CNN on CIFR Assignment:

1. Please visit this link to access the state-of-art DenseNet code for reference - DenseNet - cifar10 notebook link
2. You need to create a copy of this and "retrain" this model to achieve 90+ test accuracy.
3. You cannot use Dense Layers (also called fully connected layers), or DropOut.
4. You MUST use Image Augmentation Techniques.
5. You cannot use an already trained model as a beginning points, you have to initilize as your own
6. You cannot run the program for more than 300 Epochs, and it should be clear from your log, that you have only used 300 Epochs
7. You cannot use test images for training the model.
8. You cannot change the general architecture of DenseNet (which means you must use Dense Block, Transition and Output blocks as mentioned in the code)
9. You are free to change Convolution types (e.g. from 3x3 normal convolution to Depthwise Separable, etc)
10. You cannot have more than 1 Million parameters in total
11. You are free to move the code from Keras to Tensorflow, Pytorch, MXNET etc.
12. You can use any optimization algorithm you need.
13. You can checkpoint your model and retrain the model from that checkpoint so that no need of training the model from first if you lost at any epoch while training. You can directly load that model and Train from that epoch.

In [2]:

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

```
Go to this URL in a browser: https://accounts.google.com/o/oauth2/auth?client_id=947318989803-6bn6
qk8qdgf4n4g3pfee6491hc0brc4i.apps.googleusercontent.com&redirect_uri=urn%3aietf%3awg%3aoauth%3a2.0%
b&response_type=code&scope=email%20https%3a%2f%2fwww.googleapis.com%2fauth%2fdocs.test%20https%3a%2
www.googleapis.com%2fauth%2fdrive%20https%3a%2f%2fwww.googleapis.com%2fauth%2fdrive.photos.readonly
ttps%3a%2f%2fwww.googleapis.com%2fauth%2fpeopleapi.readonly

Enter your authorization code:
··········
Mounted at /content/drive
```

In [0]:

```
# import keras
# from keras.datasets import cifar10
# from keras.models import Model, Sequential
# from keras.layers import Dense, Dropout, Flatten, Input, AveragePooling2D, merge, Activation
# from keras.layers import Conv2D, MaxPooling2D, BatchNormalization
# from keras.layers import Concatenate
# from keras.optimizers import Adam
import tensorflow as tf
from tensorflow.keras import models, layers
from tensorflow.keras.models import Model
from tensorflow.keras.layers import BatchNormalization, Activation, Flatten
from tensorflow.keras.optimizers import Adam
```

In [0]:

```
# Hyperparameters
batch_size = 128
num_classes = 10
epochs = 30
l = 40
num_filter = 10
compression = 0.5
dropout_rate = 0
```

In [5]:

```
# Load CIFAR10 Data
(X_train, y_train), (X_test, y_test) = tf.keras.datasets.cifar10.load_data()
img_height, img_width, channel = X_train.shape[1],X_train.shape[2],X_train.shape[3]

# convert to one hot encoding
```

```
# convert to one hot encoing
y_train = tf.keras.utils.to_categorical(y_train, num_classes)
y_test = tf.keras.utils.to_categorical(y_test, num_classes)
```

```
Downloading data from https://www.cs.toronto.edu/~kriz/cifar-10-python.tar.gz
170500096/170498071 [==============================] - 11s 0us/step
```

In [6]:

```
X_train.shape
```

Out[6]:

```
(50000, 32, 32, 3)
```

In [7]:

```
X_test.shape
```

Out[7]:

```
(10000, 32, 32, 3)
```

In [0]:

```
#Dense Block
def denseblock(input, num_filter = 12, dropout_rate = 0.2):
    global compression
    temp = input
    for _ in range(l):
        BatchNorm = layers.BatchNormalization()(temp)
        relu = layers.Activation('relu')(BatchNorm)
        Conv2D_3_3 = layers.Conv2D(int(num_filter*compression), (3,3), use_bias=False ,padding='sam
e')(relu)
        if dropout_rate>0:
            Conv2D_3_3 = layers.Dropout(dropout_rate)(Conv2D_3_3)
        concat = layers.Concatenate(axis=-1)([temp,Conv2D_3_3])

        temp = concat

    return temp

## transition Blosck
def transition(input, num_filter = 12, dropout_rate = 0.2):
    global compression
    BatchNorm = layers.BatchNormalization()(input)
    relu = layers.Activation('relu')(BatchNorm)
    Conv2D_BottleNeck = layers.Conv2D(int(num_filter*compression), (1,1), use_bias=False ,padding='
same')(relu)
    if dropout_rate>0:
         Conv2D_BottleNeck = layers.Dropout(dropout_rate)(Conv2D_BottleNeck)
    avg = layers.AveragePooling2D(pool_size=(2,2))(Conv2D_BottleNeck)
    return avg

#output layer
def output_layer(input):
    global compression
    BatchNorm = layers.BatchNormalization()(input)
    relu = layers.Activation('relu')(BatchNorm)
    AvgPooling = layers.AveragePooling2D(pool_size=(2,2))(relu)
    flat = layers.Flatten()(AvgPooling)
    output = layers.Dense(num_classes, activation='softmax')(flat)
    return output
```

Defining the model architecture

In [8]:

```
input = layers.Input(shape=(img_height, img_width, channel,))
First_Conv2D = layers.Conv2D(num_filter, (3,3), use_bias=False ,padding='same')(input)
```

```
First_Block = denseblock(First_Conv2D, num_filter, dropout_rate)
First_Transition = transition(First_Block, num_filter, dropout_rate)

Second_Block = denseblock(First_Transition, num_filter, dropout_rate)
Second_Transition = transition(Second_Block, num_filter, dropout_rate)

Third_Block = denseblock(Second_Transition, num_filter, dropout_rate)
Third_Transition = transition(Third_Block, num_filter, dropout_rate)

Last_Block = denseblock(Third_Transition,  num_filter, dropout_rate)
output = output_layer(Last_Block)
```

```
WARNING:tensorflow:From /tensorflow-
1.15.0/python3.6/tensorflow_core/python/ops/resource_variable_ops.py:1630: calling
BaseResourceVariable.__init__ (from tensorflow.python.ops.resource_variable_ops) with constraint i
s deprecated and will be removed in a future version.
Instructions for updating:
If using Keras pass *_constraint arguments to layers.
```

In [9]:

```
model = Model(inputs=[input], outputs=[output])
model.summary()
```

```
Model: "model"
```

Layer (type)	Output Shape	Param #	Connected to
input_1 (InputLayer)	[(None, 32, 32, 3)]	0	
conv2d (Conv2D)	(None, 32, 32, 10)	270	input_1[0][0]
batch_normalization (BatchNorma	(None, 32, 32, 10)	40	conv2d[0][0]
activation (Activation)	(None, 32, 32, 10)	0	batch_normalization[0][0]
conv2d_1 (Conv2D)	(None, 32, 32, 5)	450	activation[0][0]
concatenate (Concatenate)	(None, 32, 32, 15)	0	conv2d[0][0] conv2d_1[0][0]
batch_normalization_1 (BatchNor	(None, 32, 32, 15)	60	concatenate[0][0]
activation_1 (Activation)	(None, 32, 32, 15)	0	batch_normalization_1[0][0]
conv2d_2 (Conv2D)	(None, 32, 32, 5)	675	activation_1[0][0]
concatenate_1 (Concatenate)	(None, 32, 32, 20)	0	concatenate[0][0] conv2d_2[0][0]
batch_normalization_2 (BatchNor	(None, 32, 32, 20)	80	concatenate_1[0][0]
activation_2 (Activation)	(None, 32, 32, 20)	0	batch_normalization_2[0][0]
conv2d_3 (Conv2D)	(None, 32, 32, 5)	900	activation_2[0][0]
concatenate_2 (Concatenate)	(None, 32, 32, 25)	0	concatenate_1[0][0] conv2d_3[0][0]
batch_normalization_3 (BatchNor	(None, 32, 32, 25)	100	concatenate_2[0][0]
activation_3 (Activation)	(None, 32, 32, 25)	0	batch_normalization_3[0][0]
conv2d_4 (Conv2D)	(None, 32, 32, 5)	1125	activation_3[0][0]
concatenate_3 (Concatenate)	(None, 32, 32, 30)	0	concatenate_2[0][0] conv2d_4[0][0]
batch_normalization_4 (BatchNor	(None, 32, 32, 30)	120	concatenate_3[0][0]
activation_4 (Activation)	(None, 32, 32, 30)	0	batch_normalization_4[0][0]
conv2d_5 (Conv2D)	(None, 32, 32, 5)	1350	activation_4[0][0]

concatenate_4 (Concatenate)	(None, 32, 32, 35)	0	concatenate_3[0][0] conv2d_5[0][0]
batch_normalization_5 (BatchNor	(None, 32, 32, 35)	140	concatenate_4[0][0]
activation_5 (Activation)	(None, 32, 32, 35)	0	batch_normalization_5[0][0]
conv2d_6 (Conv2D)	(None, 32, 32, 5)	1575	activation_5[0][0]
concatenate_5 (Concatenate)	(None, 32, 32, 40)	0	concatenate_4[0][0] conv2d_6[0][0]
batch_normalization_6 (BatchNor	(None, 32, 32, 40)	160	concatenate_5[0][0]
activation_6 (Activation)	(None, 32, 32, 40)	0	batch_normalization_6[0][0]
conv2d_7 (Conv2D)	(None, 32, 32, 5)	1800	activation_6[0][0]
concatenate_6 (Concatenate)	(None, 32, 32, 45)	0	concatenate_5[0][0] conv2d_7[0][0]
batch_normalization_7 (BatchNor	(None, 32, 32, 45)	180	concatenate_6[0][0]
activation_7 (Activation)	(None, 32, 32, 45)	0	batch_normalization_7[0][0]
conv2d_8 (Conv2D)	(None, 32, 32, 5)	2025	activation_7[0][0]
concatenate_7 (Concatenate)	(None, 32, 32, 50)	0	concatenate_6[0][0] conv2d_8[0][0]
batch_normalization_8 (BatchNor	(None, 32, 32, 50)	200	concatenate_7[0][0]
activation_8 (Activation)	(None, 32, 32, 50)	0	batch_normalization_8[0][0]
conv2d_9 (Conv2D)	(None, 32, 32, 5)	2250	activation_8[0][0]
concatenate_8 (Concatenate)	(None, 32, 32, 55)	0	concatenate_7[0][0] conv2d_9[0][0]
batch_normalization_9 (BatchNor	(None, 32, 32, 55)	220	concatenate_8[0][0]
activation_9 (Activation)	(None, 32, 32, 55)	0	batch_normalization_9[0][0]
conv2d_10 (Conv2D)	(None, 32, 32, 5)	2475	activation_9[0][0]
concatenate_9 (Concatenate)	(None, 32, 32, 60)	0	concatenate_8[0][0] conv2d_10[0][0]
batch_normalization_10 (BatchNo	(None, 32, 32, 60)	240	concatenate_9[0][0]
activation_10 (Activation)	(None, 32, 32, 60)	0	batch_normalization_10[0][0]
conv2d_11 (Conv2D)	(None, 32, 32, 5)	2700	activation_10[0][0]
concatenate_10 (Concatenate)	(None, 32, 32, 65)	0	concatenate_9[0][0] conv2d_11[0][0]
batch_normalization_11 (BatchNo	(None, 32, 32, 65)	260	concatenate_10[0][0]
activation_11 (Activation)	(None, 32, 32, 65)	0	batch_normalization_11[0][0]
conv2d_12 (Conv2D)	(None, 32, 32, 5)	2925	activation_11[0][0]
concatenate_11 (Concatenate)	(None, 32, 32, 70)	0	concatenate_10[0][0] conv2d_12[0][0]
batch_normalization_12 (BatchNo	(None, 32, 32, 70)	280	concatenate_11[0][0]
activation_12 (Activation)	(None, 32, 32, 70)	0	batch_normalization_12[0][0]
conv2d_13 (Conv2D)	(None, 32, 32, 5)	3150	activation_12[0][0]
concatenate_12 (Concatenate)	(None, 32, 32, 75)	0	concatenate_11[0][0] conv2d_13[0][0]
batch_normalization_13 (BatchNo	(None, 32, 32, 75)	300	concatenate_12[0][0]

