block6g_project_bn[0][0]']

block6g_add (Add) (None, 5, 5, 384) 0
['block6g_drop[0][0]',
'block6f_add[0][0]']

block6h_expand_conv (Conv2D) (None, 5, 5, 2304) 884736
['block6g_add[0][0]']

block6h_expand_bn (BatchNormal (None, 5, 5, 2304) 9216
['block6h_expand_conv[0][0]']
ization)

block6h_expand_activation (Act (None, 5, 5, 2304) 0
['block6h_expand_bn[0][0]']
ivation)

block6h_dwconv (DepthwiseConv2 (None, 5, 5, 2304) 57600
['block6h_expand_activation[0][0]
D)

block6h_bn (BatchNormalization (None, 5, 5, 2304) 9216
['block6h_dwconv[0][0]']
)

block6h_activation (Activation (None, 5, 5, 2304) 0
['block6h_bn[0][0]']
)

block6h_se_squeeze (GlobalAver (None, 2304) 0
['block6h_activation[0][0]']
agePooling2D)

block6h_se_reshape (Reshape) (None, 1, 1, 2304) 0
['block6h_se_squeeze[0][0]']

block6h_se_reduce (Conv2D) (None, 1, 1, 96) 221280
['block6h_se_reshape[0][0]']

```

block6h_se_expand (Conv2D) ['block6h_se_reduce[0][0]']	(None, 1, 1, 2304)	223488
block6h_se_excite (Multiply) ['block6h_activation[0][0]', 'block6h_se_expand[0][0]']	(None, 5, 5, 2304)	0
block6h_project_conv (Conv2D) ['block6h_se_excite[0][0]']	(None, 5, 5, 384)	884736
block6h_project_bn (BatchNormal ization)	(None, 5, 5, 384)	1536
block6h_drop (Dropout) ['block6h_project_bn[0][0]']	(None, 5, 5, 384)	0
block6h_add (Add) ['block6h_drop[0][0]', 'block6g_add[0][0]']	(None, 5, 5, 384)	0
block6i_expand_conv (Conv2D) ['block6h_add[0][0]']	(None, 5, 5, 2304)	884736
block6i_expand_bn (BatchNormal ization)	(None, 5, 5, 2304)	9216
block6i_expand_activation (Act ivation)	(None, 5, 5, 2304)	0
block6i_dwconv (DepthwiseConv2 D)	(None, 5, 5, 2304)	57600
block6i_bn (BatchNormalization) ['block6i_dwconv[0][0]'])	(None, 5, 5, 2304)	9216
block6i_activation (Activation) ['block6i_bn[0][0]'])	(None, 5, 5, 2304)	0
block6i_se_squeeze (GlobalAver agePooling2D) ['block6i_activation[0][0]']	(None, 2304)	0

block6i_se_reshape (Reshape) ['block6i_se_squeeze[0][0]']	(None, 1, 1, 2304)	0
block6i_se_reduce (Conv2D) ['block6i_se_reshape[0][0]']	(None, 1, 1, 96)	221280
block6i_se_expand (Conv2D) ['block6i_se_reduce[0][0]']	(None, 1, 1, 2304)	223488
block6i_se_excite (Multiply) ['block6i_activation[0][0]', 'block6i_se_expand[0][0]']	(None, 5, 5, 2304)	0
block6i_project_conv (Conv2D) ['block6i_se_excite[0][0]']	(None, 5, 5, 384)	884736
block6i_project_bn (BatchNormal lization)	(None, 5, 5, 384)	1536
block6i_drop (Dropout) ['block6i_project_bn[0][0]']	(None, 5, 5, 384)	0
block6i_add (Add) ['block6i_drop[0][0]', 'block6h_add[0][0]']	(None, 5, 5, 384)	0
block6j_expand_conv (Conv2D) ['block6i_add[0][0]']	(None, 5, 5, 2304)	884736
block6j_expand_bn (BatchNormal ization)	(None, 5, 5, 2304)	9216
block6j_expand_activation (Act ivation)	(None, 5, 5, 2304)	0
block6j_dwconv (DepthwiseConv2 D)	(None, 5, 5, 2304)	57600
block6j_bn (BatchNormalization)	(None, 5, 5, 2304)	9216
block6j_activation (Activation	(None, 5, 5, 2304)	0