activation_13 (Activation)	(None, 32, 32, 75)	0	batch_normalization_13[0][0]
conv2d_14 (Conv2D)	(None, 32, 32, 5)	3375	activation_13[0][0]
concatenate_13 (Concatenate)	(None, 32, 32, 80)	0	concatenate_12[0][0] conv2d_14[0][0]
batch_normalization_14 (BatchNo	(None, 32, 32, 80)	320	concatenate_13[0][0]
activation_14 (Activation)	(None, 32, 32, 80)	0	batch_normalization_14[0][0]
conv2d_15 (Conv2D)	(None, 32, 32, 5)	3600	activation_14[0][0]
concatenate_14 (Concatenate)	(None, 32, 32, 85)	0	concatenate_13[0][0] conv2d_15[0][0]
batch_normalization_15 (BatchNo	(None, 32, 32, 85)	340	concatenate_14[0][0]
activation_15 (Activation)	(None, 32, 32, 85)	0	batch_normalization_15[0][0]
conv2d_16 (Conv2D)	(None, 32, 32, 5)	3825	activation_15[0][0]
concatenate_15 (Concatenate)	(None, 32, 32, 90)	0	concatenate_14[0][0] conv2d_16[0][0]
batch_normalization_16 (BatchNo	(None, 32, 32, 90)	360	concatenate_15[0][0]
activation_16 (Activation)	(None, 32, 32, 90)	0	batch_normalization_16[0][0]
conv2d_17 (Conv2D)	(None, 32, 32, 5)	4050	activation_16[0][0]
concatenate_16 (Concatenate)	(None, 32, 32, 95)	0	concatenate_15[0][0] conv2d_17[0][0]
batch_normalization_17 (BatchNo	(None, 32, 32, 95)	380	concatenate_16[0][0]
activation_17 (Activation)	(None, 32, 32, 95)	0	batch_normalization_17[0][0]
conv2d_18 (Conv2D)	(None, 32, 32, 5)	4275	activation_17[0][0]
concatenate_17 (Concatenate)	(None, 32, 32, 100)	0	concatenate_16[0][0] conv2d_18[0][0]
batch_normalization_18 (BatchNo	(None, 32, 32, 100)	400	concatenate_17[0][0]
activation_18 (Activation)	(None, 32, 32, 100)	0	batch_normalization_18[0][0]
conv2d_19 (Conv2D)	(None, 32, 32, 5)	4500	activation_18[0][0]
concatenate_18 (Concatenate)	(None, 32, 32, 105)	0	concatenate_17[0][0] conv2d_19[0][0]
batch_normalization_19 (BatchNo	(None, 32, 32, 105)	420	concatenate_18[0][0]
activation_19 (Activation)	(None, 32, 32, 105)	0	batch_normalization_19[0][0]
conv2d_20 (Conv2D)	(None, 32, 32, 5)	4725	activation_19[0][0]
concatenate_19 (Concatenate)	(None, 32, 32, 110)	0	concatenate_18[0][0] conv2d_20[0][0]
batch_normalization_20 (BatchNo	(None, 32, 32, 110)	440	concatenate_19[0][0]
activation_20 (Activation)	(None, 32, 32, 110)	0	batch_normalization_20[0][0]
conv2d_21 (Conv2D)	(None, 32, 32, 5)	4950	activation_20[0][0]
concatenate_20 (Concatenate)	(None, 32, 32, 115)	0	concatenate_19[0][0] conv2d_21[0][0]
batch_normalization_21 (BatchNo	(None, 32, 32, 115)	460	concatenate_20[0][0]
activation_21 (Activation)	(None, 32, 32, 115)	0	batch_normalization_21[0][0]
conv2d_22 (Conv2D)	(None, 32, 32, 5)	5175	activation_21[0][0]
concatenate_21 (Concatenate)	(None, 32, 32, 120)	0	concatenate_20[0][0]

			conv2d_22[0][0]
batch_normalization_22 (BatchNo	(None, 32, 32, 120)	480	concatenate_21[0][0]
activation_22 (Activation)	(None, 32, 32, 120)	0	batch_normalization_22[0][0]
conv2d_23 (Conv2D)	(None, 32, 32, 5)	5400	activation_22[0][0]
concatenate_22 (Concatenate)	(None, 32, 32, 125)	0	concatenate_21[0][0] conv2d_23[0][0]
batch_normalization_23 (BatchNo	(None, 32, 32, 125)	500	concatenate_22[0][0]
activation_23 (Activation)	(None, 32, 32, 125)	0	batch_normalization_23[0][0]
conv2d_24 (Conv2D)	(None, 32, 32, 5)	5625	activation_23[0][0]
concatenate_23 (Concatenate)	(None, 32, 32, 130)	0	concatenate_22[0][0] conv2d_24[0][0]
batch_normalization_24 (BatchNo	(None, 32, 32, 130)	520	concatenate_23[0][0]
activation_24 (Activation)	(None, 32, 32, 130)	0	batch_normalization_24[0][0]
conv2d_25 (Conv2D)	(None, 32, 32, 5)	5850	activation_24[0][0]
concatenate_24 (Concatenate)	(None, 32, 32, 135)	0	concatenate_23[0][0] conv2d_25[0][0]
batch_normalization_25 (BatchNo	(None, 32, 32, 135)	540	concatenate_24[0][0]
activation_25 (Activation)	(None, 32, 32, 135)	0	batch_normalization_25[0][0]
conv2d_26 (Conv2D)	(None, 32, 32, 5)	6075	activation_25[0][0]
concatenate_25 (Concatenate)	(None, 32, 32, 140)	0	concatenate_24[0][0] conv2d_26[0][0]
batch_normalization_26 (BatchNo	(None, 32, 32, 140)	560	concatenate_25[0][0]
activation_26 (Activation)	(None, 32, 32, 140)	0	batch_normalization_26[0][0]
conv2d_27 (Conv2D)	(None, 32, 32, 5)	6300	activation_26[0][0]
concatenate_26 (Concatenate)	(None, 32, 32, 145)	0	concatenate_25[0][0] conv2d_27[0][0]
batch_normalization_27 (BatchNo	(None, 32, 32, 145)	580	concatenate_26[0][0]
activation_27 (Activation)	(None, 32, 32, 145)	0	batch_normalization_27[0][0]
conv2d_28 (Conv2D)	(None, 32, 32, 5)	6525	activation_27[0][0]
concatenate_27 (Concatenate)	(None, 32, 32, 150)	0	concatenate_26[0][0] conv2d_28[0][0]
batch_normalization_28 (BatchNo	(None, 32, 32, 150)	600	concatenate_27[0][0]
activation_28 (Activation)	(None, 32, 32, 150)	0	batch_normalization_28[0][0]
conv2d_29 (Conv2D)	(None, 32, 32, 5)	6750	activation_28[0][0]
concatenate_28 (Concatenate)	(None, 32, 32, 155)	0	concatenate_27[0][0] conv2d_29[0][0]
batch_normalization_29 (BatchNo	(None, 32, 32, 155)	620	concatenate_28[0][0]
activation_29 (Activation)	(None, 32, 32, 155)	0	batch_normalization_29[0][0]
conv2d_30 (Conv2D)	(None, 32, 32, 5)	6975	activation_29[0][0]
concatenate_29 (Concatenate)	(None, 32, 32, 160)	0	concatenate_28[0][0] conv2d_30[0][0]
batch_normalization_30 (BatchNo	(None, 32, 32, 160)	640	concatenate_29[0][0]
activation_30 (Activation)	(None, 32, 32, 160)	0	batch_normalization_30[0][0]

conv2d_31 (Conv2D)	(None, 32, 32, 5)	7200	activation_30[0][0]
concatenate_30 (Concatenate)	(None, 32, 32, 165)	0	concatenate_29[0][0] conv2d_31[0][0]
batch_normalization_31 (BatchNo	(None, 32, 32, 165)	660	concatenate_30[0][0]
activation_31 (Activation)	(None, 32, 32, 165)	0	batch_normalization_31[0][0]
conv2d_32 (Conv2D)	(None, 32, 32, 5)	7425	activation_31[0][0]
concatenate_31 (Concatenate)	(None, 32, 32, 170)	0	concatenate_30[0][0] conv2d_32[0][0]
batch_normalization_32 (BatchNo	(None, 32, 32, 170)	680	concatenate_31[0][0]
activation_32 (Activation)	(None, 32, 32, 170)	0	batch_normalization_32[0][0]
conv2d_33 (Conv2D)	(None, 32, 32, 5)	7650	activation_32[0][0]
concatenate_32 (Concatenate)	(None, 32, 32, 175)	0	concatenate_31[0][0] conv2d_33[0][0]
batch_normalization_33 (BatchNo	(None, 32, 32, 175)	700	concatenate_32[0][0]
activation_33 (Activation)	(None, 32, 32, 175)	0	batch_normalization_33[0][0]
conv2d_34 (Conv2D)	(None, 32, 32, 5)	7875	activation_33[0][0]
concatenate_33 (Concatenate)	(None, 32, 32, 180)	0	concatenate_32[0][0] conv2d_34[0][0]
batch_normalization_34 (BatchNo	(None, 32, 32, 180)	720	concatenate_33[0][0]
activation_34 (Activation)	(None, 32, 32, 180)	0	batch_normalization_34[0][0]
conv2d_35 (Conv2D)	(None, 32, 32, 5)	8100	activation_34[0][0]
concatenate_34 (Concatenate)	(None, 32, 32, 185)	0	concatenate_33[0][0] conv2d_35[0][0]
batch_normalization_35 (BatchNo	(None, 32, 32, 185)	740	concatenate_34[0][0]
activation_35 (Activation)	(None, 32, 32, 185)	0	batch_normalization_35[0][0]
conv2d_36 (Conv2D)	(None, 32, 32, 5)	8325	activation_35[0][0]
concatenate_35 (Concatenate)	(None, 32, 32, 190)	0	concatenate_34[0][0] conv2d_36[0][0]
batch_normalization_36 (BatchNo	(None, 32, 32, 190)	760	concatenate_35[0][0]
activation_36 (Activation)	(None, 32, 32, 190)	0	batch_normalization_36[0][0]
conv2d_37 (Conv2D)	(None, 32, 32, 5)	8550	activation_36[0][0]
concatenate_36 (Concatenate)	(None, 32, 32, 195)	0	concatenate_35[0][0] conv2d_37[0][0]
batch_normalization_37 (BatchNo	(None, 32, 32, 195)	780	concatenate_36[0][0]
activation_37 (Activation)	(None, 32, 32, 195)	0	batch_normalization_37[0][0]
conv2d_38 (Conv2D)	(None, 32, 32, 5)	8775	activation_37[0][0]
concatenate_37 (Concatenate)	(None, 32, 32, 200)	0	concatenate_36[0][0] conv2d_38[0][0]
batch_normalization_38 (BatchNo	(None, 32, 32, 200)	800	concatenate_37[0][0]
activation_38 (Activation)	(None, 32, 32, 200)	0	batch_normalization_38[0][0]
conv2d_39 (Conv2D)	(None, 32, 32, 5)	9000	activation_38[0][0]
concatenate_38 (Concatenate)	(None, 32, 32, 205)	0	concatenate_37[0][0] conv2d_39[0][0]