```

['block6j_bn[0][0]']
)

block6j_se_squeeze (GlobalAveragePooling2D) (None, 2304) 0
['block6j_activation[0][0]']

block6j_se_reshape (Reshape) (None, 1, 1, 2304) 0
['block6j_se_squeeze[0][0]']

block6j_se_reduce (Conv2D) (None, 1, 1, 96) 221280
['block6j_se_reshape[0][0]']

block6j_se_expand (Conv2D) (None, 1, 1, 2304) 223488
['block6j_se_reduce[0][0]']

block6j_se_excite (Multiply) (None, 5, 5, 2304) 0
['block6j_activation[0][0]',
'block6j_se_expand[0][0]']

block6j_project_conv (Conv2D) (None, 5, 5, 384) 884736
['block6j_se_excite[0][0]']

block6j_project_bn (BatchNormalization) (None, 5, 5, 384) 1536
['block6j_project_conv[0][0]']

block6j_drop (Dropout) (None, 5, 5, 384) 0
['block6j_project_bn[0][0]']

block6j_add (Add) (None, 5, 5, 384) 0
['block6j_drop[0][0]',
'block6i_add[0][0]']

block6k_expand_conv (Conv2D) (None, 5, 5, 2304) 884736
['block6j_add[0][0]']

block6k_expand_bn (BatchNormalization) (None, 5, 5, 2304) 9216
['block6k_expand_conv[0][0]']

block6k_expand_activation (Activation) (None, 5, 5, 2304) 0
['block6k_expand_bn[0][0]']

block6k_dwconv (DepthwiseConv2D) (None, 5, 5, 2304) 57600
['block6k_expand_activation[0][0]']
D)
']

```

```

    block6k_bn (BatchNormalization (None, 5, 5, 2304) 9216
['block6k_dwconv[0][0]']
)

    block6k_activation (Activation (None, 5, 5, 2304) 0
['block6k_bn[0][0]']
)

    block6k_se_squeeze (GlobalAveragePooling2D) (None, 2304) 0
['block6k_activation[0][0]']

    block6k_se_reshape (Reshape) (None, 1, 1, 2304) 0
['block6k_se_squeeze[0][0]']

    block6k_se_reduce (Conv2D) (None, 1, 1, 96) 221280
['block6k_se_reshape[0][0]']

    block6k_se_expand (Conv2D) (None, 1, 1, 2304) 223488
['block6k_se_reduce[0][0]']

    block6k_se_excite (Multiply) (None, 5, 5, 2304) 0
['block6k_activation[0][0]',
'block6k_se_expand[0][0]']

    block6k_project_conv (Conv2D) (None, 5, 5, 384) 884736
['block6k_se_excite[0][0]']

    block6k_project_bn (BatchNormalization) (None, 5, 5, 384) 1536
['block6k_project_conv[0][0]']

    block6k_drop (Dropout) (None, 5, 5, 384) 0
['block6k_project_bn[0][0]']

    block6k_add (Add) (None, 5, 5, 384) 0
['block6k_drop[0][0]',
'block6j_add[0][0]']

    block6l_expand_conv (Conv2D) (None, 5, 5, 2304) 884736
['block6k_add[0][0]']

    block6l_expand_bn (BatchNormalization) (None, 5, 5, 2304) 9216
['block6l_expand_conv[0][0]']