batch_normalization_39 (BatchNo	(None, 32, 32, 205)	820	concatenate_38[0][0]
activation_39 (Activation)	(None, 32, 32, 205)	0	batch_normalization_39[0][0]
conv2d_40 (Conv2D)	(None, 32, 32, 5)	9225	activation_39[0][0]
concatenate_39 (Concatenate)	(None, 32, 32, 210)	0	concatenate_38[0][0] conv2d_40[0][0]
batch_normalization_40 (BatchNo	(None, 32, 32, 210)	840	concatenate_39[0][0]
activation_40 (Activation)	(None, 32, 32, 210)	0	batch_normalization_40[0][0]
conv2d_41 (Conv2D)	(None, 32, 32, 5)	1050	activation_40[0][0]
average_pooling2d (AveragePooli	(None, 16, 16, 5)	0	conv2d_41[0][0]
batch_normalization_41 (BatchNo	(None, 16, 16, 5)	20	average_pooling2d[0][0]
activation_41 (Activation)	(None, 16, 16, 5)	0	batch_normalization_41[0][0]
conv2d_42 (Conv2D)	(None, 16, 16, 5)	225	activation_41[0][0]
concatenate_40 (Concatenate)	(None, 16, 16, 10)	0	average_pooling2d[0][0] conv2d_42[0][0]
batch_normalization_42 (BatchNo	(None, 16, 16, 10)	40	concatenate_40[0][0]
activation_42 (Activation)	(None, 16, 16, 10)	0	batch_normalization_42[0][0]
conv2d_43 (Conv2D)	(None, 16, 16, 5)	450	activation_42[0][0]
concatenate_41 (Concatenate)	(None, 16, 16, 15)	0	concatenate_40[0][0] conv2d_43[0][0]
batch_normalization_43 (BatchNo	(None, 16, 16, 15)	60	concatenate_41[0][0]
activation_43 (Activation)	(None, 16, 16, 15)	0	batch_normalization_43[0][0]
conv2d_44 (Conv2D)	(None, 16, 16, 5)	675	activation_43[0][0]
concatenate_42 (Concatenate)	(None, 16, 16, 20)	0	concatenate_41[0][0] conv2d_44[0][0]
batch_normalization_44 (BatchNo	(None, 16, 16, 20)	80	concatenate_42[0][0]
activation_44 (Activation)	(None, 16, 16, 20)	0	batch_normalization_44[0][0]
conv2d_45 (Conv2D)	(None, 16, 16, 5)	900	activation_44[0][0]
concatenate_43 (Concatenate)	(None, 16, 16, 25)	0	concatenate_42[0][0] conv2d_45[0][0]
batch_normalization_45 (BatchNo	(None, 16, 16, 25)	100	concatenate_43[0][0]
activation_45 (Activation)	(None, 16, 16, 25)	0	batch_normalization_45[0][0]
conv2d_46 (Conv2D)	(None, 16, 16, 5)	1125	activation_45[0][0]
concatenate_44 (Concatenate)	(None, 16, 16, 30)	0	concatenate_43[0][0] conv2d_46[0][0]
batch_normalization_46 (BatchNo	(None, 16, 16, 30)	120	concatenate_44[0][0]
activation_46 (Activation)	(None, 16, 16, 30)	0	batch_normalization_46[0][0]
conv2d_47 (Conv2D)	(None, 16, 16, 5)	1350	activation_46[0][0]
concatenate_45 (Concatenate)	(None, 16, 16, 35)	0	concatenate_44[0][0] conv2d_47[0][0]
batch_normalization_47 (BatchNo	(None, 16, 16, 35)	140	concatenate_45[0][0]
activation_47 (Activation)	(None, 16, 16, 35)	0	batch_normalization_47[0][0]
conv2d_48 (Conv2D)	(None, 16, 16, 5)	1575	activation_47[0][0]

concatenate_46 (Concatenate)	(None, 16, 16, 40)	0	concatenate_45[0][0] conv2d_48[0][0]
batch_normalization_48 (BatchNo	(None, 16, 16, 40)	160	concatenate_46[0][0]
activation_48 (Activation)	(None, 16, 16, 40)	0	batch_normalization_48[0][0]
conv2d_49 (Conv2D)	(None, 16, 16, 5)	1800	activation_48[0][0]
concatenate_47 (Concatenate)	(None, 16, 16, 45)	0	concatenate_46[0][0] conv2d_49[0][0]
batch_normalization_49 (BatchNo	(None, 16, 16, 45)	180	concatenate_47[0][0]
activation_49 (Activation)	(None, 16, 16, 45)	0	batch_normalization_49[0][0]
conv2d_50 (Conv2D)	(None, 16, 16, 5)	2025	activation_49[0][0]
concatenate_48 (Concatenate)	(None, 16, 16, 50)	0	concatenate_47[0][0] conv2d_50[0][0]
batch_normalization_50 (BatchNo	(None, 16, 16, 50)	200	concatenate_48[0][0]
activation_50 (Activation)	(None, 16, 16, 50)	0	batch_normalization_50[0][0]
conv2d_51 (Conv2D)	(None, 16, 16, 5)	2250	activation_50[0][0]
concatenate_49 (Concatenate)	(None, 16, 16, 55)	0	concatenate_48[0][0] conv2d_51[0][0]
batch_normalization_51 (BatchNo	(None, 16, 16, 55)	220	concatenate_49[0][0]
activation_51 (Activation)	(None, 16, 16, 55)	0	batch_normalization_51[0][0]
conv2d_52 (Conv2D)	(None, 16, 16, 5)	2475	activation_51[0][0]
concatenate_50 (Concatenate)	(None, 16, 16, 60)	0	concatenate_49[0][0] conv2d_52[0][0]
batch_normalization_52 (BatchNo	(None, 16, 16, 60)	240	concatenate_50[0][0]
activation_52 (Activation)	(None, 16, 16, 60)	0	batch_normalization_52[0][0]
conv2d_53 (Conv2D)	(None, 16, 16, 5)	2700	activation_52[0][0]
concatenate_51 (Concatenate)	(None, 16, 16, 65)	0	concatenate_50[0][0] conv2d_53[0][0]
batch_normalization_53 (BatchNo	(None, 16, 16, 65)	260	concatenate_51[0][0]
activation_53 (Activation)	(None, 16, 16, 65)	0	batch_normalization_53[0][0]
conv2d_54 (Conv2D)	(None, 16, 16, 5)	2925	activation_53[0][0]
concatenate_52 (Concatenate)	(None, 16, 16, 70)	0	concatenate_51[0][0] conv2d_54[0][0]
batch_normalization_54 (BatchNo	(None, 16, 16, 70)	280	concatenate_52[0][0]
activation_54 (Activation)	(None, 16, 16, 70)	0	batch_normalization_54[0][0]
conv2d_55 (Conv2D)	(None, 16, 16, 5)	3150	activation_54[0][0]
concatenate_53 (Concatenate)	(None, 16, 16, 75)	0	concatenate_52[0][0] conv2d_55[0][0]
batch_normalization_55 (BatchNo	(None, 16, 16, 75)	300	concatenate_53[0][0]
activation_55 (Activation)	(None, 16, 16, 75)	0	batch_normalization_55[0][0]
conv2d_56 (Conv2D)	(None, 16, 16, 5)	3375	activation_55[0][0]
concatenate_54 (Concatenate)	(None, 16, 16, 80)	0	concatenate_53[0][0] conv2d_56[0][0]
batch_normalization_56 (BatchNo	(None, 16, 16, 80)	320	concatenate_54[0][0]

activation_56 (Activation)	(None, 16, 16, 80)	0	batch_normalization_56[0][0]
conv2d_57 (Conv2D)	(None, 16, 16, 5)	3600	activation_56[0][0]
concatenate_55 (Concatenate)	(None, 16, 16, 85)	0	concatenate_54[0][0] conv2d_57[0][0]
batch_normalization_57 (BatchNo	(None, 16, 16, 85)	340	concatenate_55[0][0]
activation_57 (Activation)	(None, 16, 16, 85)	0	batch_normalization_57[0][0]
conv2d_58 (Conv2D)	(None, 16, 16, 5)	3825	activation_57[0][0]
concatenate_56 (Concatenate)	(None, 16, 16, 90)	0	concatenate_55[0][0] conv2d_58[0][0]
batch_normalization_58 (BatchNo	(None, 16, 16, 90)	360	concatenate_56[0][0]
activation_58 (Activation)	(None, 16, 16, 90)	0	batch_normalization_58[0][0]
conv2d_59 (Conv2D)	(None, 16, 16, 5)	4050	activation_58[0][0]
concatenate_57 (Concatenate)	(None, 16, 16, 95)	0	concatenate_56[0][0] conv2d_59[0][0]
batch_normalization_59 (BatchNo	(None, 16, 16, 95)	380	concatenate_57[0][0]
activation_59 (Activation)	(None, 16, 16, 95)	0	batch_normalization_59[0][0]
conv2d_60 (Conv2D)	(None, 16, 16, 5)	4275	activation_59[0][0]
concatenate_58 (Concatenate)	(None, 16, 16, 100)	0	concatenate_57[0][0] conv2d_60[0][0]
batch_normalization_60 (BatchNo	(None, 16, 16, 100)	400	concatenate_58[0][0]
activation_60 (Activation)	(None, 16, 16, 100)	0	batch_normalization_60[0][0]
conv2d_61 (Conv2D)	(None, 16, 16, 5)	4500	activation_60[0][0]
concatenate_59 (Concatenate)	(None, 16, 16, 105)	0	concatenate_58[0][0] conv2d_61[0][0]
batch_normalization_61 (BatchNo	(None, 16, 16, 105)	420	concatenate_59[0][0]
activation_61 (Activation)	(None, 16, 16, 105)	0	batch_normalization_61[0][0]
conv2d_62 (Conv2D)	(None, 16, 16, 5)	4725	activation_61[0][0]
concatenate_60 (Concatenate)	(None, 16, 16, 110)	0	concatenate_59[0][0] conv2d_62[0][0]
batch_normalization_62 (BatchNo	(None, 16, 16, 110)	440	concatenate_60[0][0]
activation_62 (Activation)	(None, 16, 16, 110)	0	batch_normalization_62[0][0]
conv2d_63 (Conv2D)	(None, 16, 16, 5)	4950	activation_62[0][0]
concatenate_61 (Concatenate)	(None, 16, 16, 115)	0	concatenate_60[0][0] conv2d_63[0][0]
batch_normalization_63 (BatchNo	(None, 16, 16, 115)	460	concatenate_61[0][0]
activation_63 (Activation)	(None, 16, 16, 115)	0	batch_normalization_63[0][0]
conv2d_64 (Conv2D)	(None, 16, 16, 5)	5175	activation_63[0][0]
concatenate_62 (Concatenate)	(None, 16, 16, 120)	0	concatenate_61[0][0] conv2d_64[0][0]
batch_normalization_64 (BatchNo	(None, 16, 16, 120)	480	concatenate_62[0][0]
activation_64 (Activation)	(None, 16, 16, 120)	0	batch_normalization_64[0][0]
conv2d_65 (Conv2D)	(None, 16, 16, 5)	5400	activation_64[0][0]