    block6l_expand_activation (Activation) (None, 5, 5, 2304) 0

```



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['block6l_expand_bn[0][0]']
ivation)

block6l_dwconv (DepthwiseConv2 (None, 5, 5, 2304) 57600
['block6l_expand_activation[0][0]
D)

block6l_bn (BatchNormalization (None, 5, 5, 2304) 9216
['block6l_dwconv[0][0]']
)

block6l_activation (Activation (None, 5, 5, 2304) 0
['block6l_bn[0][0]']
)

block6l_se_squeeze (GlobalAver (None, 2304) 0
['block6l_activation[0][0]']
agePooling2D)

block6l_se_reshape (Reshape) (None, 1, 1, 2304) 0
['block6l_se_squeeze[0][0]']

block6l_se_reduce (Conv2D) (None, 1, 1, 96) 221280
['block6l_se_reshape[0][0]']

block6l_se_expand (Conv2D) (None, 1, 1, 2304) 223488
['block6l_se_reduce[0][0]']

block6l_se_excite (Multiply) (None, 5, 5, 2304) 0
['block6l_activation[0][0]',
'block6l_se_expand[0][0]']

block6l_project_conv (Conv2D) (None, 5, 5, 384) 884736
['block6l_se_excite[0][0]']

block6l_project_bn (BatchNorma (None, 5, 5, 384) 1536
['block6l_project_conv[0][0]']
lization)

block6l_drop (Dropout) (None, 5, 5, 384) 0
['block6l_project_bn[0][0]']

block6l_add (Add) (None, 5, 5, 384) 0
['block6l_drop[0][0]',
'block6k_add[0][0]']

block6m_expand_conv (Conv2D) (None, 5, 5, 2304) 884736
['block6l_add[0][0]']

```

```

block6m_expand_bn (BatchNormal (None, 5, 5, 2304) 9216
['block6m_expand_conv[0][0]']
ization)

block6m_expand_activation (Act (None, 5, 5, 2304) 0
['block6m_expand_bn[0][0]']
ivation)

block6m_dwconv (DepthwiseConv2 (None, 5, 5, 2304) 57600
['block6m_expand_activation[0][0]
D)

block6m_bn (BatchNormalization (None, 5, 5, 2304) 9216
['block6m_dwconv[0][0]']
)

block6m_activation (Activation (None, 5, 5, 2304) 0
['block6m_bn[0][0]']
)

block6m_se_squeeze (GlobalAver (None, 2304) 0
['block6m_activation[0][0]']
agePooling2D)

block6m_se_reshape (Reshape) (None, 1, 1, 2304) 0
['block6m_se_squeeze[0][0]']

block6m_se_reduce (Conv2D) (None, 1, 1, 96) 221280
['block6m_se_reshape[0][0]']

block6m_se_expand (Conv2D) (None, 1, 1, 2304) 223488
['block6m_se_reduce[0][0]']

block6m_se_excite (Multiply) (None, 5, 5, 2304) 0
['block6m_activation[0][0]',
'block6m_se_expand[0][0]']

block6m_project_conv (Conv2D) (None, 5, 5, 384) 884736
['block6m_se_excite[0][0]']

block6m_project_bn (BatchNorma (None, 5, 5, 384) 1536
['block6m_project_conv[0][0]']
lization)

block6m_drop (Dropout) (None, 5, 5, 384) 0
['block6m_project_bn[0][0]']

```

block6m_add (Add)	(None, 5, 5, 384)	0
['block6m_drop[0][0]', 'block6l_add[0][0]']		
block7a_expand_conv (Conv2D)	(None, 5, 5, 2304)	884736
['block6m_add[0][0]']		
block7a_expand_bn (BatchNormal	(None, 5, 5, 2304)	9216
ization)		
block7a_expand_activation (Act	(None, 5, 5, 2304)	0
ivation)		
block7a_dwconv (DepthwiseConv2	(None, 5, 5, 2304)	20736
D)		
block7a_bn (BatchNormalization	(None, 5, 5, 2304)	9216
)		
block7a_activation (Activation	(None, 5, 5, 2304)	0
)		
block7a_se_squeeze (GlobalAver	(None, 2304)	0
agePooling2D)		
block7a_se_reshape (Reshape)	(None, 1, 1, 2304)	0
)		
block7a_se_reduce (Conv2D)	(None, 1, 1, 96)	221280
)		
block7a_se_expand (Conv2D)	(None, 1, 1, 2304)	223488
)		
block7a_se_excite (Multiply)	(None, 5, 5, 2304)	0
)		
block7a_project_conv (Conv2D)	(None, 5, 5, 640)	1474560
)		
block7a_project_bn (BatchNorma	(None, 5, 5, 640)	2560

```

['block7a_project_conv[0][0]']
lization)

block7b_expand_conv (Conv2D) (None, 5, 5, 3840) 2457600
['block7a_project_bn[0][0]']

block7b_expand_bn (BatchNormal (None, 5, 5, 3840) 15360
['block7b_expand_conv[0][0]']
ization)

block7b_expand_activation (Act (None, 5, 5, 3840) 0
['block7b_expand_bn[0][0]']
ivation)

block7b_dwconv (DepthwiseConv2 (None, 5, 5, 3840) 34560
['block7b_expand_activation[0][0]
D)

block7b_bn (BatchNormalization (None, 5, 5, 3840) 15360
['block7b_dwconv[0][0]']
)

block7b_activation (Activation (None, 5, 5, 3840) 0
['block7b_bn[0][0]']
)

block7b_se_squeeze (GlobalAver (None, 3840) 0
['block7b_activation[0][0]']
agePooling2D)

block7b_se_reshape (Reshape) (None, 1, 1, 3840) 0
['block7b_se_squeeze[0][0]']

block7b_se_reduce (Conv2D) (None, 1, 1, 160) 614560
['block7b_se_reshape[0][0]']

block7b_se_expand (Conv2D) (None, 1, 1, 3840) 618240
['block7b_se_reduce[0][0]']

block7b_se_excite (Multiply) (None, 5, 5, 3840) 0
['block7b_activation[0][0]'],
['block7b_se_expand[0][0]']

block7b_project_conv (Conv2D) (None, 5, 5, 640) 2457600
['block7b_se_excite[0][0]']

block7b_project_bn (BatchNorma (None, 5, 5, 640) 2560
['block7b_project_conv[0][0]']