concatenate_63 (Concatenate)	(None, 16, 16, 125)	0	concatenate_62[0][0] conv2d_65[0][0]
batch_normalization_65 (BatchNo	(None, 16, 16, 125)	500	concatenate_63[0][0]
activation_65 (Activation)	(None, 16, 16, 125)	0	batch_normalization_65[0][0]
conv2d_66 (Conv2D)	(None, 16, 16, 5)	5625	activation_65[0][0]
concatenate_64 (Concatenate)	(None, 16, 16, 130)	0	concatenate_63[0][0] conv2d_66[0][0]
batch_normalization_66 (BatchNo	(None, 16, 16, 130)	520	concatenate_64[0][0]
activation_66 (Activation)	(None, 16, 16, 130)	0	batch_normalization_66[0][0]
conv2d_67 (Conv2D)	(None, 16, 16, 5)	5850	activation_66[0][0]
concatenate_65 (Concatenate)	(None, 16, 16, 135)	0	concatenate_64[0][0] conv2d_67[0][0]
batch_normalization_67 (BatchNo	(None, 16, 16, 135)	540	concatenate_65[0][0]
activation_67 (Activation)	(None, 16, 16, 135)	0	batch_normalization_67[0][0]
conv2d_68 (Conv2D)	(None, 16, 16, 5)	6075	activation_67[0][0]
concatenate_66 (Concatenate)	(None, 16, 16, 140)	0	concatenate_65[0][0] conv2d_68[0][0]
batch_normalization_68 (BatchNo	(None, 16, 16, 140)	560	concatenate_66[0][0]
activation_68 (Activation)	(None, 16, 16, 140)	0	batch_normalization_68[0][0]
conv2d_69 (Conv2D)	(None, 16, 16, 5)	6300	activation_68[0][0]
concatenate_67 (Concatenate)	(None, 16, 16, 145)	0	concatenate_66[0][0] conv2d_69[0][0]
batch_normalization_69 (BatchNo	(None, 16, 16, 145)	580	concatenate_67[0][0]
activation_69 (Activation)	(None, 16, 16, 145)	0	batch_normalization_69[0][0]
conv2d_70 (Conv2D)	(None, 16, 16, 5)	6525	activation_69[0][0]
concatenate_68 (Concatenate)	(None, 16, 16, 150)	0	concatenate_67[0][0] conv2d_70[0][0]
batch_normalization_70 (BatchNo	(None, 16, 16, 150)	600	concatenate_68[0][0]
activation_70 (Activation)	(None, 16, 16, 150)	0	batch_normalization_70[0][0]
conv2d_71 (Conv2D)	(None, 16, 16, 5)	6750	activation_70[0][0]
concatenate_69 (Concatenate)	(None, 16, 16, 155)	0	concatenate_68[0][0] conv2d_71[0][0]
batch_normalization_71 (BatchNo	(None, 16, 16, 155)	620	concatenate_69[0][0]
activation_71 (Activation)	(None, 16, 16, 155)	0	batch_normalization_71[0][0]
conv2d_72 (Conv2D)	(None, 16, 16, 5)	6975	activation_71[0][0]
concatenate_70 (Concatenate)	(None, 16, 16, 160)	0	concatenate_69[0][0] conv2d_72[0][0]
batch_normalization_72 (BatchNo	(None, 16, 16, 160)	640	concatenate_70[0][0]
activation_72 (Activation)	(None, 16, 16, 160)	0	batch_normalization_72[0][0]
conv2d_73 (Conv2D)	(None, 16, 16, 5)	7200	activation_72[0][0]
concatenate_71 (Concatenate)	(None, 16, 16, 165)	0	concatenate_70[0][0] conv2d_73[0][0]
batch_normalization_73 (BatchNo	(None, 16, 16, 165)	660	concatenate_71[0][0]

activation_73 (Activation)	(None, 16, 16, 165)	0	batch_normalization_73[0][0]
conv2d_74 (Conv2D)	(None, 16, 16, 5)	7425	activation_73[0][0]
concatenate_72 (Concatenate)	(None, 16, 16, 170)	0	concatenate_71[0][0] conv2d_74[0][0]
batch_normalization_74 (BatchNo	(None, 16, 16, 170)	680	concatenate_72[0][0]
activation_74 (Activation)	(None, 16, 16, 170)	0	batch_normalization_74[0][0]
conv2d_75 (Conv2D)	(None, 16, 16, 5)	7650	activation_74[0][0]
concatenate_73 (Concatenate)	(None, 16, 16, 175)	0	concatenate_72[0][0] conv2d_75[0][0]
batch_normalization_75 (BatchNo	(None, 16, 16, 175)	700	concatenate_73[0][0]
activation_75 (Activation)	(None, 16, 16, 175)	0	batch_normalization_75[0][0]
conv2d_76 (Conv2D)	(None, 16, 16, 5)	7875	activation_75[0][0]
concatenate_74 (Concatenate)	(None, 16, 16, 180)	0	concatenate_73[0][0] conv2d_76[0][0]
batch_normalization_76 (BatchNo	(None, 16, 16, 180)	720	concatenate_74[0][0]
activation_76 (Activation)	(None, 16, 16, 180)	0	batch_normalization_76[0][0]
conv2d_77 (Conv2D)	(None, 16, 16, 5)	8100	activation_76[0][0]
concatenate_75 (Concatenate)	(None, 16, 16, 185)	0	concatenate_74[0][0] conv2d_77[0][0]
batch_normalization_77 (BatchNo	(None, 16, 16, 185)	740	concatenate_75[0][0]
activation_77 (Activation)	(None, 16, 16, 185)	0	batch_normalization_77[0][0]
conv2d_78 (Conv2D)	(None, 16, 16, 5)	8325	activation_77[0][0]
concatenate_76 (Concatenate)	(None, 16, 16, 190)	0	concatenate_75[0][0] conv2d_78[0][0]
batch_normalization_78 (BatchNo	(None, 16, 16, 190)	760	concatenate_76[0][0]
activation_78 (Activation)	(None, 16, 16, 190)	0	batch_normalization_78[0][0]
conv2d_79 (Conv2D)	(None, 16, 16, 5)	8550	activation_78[0][0]
concatenate_77 (Concatenate)	(None, 16, 16, 195)	0	concatenate_76[0][0] conv2d_79[0][0]
batch_normalization_79 (BatchNo	(None, 16, 16, 195)	780	concatenate_77[0][0]
activation_79 (Activation)	(None, 16, 16, 195)	0	batch_normalization_79[0][0]
conv2d_80 (Conv2D)	(None, 16, 16, 5)	8775	activation_79[0][0]
concatenate_78 (Concatenate)	(None, 16, 16, 200)	0	concatenate_77[0][0] conv2d_80[0][0]
batch_normalization_80 (BatchNo	(None, 16, 16, 200)	800	concatenate_78[0][0]
activation_80 (Activation)	(None, 16, 16, 200)	0	batch_normalization_80[0][0]
conv2d_81 (Conv2D)	(None, 16, 16, 5)	9000	activation_80[0][0]
concatenate_79 (Concatenate)	(None, 16, 16, 205)	0	concatenate_78[0][0] conv2d_81[0][0]
batch_normalization_81 (BatchNo	(None, 16, 16, 205)	820	concatenate_79[0][0]
activation_81 (Activation)	(None, 16, 16, 205)	0	batch_normalization_81[0][0]
conv2d_82 (Conv2D)	(None, 16, 16, 5)	1025	activation_81[0][0]
average_pooling2d_1 (AveragePoo	(None, 8, 8, 5)	0	conv2d_82[0][0]

average_pooling2d_1 (AveragePoo	(None, 8, 8, 5)	0	conv2d_82[0][0]	
batch_normalization_82 (BatchNo	(None, 8, 8, 5)	20	average_pooling2d_1[0][0]	
activation_82 (Activation)	(None, 8, 8, 5)	0	batch_normalization_82[0][0]	
conv2d_83 (Conv2D)	(None, 8, 8, 5)	225	activation_82[0][0]	
concatenate_80 (Concatenate)	(None, 8, 8, 10)	0	average_pooling2d_1[0][0] conv2d_83[0][0]	
batch_normalization_83 (BatchNo	(None, 8, 8, 10)	40	concatenate_80[0][0]	
activation_83 (Activation)	(None, 8, 8, 10)	0	batch_normalization_83[0][0]	
conv2d_84 (Conv2D)	(None, 8, 8, 5)	450	activation_83[0][0]	
concatenate_81 (Concatenate)	(None, 8, 8, 15)	0	concatenate_80[0][0] conv2d_84[0][0]	
batch_normalization_84 (BatchNo	(None, 8, 8, 15)	60	concatenate_81[0][0]	
activation_84 (Activation)	(None, 8, 8, 15)	0	batch_normalization_84[0][0]	
conv2d_85 (Conv2D)	(None, 8, 8, 5)	675	activation_84[0][0]	
concatenate_82 (Concatenate)	(None, 8, 8, 20)	0	concatenate_81[0][0] conv2d_85[0][0]	
batch_normalization_85 (BatchNo	(None, 8, 8, 20)	80	concatenate_82[0][0]	
activation_85 (Activation)	(None, 8, 8, 20)	0	batch_normalization_85[0][0]	
conv2d_86 (Conv2D)	(None, 8, 8, 5)	900	activation_85[0][0]	
concatenate_83 (Concatenate)	(None, 8, 8, 25)	0	concatenate_82[0][0] conv2d_86[0][0]	
batch_normalization_86 (BatchNo	(None, 8, 8, 25)	100	concatenate_83[0][0]	
activation_86 (Activation)	(None, 8, 8, 25)	0	batch_normalization_86[0][0]	
conv2d_87 (Conv2D)	(None, 8, 8, 5)	1125	activation_86[0][0]	
concatenate_84 (Concatenate)	(None, 8, 8, 30)	0	concatenate_83[0][0] conv2d_87[0][0]	
batch_normalization_87 (BatchNo	(None, 8, 8, 30)	120	concatenate_84[0][0]	
activation_87 (Activation)	(None, 8, 8, 30)	0	batch_normalization_87[0][0]	
conv2d_88 (Conv2D)	(None, 8, 8, 5)	1350	activation_87[0][0]	
concatenate_85 (Concatenate)	(None, 8, 8, 35)	0	concatenate_84[0][0] conv2d_88[0][0]	
batch_normalization_88 (BatchNo	(None, 8, 8, 35)	140	concatenate_85[0][0]	
activation_88 (Activation)	(None, 8, 8, 35)	0	batch_normalization_88[0][0]	
conv2d_89 (Conv2D)	(None, 8, 8, 5)	1575	activation_88[0][0]	
concatenate_86 (Concatenate)	(None, 8, 8, 40)	0	concatenate_85[0][0] conv2d_89[0][0]	
batch_normalization_89 (BatchNo	(None, 8, 8, 40)	160	concatenate_86[0][0]	
activation_89 (Activation)	(None, 8, 8, 40)	0	batch_normalization_89[0][0]	
conv2d_90 (Conv2D)	(None, 8, 8, 5)	1800	activation_89[0][0]	
concatenate_87 (Concatenate)	(None, 8, 8, 45)	0	concatenate_86[0][0] conv2d_90[0][0]	
batch_normalization_90 (BatchNo	(None, 8, 8, 45)	180	concatenate_87[0][0]	
activation_90 (Activation)	(None, 8, 8, 45)	0	batch_normalization_90[0][0]	