```

```

lization)

block7b_drop (Dropout)          (None, 5, 5, 640)    0
['block7b_project_bn[0][0]']

block7b_add (Add)               (None, 5, 5, 640)    0
['block7b_drop[0][0]',
'block7a_project_bn[0][0]']

block7c_expand_conv (Conv2D)    (None, 5, 5, 3840)  2457600
['block7b_add[0][0]']

block7c_expand_bn (BatchNormal (None, 5, 5, 3840)  15360
['block7c_expand_conv[0][0]']
ization)

block7c_expand_activation (Act (None, 5, 5, 3840)  0
['block7c_expand_bn[0][0]']
ivation)

block7c_dwconv (DepthwiseConv2 (None, 5, 5, 3840)  34560
['block7c_expand_activation[0][0]
D)

block7c_bn (BatchNormalization (None, 5, 5, 3840)  15360
['block7c_dwconv[0][0]']
)

block7c_activation (Activation (None, 5, 5, 3840)  0
['block7c_bn[0][0]']
)

block7c_se_squeeze (GlobalAver (None, 3840)      0
['block7c_activation[0][0]']
agePooling2D)

block7c_se_reshape (Reshape)    (None, 1, 1, 3840)  0
['block7c_se_squeeze[0][0]']

block7c_se_reduce (Conv2D)      (None, 1, 1, 160)   614560
['block7c_se_reshape[0][0]']

block7c_se_expand (Conv2D)      (None, 1, 1, 3840)  618240
['block7c_se_reduce[0][0]']

block7c_se_excite (Multiply)    (None, 5, 5, 3840)  0
['block7c_activation[0][0]',
'block7c_se_expand[0][0]']

```

block7c_project_conv (Conv2D)	(None, 5, 5, 640)	2457600
['block7c_se_excite[0][0]']		
block7c_project_bn (BatchNormalization)	(None, 5, 5, 640)	2560
['block7c_project_conv[0][0]']		
block7c_drop (Dropout)	(None, 5, 5, 640)	0
['block7c_project_bn[0][0]']		
block7c_add (Add)	(None, 5, 5, 640)	0
['block7c_drop[0][0]', 'block7b_add[0][0]']		
block7d_expand_conv (Conv2D)	(None, 5, 5, 3840)	2457600
['block7c_add[0][0]']		
block7d_expand_bn (BatchNormalization)	(None, 5, 5, 3840)	15360
['block7d_expand_conv[0][0]']		
block7d_expand_activation (Activation)	(None, 5, 5, 3840)	0
['block7d_expand_bn[0][0]']		
block7d_dwconv (DepthwiseConv2D)	(None, 5, 5, 3840)	34560
['block7d_expand_activation[0][0]']		
block7d_bn (BatchNormalization)	(None, 5, 5, 3840)	15360
['block7d_dwconv[0][0]']		
block7d_activation (Activation)	(None, 5, 5, 3840)	0
['block7d_bn[0][0]']		
block7d_se_squeeze (GlobalAveragePooling2D)	(None, 3840)	0
['block7d_activation[0][0]']		
block7d_se_reshape (Reshape)	(None, 1, 1, 3840)	0
['block7d_se_squeeze[0][0]']		
block7d_se_reduce (Conv2D)	(None, 1, 1, 160)	614560
['block7d_se_reshape[0][0]']		

block7d_se_expand (Conv2D) ['block7d_se_reduce[0][0]']	(None, 1, 1, 3840)	618240
block7d_se_excite (Multiply) ['block7d_activation[0][0]', 'block7d_se_expand[0][0]']	(None, 5, 5, 3840)	0
block7d_project_conv (Conv2D) ['block7d_se_excite[0][0]']	(None, 5, 5, 640)	2457600
block7d_project_bn (BatchNormal lization)	(None, 5, 5, 640)	2560
block7d_drop (Dropout) ['block7d_project_bn[0][0]']	(None, 5, 5, 640)	0
block7d_add (Add) ['block7d_drop[0][0]', 'block7c_add[0][0]']	(None, 5, 5, 640)	0
top_conv (Conv2D) ['block7d_add[0][0]']	(None, 5, 5, 2560)	1638400
top_bn (BatchNormalization) ['top_conv[0][0]']	(None, 5, 5, 2560)	10240
top_activation (Activation) ['top_bn[0][0]']	(None, 5, 5, 2560)	0
max_pool (GlobalMaxPooling2D) ['top_activation[0][0]']	(None, 2560)	0

=====

Total params: 64,097,687
Trainable params: 63,786,960
Non-trainable params: 310,727

```
[9]: def extract_features(directory, sample_amount, transfer, batch_size = 30,
    ↪n_class = 7):
    features = np.zeros(shape=(sample_amount, 2560))
    labels = np.zeros(shape=(sample_amount, n_class))
    generator = datagen.flow_from_directory(
                                directory,
```

```

target_size = target_size,
batch_size = batch_size,
class_mode = 'categorical')

# i=0
for i, (inputs_batch, labels_batch) in enumerate(generator):
    features_batch = transfer.predict(inputs_batch)
    features[i * batch_size : (i + 1) * batch_size] = features_batch
    labels[i * batch_size : (i + 1) * batch_size] = labels_batch
    i = i + 1
    if i * batch_size >= sample_amount:
        break
return features, labels

```

```

[10]: # You should be able to divide sample_amount by batch_size
train_features, train_labels = extract_features(train_dir, 2240, efficient_7)
test_features, test_labels = extract_features(test_dir, 560, efficient_7)

```

Found 2240 images belonging to 7 classes.
Found 560 images belonging to 7 classes.
train_features: (2240, 2560)
train_labels: (2240, 7)

```

[24]: eff_model_7 = Sequential()
eff_model_7.add(tf.keras.layers.BatchNormalization(axis=-1, momentum=0.99,
↪epsilon=0.001))
eff_model_7.add(layers.Dense(512,
                             kernel_regularizer = tf.keras.regularizers.l2(1e-05),
↪
                             activity_regularizer = tf.keras.regularizers.l1(0.05),
                             bias_regularizer = tf.keras.regularizers.l1(0.05),
                             activation='relu',
                             input_dim=2560))
eff_model_7.add(Dropout(0.45))
eff_model_7.add(layers.Dense(256))
eff_model_7.add(Dropout(0.45))
eff_model_7.add(layers.Dense(128))
eff_model_7.add(Dropout(0.45))

eff_model_7.add(layers.Dense(7, activation='softmax'))

eff_model_7.compile(optimizer=tf.keras.optimizers.RMSprop(lr=1e-4),
                    loss='categorical_crossentropy',
                    metrics=['accuracy'])

eff_model_7.fit(train_features, train_labels,
                epochs=35,
                batch_size=30,