conv2d_91 (Conv2D)	(None, 8, 8, 5)	2025	activation_90[0][0]
concatenate_88 (Concatenate)	(None, 8, 8, 50)	0	concatenate_87[0][0] conv2d_91[0][0]
batch_normalization_91 (BatchNo	(None, 8, 8, 50)	200	concatenate_88[0][0]
activation_91 (Activation)	(None, 8, 8, 50)	0	batch_normalization_91[0][0]
conv2d_92 (Conv2D)	(None, 8, 8, 5)	2250	activation_91[0][0]
concatenate_89 (Concatenate)	(None, 8, 8, 55)	0	concatenate_88[0][0] conv2d_92[0][0]
batch_normalization_92 (BatchNo	(None, 8, 8, 55)	220	concatenate_89[0][0]
activation_92 (Activation)	(None, 8, 8, 55)	0	batch_normalization_92[0][0]
conv2d_93 (Conv2D)	(None, 8, 8, 5)	2475	activation_92[0][0]
concatenate_90 (Concatenate)	(None, 8, 8, 60)	0	concatenate_89[0][0] conv2d_93[0][0]
batch_normalization_93 (BatchNo	(None, 8, 8, 60)	240	concatenate_90[0][0]
activation_93 (Activation)	(None, 8, 8, 60)	0	batch_normalization_93[0][0]
conv2d_94 (Conv2D)	(None, 8, 8, 5)	2700	activation_93[0][0]
concatenate_91 (Concatenate)	(None, 8, 8, 65)	0	concatenate_90[0][0] conv2d_94[0][0]
batch_normalization_94 (BatchNo	(None, 8, 8, 65)	260	concatenate_91[0][0]
activation_94 (Activation)	(None, 8, 8, 65)	0	batch_normalization_94[0][0]
conv2d_95 (Conv2D)	(None, 8, 8, 5)	2925	activation_94[0][0]
concatenate_92 (Concatenate)	(None, 8, 8, 70)	0	concatenate_91[0][0] conv2d_95[0][0]
batch_normalization_95 (BatchNo	(None, 8, 8, 70)	280	concatenate_92[0][0]
activation_95 (Activation)	(None, 8, 8, 70)	0	batch_normalization_95[0][0]
conv2d_96 (Conv2D)	(None, 8, 8, 5)	3150	activation_95[0][0]
concatenate_93 (Concatenate)	(None, 8, 8, 75)	0	concatenate_92[0][0] conv2d_96[0][0]
batch_normalization_96 (BatchNo	(None, 8, 8, 75)	300	concatenate_93[0][0]
activation_96 (Activation)	(None, 8, 8, 75)	0	batch_normalization_96[0][0]
conv2d_97 (Conv2D)	(None, 8, 8, 5)	3375	activation_96[0][0]
concatenate_94 (Concatenate)	(None, 8, 8, 80)	0	concatenate_93[0][0] conv2d_97[0][0]
batch_normalization_97 (BatchNo	(None, 8, 8, 80)	320	concatenate_94[0][0]
activation_97 (Activation)	(None, 8, 8, 80)	0	batch_normalization_97[0][0]
conv2d_98 (Conv2D)	(None, 8, 8, 5)	3600	activation_97[0][0]
concatenate_95 (Concatenate)	(None, 8, 8, 85)	0	concatenate_94[0][0] conv2d_98[0][0]
batch_normalization_98 (BatchNo	(None, 8, 8, 85)	340	concatenate_95[0][0]
activation_98 (Activation)	(None, 8, 8, 85)	0	batch_normalization_98[0][0]
conv2d_99 (Conv2D)	(None, 8, 8, 5)	3825	activation_98[0][0]
concatenate_96 (Concatenate)	(None, 8, 8, 90)	0	concatenate_95[0][0] conv2d_99[0][0]

batch_normalization_99 (BatchNo	(None, 8, 8, 90)	360	concatenate_96[0][0]
activation_99 (Activation)	(None, 8, 8, 90)	0	batch_normalization_99[0][0]
conv2d_100 (Conv2D)	(None, 8, 8, 5)	4050	activation_99[0][0]
concatenate_97 (Concatenate)	(None, 8, 8, 95)	0	concatenate_96[0][0] conv2d_100[0][0]
batch_normalization_100 (BatchN	(None, 8, 8, 95)	380	concatenate_97[0][0]
activation_100 (Activation)	(None, 8, 8, 95)	0	batch_normalization_100[0][0]
conv2d_101 (Conv2D)	(None, 8, 8, 5)	4275	activation_100[0][0]
concatenate_98 (Concatenate)	(None, 8, 8, 100)	0	concatenate_97[0][0] conv2d_101[0][0]
batch_normalization_101 (BatchN	(None, 8, 8, 100)	400	concatenate_98[0][0]
activation_101 (Activation)	(None, 8, 8, 100)	0	batch_normalization_101[0][0]
conv2d_102 (Conv2D)	(None, 8, 8, 5)	4500	activation_101[0][0]
concatenate_99 (Concatenate)	(None, 8, 8, 105)	0	concatenate_98[0][0] conv2d_102[0][0]
batch_normalization_102 (BatchN	(None, 8, 8, 105)	420	concatenate_99[0][0]
activation_102 (Activation)	(None, 8, 8, 105)	0	batch_normalization_102[0][0]
conv2d_103 (Conv2D)	(None, 8, 8, 5)	4725	activation_102[0][0]
concatenate_100 (Concatenate)	(None, 8, 8, 110)	0	concatenate_99[0][0] conv2d_103[0][0]
batch_normalization_103 (BatchN	(None, 8, 8, 110)	440	concatenate_100[0][0]
activation_103 (Activation)	(None, 8, 8, 110)	0	batch_normalization_103[0][0]
conv2d_104 (Conv2D)	(None, 8, 8, 5)	4950	activation_103[0][0]
concatenate_101 (Concatenate)	(None, 8, 8, 115)	0	concatenate_100[0][0] conv2d_104[0][0]
batch_normalization_104 (BatchN	(None, 8, 8, 115)	460	concatenate_101[0][0]
activation_104 (Activation)	(None, 8, 8, 115)	0	batch_normalization_104[0][0]
conv2d_105 (Conv2D)	(None, 8, 8, 5)	5175	activation_104[0][0]
concatenate_102 (Concatenate)	(None, 8, 8, 120)	0	concatenate_101[0][0] conv2d_105[0][0]
batch_normalization_105 (BatchN	(None, 8, 8, 120)	480	concatenate_102[0][0]
activation_105 (Activation)	(None, 8, 8, 120)	0	batch_normalization_105[0][0]
conv2d_106 (Conv2D)	(None, 8, 8, 5)	5400	activation_105[0][0]
concatenate_103 (Concatenate)	(None, 8, 8, 125)	0	concatenate_102[0][0] conv2d_106[0][0]
batch_normalization_106 (BatchN	(None, 8, 8, 125)	500	concatenate_103[0][0]
activation_106 (Activation)	(None, 8, 8, 125)	0	batch_normalization_106[0][0]
conv2d_107 (Conv2D)	(None, 8, 8, 5)	5625	activation_106[0][0]
concatenate_104 (Concatenate)	(None, 8, 8, 130)	0	concatenate_103[0][0] conv2d_107[0][0]
batch_normalization_107 (BatchN	(None, 8, 8, 130)	520	concatenate_104[0][0]
activation_107 (Activation)	(None, 8, 8, 130)	0	batch_normalization_107[0][0]

conv2d_108 (Conv2D)	(None, 8, 8, 5)	5850	activation_107[0][0]
concatenate_105 (Concatenate)	(None, 8, 8, 135)	0	concatenate_104[0][0] conv2d_108[0][0]
batch_normalization_108 (BatchN	(None, 8, 8, 135)	540	concatenate_105[0][0]
activation_108 (Activation)	(None, 8, 8, 135)	0	batch_normalization_108[0][0]
conv2d_109 (Conv2D)	(None, 8, 8, 5)	6075	activation_108[0][0]
concatenate_106 (Concatenate)	(None, 8, 8, 140)	0	concatenate_105[0][0] conv2d_109[0][0]
batch_normalization_109 (BatchN	(None, 8, 8, 140)	560	concatenate_106[0][0]
activation_109 (Activation)	(None, 8, 8, 140)	0	batch_normalization_109[0][0]
conv2d_110 (Conv2D)	(None, 8, 8, 5)	6300	activation_109[0][0]
concatenate_107 (Concatenate)	(None, 8, 8, 145)	0	concatenate_106[0][0] conv2d_110[0][0]
batch_normalization_110 (BatchN	(None, 8, 8, 145)	580	concatenate_107[0][0]
activation_110 (Activation)	(None, 8, 8, 145)	0	batch_normalization_110[0][0]
conv2d_111 (Conv2D)	(None, 8, 8, 5)	6525	activation_110[0][0]
concatenate_108 (Concatenate)	(None, 8, 8, 150)	0	concatenate_107[0][0] conv2d_111[0][0]
batch_normalization_111 (BatchN	(None, 8, 8, 150)	600	concatenate_108[0][0]
activation_111 (Activation)	(None, 8, 8, 150)	0	batch_normalization_111[0][0]
conv2d_112 (Conv2D)	(None, 8, 8, 5)	6750	activation_111[0][0]
concatenate_109 (Concatenate)	(None, 8, 8, 155)	0	concatenate_108[0][0] conv2d_112[0][0]
batch_normalization_112 (BatchN	(None, 8, 8, 155)	620	concatenate_109[0][0]
activation_112 (Activation)	(None, 8, 8, 155)	0	batch_normalization_112[0][0]
conv2d_113 (Conv2D)	(None, 8, 8, 5)	6975	activation_112[0][0]
concatenate_110 (Concatenate)	(None, 8, 8, 160)	0	concatenate_109[0][0] conv2d_113[0][0]
batch_normalization_113 (BatchN	(None, 8, 8, 160)	640	concatenate_110[0][0]
activation_113 (Activation)	(None, 8, 8, 160)	0	batch_normalization_113[0][0]
conv2d_114 (Conv2D)	(None, 8, 8, 5)	7200	activation_113[0][0]
concatenate_111 (Concatenate)	(None, 8, 8, 165)	0	concatenate_110[0][0] conv2d_114[0][0]
batch_normalization_114 (BatchN	(None, 8, 8, 165)	660	concatenate_111[0][0]
activation_114 (Activation)	(None, 8, 8, 165)	0	batch_normalization_114[0][0]
conv2d_115 (Conv2D)	(None, 8, 8, 5)	7425	activation_114[0][0]
concatenate_112 (Concatenate)	(None, 8, 8, 170)	0	concatenate_111[0][0] conv2d_115[0][0]
batch_normalization_115 (BatchN	(None, 8, 8, 170)	680	concatenate_112[0][0]
activation_115 (Activation)	(None, 8, 8, 170)	0	batch_normalization_115[0][0]
conv2d_116 (Conv2D)	(None, 8, 8, 5)	7650	activation_115[0][0]
concatenate_113 (Concatenate)	(None, 8, 8, 175)	0	concatenate_112[0][0] conv2d_116[0][0]

batch_normalization_116 (BatchN	(None, 8, 8, 175)	700	concatenate_113[0][0]
activation_116 (Activation)	(None, 8, 8, 175)	0	batch_normalization_116[0][0]
conv2d_117 (Conv2D)	(None, 8, 8, 5)	7875	activation_116[0][0]
concatenate_114 (Concatenate)	(None, 8, 8, 180)	0	concatenate_113[0][0] conv2d_117[0][0]
batch_normalization_117 (BatchN	(None, 8, 8, 180)	720	concatenate_114[0][0]
activation_117 (Activation)	(None, 8, 8, 180)	0	batch_normalization_117[0][0]
conv2d_118 (Conv2D)	(None, 8, 8, 5)	8100	activation_117[0][0]
concatenate_115 (Concatenate)	(None, 8, 8, 185)	0	concatenate_114[0][0] conv2d_118[0][0]
batch_normalization_118 (BatchN	(None, 8, 8, 185)	740	concatenate_115[0][0]
activation_118 (Activation)	(None, 8, 8, 185)	0	batch_normalization_118[0][0]
conv2d_119 (Conv2D)	(None, 8, 8, 5)	8325	activation_118[0][0]
concatenate_116 (Concatenate)	(None, 8, 8, 190)	0	concatenate_115[0][0] conv2d_119[0][0]
batch_normalization_119 (BatchN	(None, 8, 8, 190)	760	concatenate_116[0][0]
activation_119 (Activation)	(None, 8, 8, 190)	0	batch_normalization_119[0][0]
conv2d_120 (Conv2D)	(None, 8, 8, 5)	8550	activation_119[0][0]
concatenate_117 (Concatenate)	(None, 8, 8, 195)	0	concatenate_116[0][0] conv2d_120[0][0]
batch_normalization_120 (BatchN	(None, 8, 8, 195)	780	concatenate_117[0][0]
activation_120 (Activation)	(None, 8, 8, 195)	0	batch_normalization_120[0][0]
conv2d_121 (Conv2D)	(None, 8, 8, 5)	8775	activation_120[0][0]
concatenate_118 (Concatenate)	(None, 8, 8, 200)	0	concatenate_117[0][0] conv2d_121[0][0]
batch_normalization_121 (BatchN	(None, 8, 8, 200)	800	concatenate_118[0][0]
activation_121 (Activation)	(None, 8, 8, 200)	0	batch_normalization_121[0][0]
conv2d_122 (Conv2D)	(None, 8, 8, 5)	9000	activation_121[0][0]
concatenate_119 (Concatenate)	(None, 8, 8, 205)	0	concatenate_118[0][0] conv2d_122[0][0]
batch_normalization_122 (BatchN	(None, 8, 8, 205)	820	concatenate_119[0][0]
activation_122 (Activation)	(None, 8, 8, 205)	0	batch_normalization_122[0][0]
conv2d_123 (Conv2D)	(None, 8, 8, 5)	1025	activation_122[0][0]
average_pooling2d_2 (AveragePoo	(None, 4, 4, 5)	0	conv2d_123[0][0]
batch_normalization_123 (BatchN	(None, 4, 4, 5)	20	average_pooling2d_2[0][0]
activation_123 (Activation)	(None, 4, 4, 5)	0	batch_normalization_123[0][0]
conv2d_124 (Conv2D)	(None, 4, 4, 5)	225	activation_123[0][0]
concatenate_120 (Concatenate)	(None, 4, 4, 10)	0	average_pooling2d_2[0][0] conv2d_124[0][0]
batch_normalization_124 (BatchN	(None, 4, 4, 10)	40	concatenate_120[0][0]
activation_124 (Activation)	(None, 4, 4, 10)	0	batch_normalization_124[0][0]
conv2d_125 (Conv2D)	(None, 4, 4, 5)	450	activation_124[0][0]

concatenate_121 (Concatenate)	(None, 4, 4, 15)	0	concatenate_120[0][0] conv2d_125[0][0]
batch_normalization_125 (BatchN	(None, 4, 4, 15)	60	concatenate_121[0][0]
activation_125 (Activation)	(None, 4, 4, 15)	0	batch_normalization_125[0][0]
conv2d_126 (Conv2D)	(None, 4, 4, 5)	675	activation_125[0][0]
concatenate_122 (Concatenate)	(None, 4, 4, 20)	0	concatenate_121[0][0] conv2d_126[0][0]
batch_normalization_126 (BatchN	(None, 4, 4, 20)	80	concatenate_122[0][0]
activation_126 (Activation)	(None, 4, 4, 20)	0	batch_normalization_126[0][0]
conv2d_127 (Conv2D)	(None, 4, 4, 5)	900	activation_126[0][0]
concatenate_123 (Concatenate)	(None, 4, 4, 25)	0	concatenate_122[0][0] conv2d_127[0][0]
batch_normalization_127 (BatchN	(None, 4, 4, 25)	100	concatenate_123[0][0]
activation_127 (Activation)	(None, 4, 4, 25)	0	batch_normalization_127[0][0]
conv2d_128 (Conv2D)	(None, 4, 4, 5)	1125	activation_127[0][0]
concatenate_124 (Concatenate)	(None, 4, 4, 30)	0	concatenate_123[0][0] conv2d_128[0][0]
batch_normalization_128 (BatchN	(None, 4, 4, 30)	120	concatenate_124[0][0]
activation_128 (Activation)	(None, 4, 4, 30)	0	batch_normalization_128[0][0]
conv2d_129 (Conv2D)	(None, 4, 4, 5)	1350	activation_128[0][0]
concatenate_125 (Concatenate)	(None, 4, 4, 35)	0	concatenate_124[0][0] conv2d_129[0][0]
batch_normalization_129 (BatchN	(None, 4, 4, 35)	140	concatenate_125[0][0]
activation_129 (Activation)	(None, 4, 4, 35)	0	batch_normalization_129[0][0]
conv2d_130 (Conv2D)	(None, 4, 4, 5)	1575	activation_129[0][0]
concatenate_126 (Concatenate)	(None, 4, 4, 40)	0	concatenate_125[0][0] conv2d_130[0][0]
batch_normalization_130 (BatchN	(None, 4, 4, 40)	160	concatenate_126[0][0]
activation_130 (Activation)	(None, 4, 4, 40)	0	batch_normalization_130[0][0]
conv2d_131 (Conv2D)	(None, 4, 4, 5)	1800	activation_130[0][0]
concatenate_127 (Concatenate)	(None, 4, 4, 45)	0	concatenate_126[0][0] conv2d_131[0][0]
batch_normalization_131 (BatchN	(None, 4, 4, 45)	180	concatenate_127[0][0]
activation_131 (Activation)	(None, 4, 4, 45)	0	batch_normalization_131[0][0]
conv2d_132 (Conv2D)	(None, 4, 4, 5)	2025	activation_131[0][0]
concatenate_128 (Concatenate)	(None, 4, 4, 50)	0	concatenate_127[0][0] conv2d_132[0][0]
batch_normalization_132 (BatchN	(None, 4, 4, 50)	200	concatenate_128[0][0]
activation_132 (Activation)	(None, 4, 4, 50)	0	batch_normalization_132[0][0]
conv2d_133 (Conv2D)	(None, 4, 4, 5)	2250	activation_132[0][0]
concatenate_129 (Concatenate)	(None, 4, 4, 55)	0	concatenate_128[0][0] conv2d_133[0][0]
batch_normalization_133 (BatchN	(None, 4, 4, 55)	220	concatenate_129[0][0]

activation_133 (Activation)	(None, 4, 4, 55)	0	batch_normalization_133[0][0]
conv2d_134 (Conv2D)	(None, 4, 4, 5)	2475	activation_133[0][0]
concatenate_130 (Concatenate)	(None, 4, 4, 60)	0	concatenate_129[0][0] conv2d_134[0][0]
batch_normalization_134 (BatchN	(None, 4, 4, 60)	240	concatenate_130[0][0]
activation_134 (Activation)	(None, 4, 4, 60)	0	batch_normalization_134[0][0]
conv2d_135 (Conv2D)	(None, 4, 4, 5)	2700	activation_134[0][0]
concatenate_131 (Concatenate)	(None, 4, 4, 65)	0	concatenate_130[0][0] conv2d_135[0][0]
batch_normalization_135 (BatchN	(None, 4, 4, 65)	260	concatenate_131[0][0]
activation_135 (Activation)	(None, 4, 4, 65)	0	batch_normalization_135[0][0]
conv2d_136 (Conv2D)	(None, 4, 4, 5)	2925	activation_135[0][0]
concatenate_132 (Concatenate)	(None, 4, 4, 70)	0	concatenate_131[0][0] conv2d_136[0][0]
batch_normalization_136 (BatchN	(None, 4, 4, 70)	280	concatenate_132[0][0]
activation_136 (Activation)	(None, 4, 4, 70)	0	batch_normalization_136[0][0]
conv2d_137 (Conv2D)	(None, 4, 4, 5)	3150	activation_136[0][0]
concatenate_133 (Concatenate)	(None, 4, 4, 75)	0	concatenate_132[0][0] conv2d_137[0][0]
batch_normalization_137 (BatchN	(None, 4, 4, 75)	300	concatenate_133[0][0]
activation_137 (Activation)	(None, 4, 4, 75)	0	batch_normalization_137[0][0]
conv2d_138 (Conv2D)	(None, 4, 4, 5)	3375	activation_137[0][0]
concatenate_134 (Concatenate)	(None, 4, 4, 80)	0	concatenate_133[0][0] conv2d_138[0][0]
batch_normalization_138 (BatchN	(None, 4, 4, 80)	320	concatenate_134[0][0]
activation_138 (Activation)	(None, 4, 4, 80)	0	batch_normalization_138[0][0]
conv2d_139 (Conv2D)	(None, 4, 4, 5)	3600	activation_138[0][0]
concatenate_135 (Concatenate)	(None, 4, 4, 85)	0	concatenate_134[0][0] conv2d_139[0][0]
batch_normalization_139 (BatchN	(None, 4, 4, 85)	340	concatenate_135[0][0]
activation_139 (Activation)	(None, 4, 4, 85)	0	batch_normalization_139[0][0]
conv2d_140 (Conv2D)	(None, 4, 4, 5)	3825	activation_139[0][0]
concatenate_136 (Concatenate)	(None, 4, 4, 90)	0	concatenate_135[0][0] conv2d_140[0][0]
batch_normalization_140 (BatchN	(None, 4, 4, 90)	360	concatenate_136[0][0]
activation_140 (Activation)	(None, 4, 4, 90)	0	batch_normalization_140[0][0]
conv2d_141 (Conv2D)	(None, 4, 4, 5)	4050	activation_140[0][0]
concatenate_137 (Concatenate)	(None, 4, 4, 95)	0	concatenate_136[0][0] conv2d_141[0][0]
batch_normalization_141 (BatchN	(None, 4, 4, 95)	380	concatenate_137[0][0]
activation_141 (Activation)	(None, 4, 4, 95)	0	batch_normalization_141[0][0]
conv2d_142 (Conv2D)	(None, 4, 4, 5)	4275	activation_141[0][0]
concatenate_138 (Concatenate)	(None, 4, 4, 100)	0	concatenate_137[0][0]