```



```
validation_data=(test_features, test_labels))  
print("Fitting Done")
```

```
Epoch 1/35  
75/75 [=====] - 2s 8ms/step - loss: 38.3365 - accuracy:  
0.4442 - val_loss: 49.2902 - val_accuracy: 0.1429  
Epoch 2/35  
75/75 [=====] - 0s 5ms/step - loss: 27.3988 - accuracy:  
0.6384 - val_loss: 31.1480 - val_accuracy: 0.1429  
Epoch 3/35  
75/75 [=====] - 0s 6ms/step - loss: 19.3691 - accuracy:  
0.7147 - val_loss: 23.0242 - val_accuracy: 0.1429  
Epoch 4/35  
75/75 [=====] - 0s 5ms/step - loss: 13.5342 - accuracy:  
0.7701 - val_loss: 15.1376 - val_accuracy: 0.1429  
Epoch 5/35  
75/75 [=====] - 0s 5ms/step - loss: 9.5700 - accuracy:  
0.8219 - val_loss: 10.8307 - val_accuracy: 0.1429  
Epoch 6/35  
75/75 [=====] - 0s 6ms/step - loss: 6.9127 - accuracy:  
0.8469 - val_loss: 8.4061 - val_accuracy: 0.1482  
Epoch 7/35  
75/75 [=====] - 1s 7ms/step - loss: 5.1907 - accuracy:  
0.8647 - val_loss: 5.9000 - val_accuracy: 0.2625  
Epoch 8/35  
75/75 [=====] - 0s 6ms/step - loss: 4.0328 - accuracy:  
0.8848 - val_loss: 4.2321 - val_accuracy: 0.6214  
Epoch 9/35  
75/75 [=====] - 0s 6ms/step - loss: 3.2516 - accuracy:  
0.8902 - val_loss: 3.2892 - val_accuracy: 0.7214  
Epoch 10/35  
75/75 [=====] - 0s 6ms/step - loss: 2.7281 - accuracy:  
0.8888 - val_loss: 2.5522 - val_accuracy: 0.8804  
Epoch 11/35  
75/75 [=====] - 0s 6ms/step - loss: 2.3542 - accuracy:  
0.8946 - val_loss: 2.0965 - val_accuracy: 0.9304  
Epoch 12/35  
75/75 [=====] - 0s 5ms/step - loss: 2.0647 - accuracy:  
0.8964 - val_loss: 1.8803 - val_accuracy: 0.9179  
Epoch 13/35  
75/75 [=====] - 0s 5ms/step - loss: 1.8172 - accuracy:  
0.9071 - val_loss: 1.6019 - val_accuracy: 0.9464  
Epoch 14/35  
75/75 [=====] - 0s 5ms/step - loss: 1.6225 - accuracy:  
0.9076 - val_loss: 1.4607 - val_accuracy: 0.9446  
Epoch 15/35  
75/75 [=====] - 0s 6ms/step - loss: 1.4794 - accuracy:
```