			conv2d_142[0][0]
batch_normalization_142 (BatchN	(None, 4, 4, 100)	400	concatenate_138[0][0]
activation_142 (Activation)	(None, 4, 4, 100)	0	batch_normalization_142[0][0]
conv2d_143 (Conv2D)	(None, 4, 4, 5)	4500	activation_142[0][0]
concatenate_139 (Concatenate)	(None, 4, 4, 105)	0	concatenate_138[0][0] conv2d_143[0][0]
batch_normalization_143 (BatchN	(None, 4, 4, 105)	420	concatenate_139[0][0]
activation_143 (Activation)	(None, 4, 4, 105)	0	batch_normalization_143[0][0]
conv2d_144 (Conv2D)	(None, 4, 4, 5)	4725	activation_143[0][0]
concatenate_140 (Concatenate)	(None, 4, 4, 110)	0	concatenate_139[0][0] conv2d_144[0][0]
batch_normalization_144 (BatchN	(None, 4, 4, 110)	440	concatenate_140[0][0]
activation_144 (Activation)	(None, 4, 4, 110)	0	batch_normalization_144[0][0]
conv2d_145 (Conv2D)	(None, 4, 4, 5)	4950	activation_144[0][0]
concatenate_141 (Concatenate)	(None, 4, 4, 115)	0	concatenate_140[0][0] conv2d_145[0][0]
batch_normalization_145 (BatchN	(None, 4, 4, 115)	460	concatenate_141[0][0]
activation_145 (Activation)	(None, 4, 4, 115)	0	batch_normalization_145[0][0]
conv2d_146 (Conv2D)	(None, 4, 4, 5)	5175	activation_145[0][0]
concatenate_142 (Concatenate)	(None, 4, 4, 120)	0	concatenate_141[0][0] conv2d_146[0][0]
batch_normalization_146 (BatchN	(None, 4, 4, 120)	480	concatenate_142[0][0]
activation_146 (Activation)	(None, 4, 4, 120)	0	batch_normalization_146[0][0]
conv2d_147 (Conv2D)	(None, 4, 4, 5)	5400	activation_146[0][0]
concatenate_143 (Concatenate)	(None, 4, 4, 125)	0	concatenate_142[0][0] conv2d_147[0][0]
batch_normalization_147 (BatchN	(None, 4, 4, 125)	500	concatenate_143[0][0]
activation_147 (Activation)	(None, 4, 4, 125)	0	batch_normalization_147[0][0]
conv2d_148 (Conv2D)	(None, 4, 4, 5)	5625	activation_147[0][0]
concatenate_144 (Concatenate)	(None, 4, 4, 130)	0	concatenate_143[0][0] conv2d_148[0][0]
batch_normalization_148 (BatchN	(None, 4, 4, 130)	520	concatenate_144[0][0]
activation_148 (Activation)	(None, 4, 4, 130)	0	batch_normalization_148[0][0]
conv2d_149 (Conv2D)	(None, 4, 4, 5)	5850	activation_148[0][0]
concatenate_145 (Concatenate)	(None, 4, 4, 135)	0	concatenate_144[0][0] conv2d_149[0][0]
batch_normalization_149 (BatchN	(None, 4, 4, 135)	540	concatenate_145[0][0]
activation_149 (Activation)	(None, 4, 4, 135)	0	batch_normalization_149[0][0]
conv2d_150 (Conv2D)	(None, 4, 4, 5)	6075	activation_149[0][0]
concatenate_146 (Concatenate)	(None, 4, 4, 140)	0	concatenate_145[0][0] conv2d_150[0][0]
batch_normalization_150 (BatchN	(None, 4, 4, 140)	560	concatenate_146[0][0]
activation_150 (Activation)	(None, 4, 4, 140)	0	batch_normalization_150[0][0]

conv2d_151 (Conv2D)	(None, 4, 4, 5)	6300	activation_150[0][0]
concatenate_147 (Concatenate)	(None, 4, 4, 145)	0	concatenate_146[0][0] conv2d_151[0][0]
batch_normalization_151 (BatchN	(None, 4, 4, 145)	580	concatenate_147[0][0]
activation_151 (Activation)	(None, 4, 4, 145)	0	batch_normalization_151[0][0]
conv2d_152 (Conv2D)	(None, 4, 4, 5)	6525	activation_151[0][0]
concatenate_148 (Concatenate)	(None, 4, 4, 150)	0	concatenate_147[0][0] conv2d_152[0][0]
batch_normalization_152 (BatchN	(None, 4, 4, 150)	600	concatenate_148[0][0]
activation_152 (Activation)	(None, 4, 4, 150)	0	batch_normalization_152[0][0]
conv2d_153 (Conv2D)	(None, 4, 4, 5)	6750	activation_152[0][0]
concatenate_149 (Concatenate)	(None, 4, 4, 155)	0	concatenate_148[0][0] conv2d_153[0][0]
batch_normalization_153 (BatchN	(None, 4, 4, 155)	620	concatenate_149[0][0]
activation_153 (Activation)	(None, 4, 4, 155)	0	batch_normalization_153[0][0]
conv2d_154 (Conv2D)	(None, 4, 4, 5)	6975	activation_153[0][0]
concatenate_150 (Concatenate)	(None, 4, 4, 160)	0	concatenate_149[0][0] conv2d_154[0][0]
batch_normalization_154 (BatchN	(None, 4, 4, 160)	640	concatenate_150[0][0]
activation_154 (Activation)	(None, 4, 4, 160)	0	batch_normalization_154[0][0]
conv2d_155 (Conv2D)	(None, 4, 4, 5)	7200	activation_154[0][0]
concatenate_151 (Concatenate)	(None, 4, 4, 165)	0	concatenate_150[0][0] conv2d_155[0][0]
batch_normalization_155 (BatchN	(None, 4, 4, 165)	660	concatenate_151[0][0]
activation_155 (Activation)	(None, 4, 4, 165)	0	batch_normalization_155[0][0]
conv2d_156 (Conv2D)	(None, 4, 4, 5)	7425	activation_155[0][0]
concatenate_152 (Concatenate)	(None, 4, 4, 170)	0	concatenate_151[0][0] conv2d_156[0][0]
batch_normalization_156 (BatchN	(None, 4, 4, 170)	680	concatenate_152[0][0]
activation_156 (Activation)	(None, 4, 4, 170)	0	batch_normalization_156[0][0]
conv2d_157 (Conv2D)	(None, 4, 4, 5)	7650	activation_156[0][0]
concatenate_153 (Concatenate)	(None, 4, 4, 175)	0	concatenate_152[0][0] conv2d_157[0][0]
batch_normalization_157 (BatchN	(None, 4, 4, 175)	700	concatenate_153[0][0]
activation_157 (Activation)	(None, 4, 4, 175)	0	batch_normalization_157[0][0]
conv2d_158 (Conv2D)	(None, 4, 4, 5)	7875	activation_157[0][0]
concatenate_154 (Concatenate)	(None, 4, 4, 180)	0	concatenate_153[0][0] conv2d_158[0][0]
batch_normalization_158 (BatchN	(None, 4, 4, 180)	720	concatenate_154[0][0]
activation_158 (Activation)	(None, 4, 4, 180)	0	batch_normalization_158[0][0]
conv2d_159 (Conv2D)	(None, 4, 4, 5)	8100	activation_158[0][0]
concatenate_155 (Concatenate)	(None, 4, 4, 185)	0	concatenate_154[0][0] conv2d_159[0][0]

```
batch_normalization_159 (BatchN (None, 4, 4, 185)    740         concatenate_155[0][0]
activation_159 (Activation)     (None, 4, 4, 185)    0           batch_normalization_159[0][0]
conv2d_160 (Conv2D)             (None, 4, 4, 5)      8325        activation_159[0][0]
concatenate_156 (Concatenate)   (None, 4, 4, 190)    0           concatenate_155[0][0]
                                                                 conv2d_160[0][0]
batch_normalization_160 (BatchN (None, 4, 4, 190)    760         concatenate_156[0][0]
activation_160 (Activation)     (None, 4, 4, 190)    0           batch_normalization_160[0][0]
conv2d_161 (Conv2D)             (None, 4, 4, 5)      8550        activation_160[0][0]
concatenate_157 (Concatenate)   (None, 4, 4, 195)    0           concatenate_156[0][0]
                                                                 conv2d_161[0][0]
batch_normalization_161 (BatchN (None, 4, 4, 195)    780         concatenate_157[0][0]
activation_161 (Activation)     (None, 4, 4, 195)    0           batch_normalization_161[0][0]
conv2d_162 (Conv2D)             (None, 4, 4, 5)      8775        activation_161[0][0]
concatenate_158 (Concatenate)   (None, 4, 4, 200)    0           concatenate_157[0][0]
                                                                 conv2d_162[0][0]
batch_normalization_162 (BatchN (None, 4, 4, 200)    800         concatenate_158[0][0]
activation_162 (Activation)     (None, 4, 4, 200)    0           batch_normalization_162[0][0]
conv2d_163 (Conv2D)             (None, 4, 4, 5)      9000        activation_162[0][0]
concatenate_159 (Concatenate)   (None, 4, 4, 205)    0           concatenate_158[0][0]
                                                                 conv2d_163[0][0]
batch_normalization_163 (BatchN (None, 4, 4, 205)    820         concatenate_159[0][0]
activation_163 (Activation)     (None, 4, 4, 205)    0           batch_normalization_163[0][0]
average_pooling2d_3 (AveragePoo (None, 2, 2, 205)    0           activation_163[0][0]
flatten (Flatten)               (None, 820)          0           average_pooling2d_3[0][0]
dense (Dense)                   (None, 10)           8210        flatten[0][0]
==================================================================================================
Total params: 828,280
Trainable params: 793,430
Non-trainable params: 34,850
__________________________________________________________________________________________________
```

Standardizing the data

In [0]:

```
X_train = X_train.astype('float32')
X_test = X_test.astype('float32')

mean = X_train.mean(0)
dev = X_train.std(0)

def Standardization(data):
    data = data - mean
    data = data / dev
    return data

X_train = Standardization(X_train)
X_test = Standardization(X_test)
```

Data augementation

In [10]:

```
from keras.preprocessing.image import ImageDataGenerator
datagen_train = ImageDataGenerator(
    rotation_range=20,
  zoom_range=0.15,
    width_shift_range=0.2,
    height_shift_range=0.2,
    shear_range=0.15,
    horizontal_flip=True,
)

datagen_train.fit(X_train)
```

```
Using TensorFlow backend.
```

Using checkpoint and early stopping method

In [0]:

```
from tensorflow.keras.callbacks import Callback, EarlyStopping,
ModelCheckpoint,LearningRateScheduler
checkpoint_1 = ModelCheckpoint("densenet_model.hdf5",monitor="val_acc",mode="max",save_best_only =
True,verbose=1)

earlystop_1 = EarlyStopping(monitor = 'val_acc',
                            mode="max",
                            min_delta = 0,
                            patience = 10,
                            verbose = 1,)
callbacks_1 = [earlystop_1,checkpoint_1]
```

In [0]:

```
# determine Loss function and Optimizer
model.compile(loss='categorical_crossentropy',
              optimizer=Adam(),
              metrics=['accuracy'])
```

Suppressing warnings

In [0]:

```
def warn(*args, **kwargs):
    pass
import warnings
warnings.warn = warn
```

In [0]:

```
history = model.fit_generator(datagen_train.flow(X_train, y_train,
batch_size=batch_size),steps_per_epoch=(len(X_train)/batch_size)*5,
    epochs=epochs,
    verbose = 1,
    validation_data=(X_test, y_test),
    callbacks = callbacks_1
)
```

```
Epoch 1/30
1953/1953 [==============================>.] - ETA: 0s - loss: 0.2051 - acc: 0.9277Epoch 1/30
10000/1953
[==============================================================================================================
==================================================] - 8s 793us/sample - loss: 0.6152 - acc:
0.8753

Epoch 00001: val_acc did not improve from 0.87690
1954/1953 [==============================] - 744s 381ms/step - loss: 0.2051 - acc: 0.9277 - val_lo
```

```
ss: 0.4402 - val_acc: 0.8753
Epoch 2/30
1953/1953 [==============================>.] - ETA: 0s - loss: 0.2026 - acc: 0.9286Epoch 1/30
10000/1953
[==============================================================================================
================================================] - 8s 805us/sample - loss: 0.4845 - acc:
0.8900

Epoch 00002: val_acc improved from 0.87690 to 0.89000, saving model to densenet_model.hdf5
1954/1953 [==============================] - 747s 382ms/step - loss: 0.2026 - acc: 0.9286 - val_lo
ss: 0.3780 - val_acc: 0.8900
Epoch 3/30
1953/1953 [==============================>.] - ETA: 0s - loss: 0.1983 - acc: 0.9303Epoch 1/30
10000/1953
[==============================================================================================
================================================] - 8s 787us/sample - loss: 0.6657 - acc:
0.8560

Epoch 00003: val_acc did not improve from 0.89000
1954/1953 [==============================] - 744s 381ms/step - loss: 0.1983 - acc: 0.9304 - val_lo
ss: 0.5055 - val_acc: 0.8560
Epoch 4/30
1953/1953 [==============================>.] - ETA: 0s - loss: 0.1924 - acc: 0.9318Epoch 1/30
10000/1953
[==============================================================================================
================================================] - 8s 799us/sample - loss: 0.5119 - acc:
0.8783

Epoch 00004: val_acc did not improve from 0.89000
1954/1953 [==============================] - 746s 382ms/step - loss: 0.1923 - acc: 0.9318 - val_lo
ss: 0.4233 - val_acc: 0.8783
Epoch 5/30
1953/1953 [==============================>.] - ETA: 0s - loss: 0.1878 - acc: 0.9334Epoch 1/30
10000/1953
[==============================================================================================
================================================] - 8s 803us/sample - loss: 0.5256 - acc:
0.8892

Epoch 00005: val_acc did not improve from 0.89000
1954/1953 [==============================] - 744s 381ms/step - loss: 0.1877 - acc: 0.9334 - val_lo
ss: 0.3763 - val_acc: 0.8892
Epoch 6/30
1953/1953 [==============================>.] - ETA: 0s - loss: 0.1858 - acc: 0.9336Epoch 1/30
10000/1953
[==============================================================================================
================================================] - 8s 796us/sample - loss: 0.6000 - acc:
0.8916

Epoch 00006: val_acc improved from 0.89000 to 0.89160, saving model to densenet_model.hdf5
1954/1953 [==============================] - 746s 382ms/step - loss: 0.1859 - acc: 0.9336 - val_lo
ss: 0.3715 - val_acc: 0.8916
Epoch 7/30
1953/1953 [==============================>.] - ETA: 0s - loss: 0.1825 - acc: 0.9355Epoch 1/30
10000/1953
[==============================================================================================
================================================] - 8s 794us/sample - loss: 0.6396 - acc:
0.8914

Epoch 00007: val_acc did not improve from 0.89160
1954/1953 [==============================] - 744s 381ms/step - loss: 0.1825 - acc: 0.9355 - val_lo
ss: 0.3761 - val_acc: 0.8914
Epoch 8/30
1953/1953 [==============================>.] - ETA: 0s - loss: 0.1803 - acc: 0.9362Epoch 1/30
10000/1953
[==============================================================================================
================================================] - 8s 788us/sample - loss: 0.7590 - acc:
0.8907

Epoch 00008: val_acc did not improve from 0.89160
1954/1953 [==============================] - 743s 380ms/step - loss: 0.1803 - acc: 0.9362 - val_lo
ss: 0.3926 - val_acc: 0.8907
Epoch 9/30
1953/1953 [==============================>.] - ETA: 0s - loss: 0.1773 - acc: 0.9377Epoch 1/30
10000/1953
[==============================================================================================
================================================] - 8s 797us/sample - loss: 0.7043 - acc:
0.8916
```

```
Epoch 00009: val_acc did not improve from 0.89160
1954/1953 [==============================] - 747s 382ms/step - loss: 0.1773 - acc: 0.9377 - val_lo
ss: 0.3816 - val_acc: 0.8916
Epoch 10/30
1953/1953 [==============================>.] - ETA: 0s - loss: 0.1740 - acc: 0.9384Epoch 1/30
10000/1953
[==============================================================================================
================================================] - 8s 784us/sample - loss: 0.8657 - acc:
0.8660

Epoch 00010: val_acc did not improve from 0.89160
1954/1953 [==============================] - 744s 381ms/step - loss: 0.1740 - acc: 0.9384 - val_lo
ss: 0.5221 - val_acc: 0.8660
Epoch 11/30
1953/1953 [==============================>.] - ETA: 0s - loss: 0.1706 - acc: 0.9398Epoch 1/30
10000/1953
[==============================================================================================
================================================] - 8s 801us/sample - loss: 0.7643 - acc:
0.8869

Epoch 00011: val_acc did not improve from 0.89160
1954/1953 [==============================] - 744s 381ms/step - loss: 0.1706 - acc: 0.9398 - val_lo
ss: 0.4136 - val_acc: 0.8869
Epoch 12/30
1953/1953 [==============================>.] - ETA: 0s - loss: 0.1667 - acc: 0.9411Epoch 1/30
10000/1953
[==============================================================================================
================================================] - 8s 784us/sample - loss: 0.5279 - acc:
0.8882

Epoch 00012: val_acc did not improve from 0.89160
1954/1953 [==============================] - 744s 381ms/step - loss: 0.1666 - acc: 0.9412 - val_lo
ss: 0.3789 - val_acc: 0.8882
Epoch 13/30
1953/1953 [==============================>.] - ETA: 0s - loss: 0.1640 - acc: 0.9423Epoch 1/30
10000/1953
[==============================================================================================
================================================] - 8s 783us/sample - loss: 0.7449 - acc:
0.8741

Epoch 00013: val_acc did not improve from 0.89160
1954/1953 [==============================] - 744s 381ms/step - loss: 0.1640 - acc: 0.9422 - val_lo
ss: 0.4831 - val_acc: 0.8741
Epoch 14/30
1953/1953 [==============================>.] - ETA: 0s - loss: 0.1623 - acc: 0.9426Epoch 1/30
10000/1953
[==============================================================================================
================================================] - 8s 786us/sample - loss: 0.6173 - acc:
0.9004

Epoch 00014: val_acc improved from 0.89160 to 0.90040, saving model to densenet_model.hdf5
1954/1953 [==============================] - 747s 383ms/step - loss: 0.1624 - acc: 0.9426 - val_lo
ss: 0.3423 - val_acc: 0.9004
Epoch 15/30
1953/1953 [==============================>.] - ETA: 0s - loss: 0.1595 - acc: 0.9434Epoch 1/30
10000/1953
[==============================================================================================
================================================] - 8s 785us/sample - loss: 0.8160 - acc:
0.8751

Epoch 00015: val_acc did not improve from 0.90040
1954/1953 [==============================] - 744s 381ms/step - loss: 0.1595 - acc: 0.9434 - val_lo
ss: 0.4851 - val_acc: 0.8751
Epoch 16/30
1953/1953 [==============================>.] - ETA: 0s - loss: 0.1575 - acc: 0.9438Epoch 1/30
10000/1953
[==============================================================================================
================================================] - 8s 795us/sample - loss: 0.7062 - acc:
0.8815

Epoch 00016: val_acc did not improve from 0.90040
1954/1953 [==============================] - 744s 381ms/step - loss: 0.1575 - acc: 0.9438 - val_lo
ss: 0.4549 - val_acc: 0.8815
Epoch 17/30
1751/1953 [=========================>....] - ETA: 1:16 - loss: 0.1551 - acc: 0.9454
```

Loading the saved model

In [13]:

```
from numpy import loadtxt
from tensorflow.keras.models import load_model

# load model
model = load_model('/content/drive/My Drive/densenet_model.hdf5')
```

```
WARNING:tensorflow:From /tensorflow-1.15.0/python3.6/tensorflow_core/python/ops/init_ops.py:97: ca
lling GlorotUniform.__init__ (from tensorflow.python.ops.init_ops) with dtype is deprecated and wi
ll be removed in a future version.
Instructions for updating:
Call initializer instance with the dtype argument instead of passing it to the constructor
WARNING:tensorflow:From /tensorflow-1.15.0/python3.6/tensorflow_core/python/ops/init_ops.py:97: ca
lling Zeros.__init__ (from tensorflow.python.ops.init_ops) with dtype is deprecated and will be re
moved in a future version.
Instructions for updating:
Call initializer instance with the dtype argument instead of passing it to the constructor
WARNING:tensorflow:From /tensorflow-1.15.0/python3.6/tensorflow_core/python/ops/init_ops.py:97: ca
lling Ones.__init__ (from tensorflow.python.ops.init_ops) with dtype is deprecated and will be
removed in a future version.
Instructions for updating:
Call initializer instance with the dtype argument instead of passing it to the constructor
WARNING:tensorflow:From /tensorflow-
1.15.0/python3.6/tensorflow_core/python/ops/resource_variable_ops.py:1630: calling
BaseResourceVariable.__init__ (from tensorflow.python.ops.resource_variable_ops) with constraint i
s deprecated and will be removed in a future version.
Instructions for updating:
If using Keras pass *_constraint arguments to layers.
```

Test the model

In [14]:

```
score = model.evaluate(X_test, y_test, verbose=1)
print('Test loss:', score[0])
print('Test accuracy:', score[1])
```

```
10000/10000 [==============================] - 23s 2ms/sample - loss: 0.3354 - acc: 0.9004
Test loss: 0.3354230671226978
Test accuracy: 0.9004
```

Save the trained weights in to .h5 format

In [0]:

```
model.save_weights("Densenet_model_final.h5")
```

Note:

1.I have acheieved a Test accuracy of 90.04%

2.The number of epochs I specified was 30 so to complete each epoch it took around 13 minutes so for 30 epochs it took 6 hours 30 minutes and i could reach a validation accuracy of 87.69%

3.I again reran the same cell and the epoch continued with test accuracy from 87.69% and after 14 more epochs it gave an test accuracy of 90.04% and following 3 epochs had reduced test accuracy and the best weights were saved and downloaded and I loaded it again and performed testing in another cell and gave test accuracy of 90.04%.

4.17 epochs ran during 2nd time and it took around 3 hours 40 mins to compute.

5.The number of total parameters are 0.8 million.

6.No dropouts or fully connected layers are used in architecture.

7.So in total I ran 47 epochs and the model was trained for 10 hours and 10 minutes after which google colab runtime got disconnected and i lost my variables thats the reason you can only see 17 epochs in output.