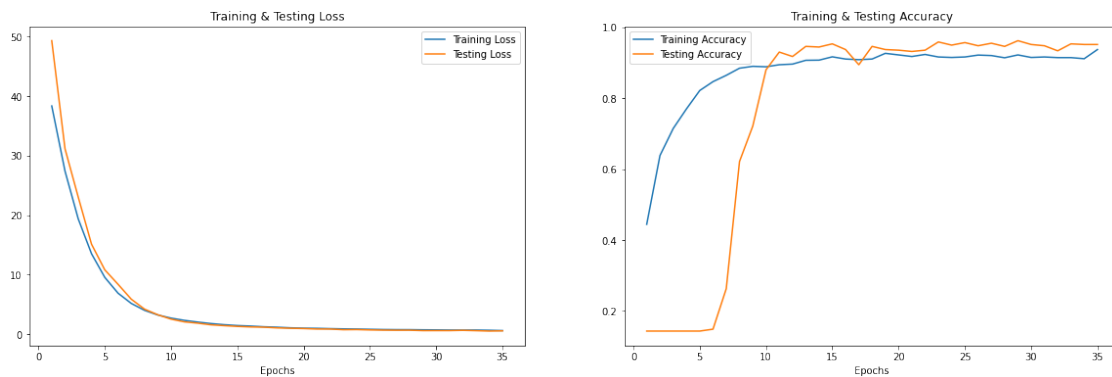
0.9170 - val_loss: 1.3353 - val_accuracy: 0.9536
 Epoch 16/35
 75/75 [=====] - 0s 6ms/step - loss: 1.3918 - accuracy:
 0.9107 - val_loss: 1.2443 - val_accuracy: 0.9375
 Epoch 17/35
 75/75 [=====] - 0s 6ms/step - loss: 1.2745 - accuracy:
 0.9089 - val_loss: 1.2029 - val_accuracy: 0.8946
 Epoch 18/35
 75/75 [=====] - 0s 6ms/step - loss: 1.1992 - accuracy:
 0.9107 - val_loss: 1.0844 - val_accuracy: 0.9464
 Epoch 19/35
 75/75 [=====] - 0s 6ms/step - loss: 1.0970 - accuracy:
 0.9268 - val_loss: 1.0238 - val_accuracy: 0.9375
 Epoch 20/35
 75/75 [=====] - 0s 6ms/step - loss: 1.0357 - accuracy:
 0.9223 - val_loss: 0.9757 - val_accuracy: 0.9357
 Epoch 21/35
 75/75 [=====] - 0s 6ms/step - loss: 1.0126 - accuracy:
 0.9179 - val_loss: 0.8937 - val_accuracy: 0.9321
 Epoch 22/35
 75/75 [=====] - 0s 5ms/step - loss: 0.9604 - accuracy:
 0.9237 - val_loss: 0.8907 - val_accuracy: 0.9357
 Epoch 23/35
 75/75 [=====] - 0s 6ms/step - loss: 0.9165 - accuracy:
 0.9165 - val_loss: 0.7824 - val_accuracy: 0.9589
 Epoch 24/35
 75/75 [=====] - 0s 6ms/step - loss: 0.8922 - accuracy:
 0.9152 - val_loss: 0.8026 - val_accuracy: 0.9500
 Epoch 25/35
 75/75 [=====] - 0s 6ms/step - loss: 0.8512 - accuracy:
 0.9165 - val_loss: 0.7436 - val_accuracy: 0.9571
 Epoch 26/35
 75/75 [=====] - 0s 5ms/step - loss: 0.8127 - accuracy:
 0.9219 - val_loss: 0.7088 - val_accuracy: 0.9482
 Epoch 27/35
 75/75 [=====] - 0s 6ms/step - loss: 0.7940 - accuracy:
 0.9205 - val_loss: 0.6937 - val_accuracy: 0.9554
 Epoch 28/35
 75/75 [=====] - 0s 5ms/step - loss: 0.7884 - accuracy:
 0.9143 - val_loss: 0.6964 - val_accuracy: 0.9464
 Epoch 29/35
 75/75 [=====] - 0s 6ms/step - loss: 0.7609 - accuracy:
 0.9223 - val_loss: 0.6266 - val_accuracy: 0.9625
 Epoch 30/35
 75/75 [=====] - 0s 6ms/step - loss: 0.7482 - accuracy:
 0.9152 - val_loss: 0.6300 - val_accuracy: 0.9518
 Epoch 31/35
 75/75 [=====] - 0s 6ms/step - loss: 0.7212 - accuracy:

```

0.9165 - val_loss: 0.6310 - val_accuracy: 0.9482
Epoch 32/35
75/75 [=====] - 0s 6ms/step - loss: 0.7135 - accuracy:
0.9147 - val_loss: 0.6765 - val_accuracy: 0.9339
Epoch 33/35
75/75 [=====] - 0s 5ms/step - loss: 0.7230 - accuracy:
0.9147 - val_loss: 0.6192 - val_accuracy: 0.9536
Epoch 34/35
75/75 [=====] - 0s 6ms/step - loss: 0.6896 - accuracy:
0.9116 - val_loss: 0.5528 - val_accuracy: 0.9518
Epoch 35/35
75/75 [=====] - 0s 6ms/step - loss: 0.6360 - accuracy:
0.9375 - val_loss: 0.5882 - val_accuracy: 0.9518
Fitting Done

```

```
[25]: loss_acc(eff_model_7)
```



7 Results and Conclusion

In this notebook, we trained several deep learning models by using convolutional neural network as well as transfer learning. We can see that all models performed well. Therefore, we will use the structure of the model to choose the final model for this work. Since the first model has the simplest structure and it converges after only 2 epochs, we would recommend this model to be used for emotion detection in audio speech.

For future work, we would recommend obtaining more data for training purposes and also we would recommend using LSTM layers for numerical values obtained from audio files.