CNN_cifar10

without Image Augmentation

codes from below source are used in this casesetudy

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https://machinelearningmastery.com/how-to-develop-a-cnn-from-scratch-for-cifar-10-photo-classification/
https://machinelearningmastery.com/how-to-configure-image-data-augmentation-when-training-deep-learning-neural-networks/
https://machinelearningmastery.com/how-to-stop-training-deep-neural-networks-at-the-right-time-using-early-stopping/
https://github.com/moritzhambach/Image-Augmentation-in-Keras-CIFAR-10-/blob/master/CNN%20with%20Image%20Augmentation%20(CIFAR10).ipynb

In [1]:

```
import keras
!pip install scipy==1.1.0

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
from keras import models, layers
from keras.models import Model
from keras.layers import BatchNormalization, Activation, Flatten
from keras.optimizers import Adam
from matplotlib import pyplot
#from scipy.misc import toimage
import h5py
from keras.models import load_model
from keras.preprocessing.image import ImageDataGenerator
from keras.regularizers import l2
from keras import optimizers
from tensorflow import keras
from keras import backend as k
import tensorflow as tf
```

```
Using TensorFlow backend.
```

```
Requirement already satisfied: scipy==1.1.0 in /usr/local/lib/python3.6/dist-packages (1.1.0)
Requirement already satisfied: numpy>=1.8.2 in /usr/local/lib/python3.6/dist-packages (from
scipy==1.1.0) (1.18.2)
```

In [2]:

```
import tensorflow as tf
device_name = tf.test.gpu_device_name()
if device_name != '/device:GPU:0':
  raise SystemError('GPU device not found')
print('Found GPU at: {}'.format(device_name))
```

```
Found GPU at: /device:GPU:0
```

In [0]:

```
# Hyperparameters
batch_size = 32
num_classes = 10
#epochs = 10
l = 40
num_filter = 12
compression = 0.5
dropout_rate = 0.2
```

In [4]:

```
# 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 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 [==============================] - 6s 0us/step
```

In [5]:

```
X_train.shape
```

Out[5]:

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

In [6]:

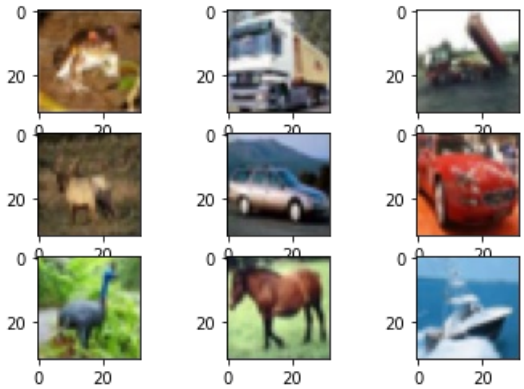
```
X_test.shape
```

Out[6]:

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

In [7]:

```
from matplotlib import pyplot
for i in range(9):
 # define subplot
 pyplot.subplot(330 + 1 + i)
 # plot raw pixel data
 pyplot.imshow(X_train[i])
# show the figure
pyplot.show()
```



In [0]:

```
# set up image augmentation
datagen = ImageDataGenerator(
    rotation_range=15,
    horizontal_flip=True,
    width_shift_range=0.1,
    height_shift_range=0.1

    )
datagen.fit(X_train,augment=True, rounds=3)
```

In [9]:

```
import matplotlib.pyplot as plt
import numpy as np
# see example augmentation images
for X_batch, y_batch in datagen.flow(X_train, y_train, batch_size=9):
    for i in range(0, 9):
        plt.subplot(330 + 1 + i)
        plt.imshow(X_batch[i].astype(np.uint8))
    plt.show()
    break
```

In [10]:

```
#reshape into images

X_train = X_train.reshape(X_train.shape[0], img_height, img_width, channel)
X_test = X_test.reshape(X_test.shape[0], img_height, img_width, channel)
input_shape = (img_height, img_width, 1)
print('x_train shape:', X_train.shape)
print(X_train.shape[0], 'train samples')
print(X_test.shape[0], 'test samples')
```

```
x_train shape: (50000, 32, 32, 3)
50000 train samples
10000 test samples
```

In [0]:

```
#convert integers to float; normalise and center the mean
import numpy as np
X_train=X_train.astype("float32")
X_test=X_test.astype("float32")
mean=np.mean(X_train)
std=np.std(X_train)
X_test=(X_test-mean)/std
X_train=(X_train-mean)/std
```

In [0]:

```
# plotting epoch vs accuracy
def plothist(hist):
    plt.plot(hist.history['accuracy'])
    plt.plot(hist.history['val_accuracy'])
    plt.title('model accuracy')
    plt.ylabel('accuracy')
    plt.xlabel('epoch')
    plt.legend(['train', 'test'], loc='upper left')
    plt.show()
```

In [0]:

```
# Dense Block
def denseblock(input, num_filter = 12):
    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):
    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)
    #replcaing Dense layer by conv layer
    #http://cs231n.github.io/convolutional-networks/#convert
    conv_layer = layers.Conv2D(num_classes, (1,1), use_bias=False ,padding='same')(AvgPooling)
    last = layers.GlobalMaxPooling2D()(conv_layer)
#https://www.researchgate.net/post/Differences_between_Global_Max_Pooling_and_Global_Average_poolin

    output = layers.Activation('softmax')(last)
    return output
```

In [0]:

```
num_filter = 12
#dropout_rate = 0.2
l = 40

reg=l2(1e-4)

input = layers.Input(shape=(img_height, img_width, channel,))
First_Conv2D = layers.Conv2D(num_filter, (3,3), activation = 'relu', kernel_initializer = 'he_norma
l' , kernel_regularizer =reg , use_bias=False ,padding='same')(input)

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

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

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

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

In [0]:

```
#https://arxiv.org/pdf/1608.06993.pdf
from IPython.display import IFrame, YouTubeVideo
YouTubeVideo(id='-W6y8xnd--U', width=600)
```

Out[0]:

In [32]:

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

Model: "model_4"

Layer (type)	Output Shape	Param #	Connected to
input_4 (InputLayer)	(None, 32, 32, 3)	0	
conv2d_496 (Conv2D)	(None, 32, 32, 12)	324	input_4[0][0]
batch_normalization_493 (BatchN	(None, 32, 32, 12)	48	conv2d_496[0][0]
activation_496 (Activation)	(None, 32, 32, 12)	0	batch_normalization_493[0][0]
conv2d_497 (Conv2D)	(None, 32, 32, 6)	648	activation_496[0][0]
concatenate_481 (Concatenate)	(None, 32, 32, 18)	0	conv2d_496[0][0] conv2d_497[0][0]
batch_normalization_494 (BatchN	(None, 32, 32, 18)	72	concatenate_481[0][0]
activation_497 (Activation)	(None, 32, 32, 18)	0	batch_normalization_494[0][0]
conv2d_498 (Conv2D)	(None, 32, 32, 6)	972	activation_497[0][0]
concatenate_482 (Concatenate)	(None, 32, 32, 24)	0	concatenate_481[0][0] conv2d_498[0][0]
batch_normalization_495 (BatchN	(None, 32, 32, 24)	96	concatenate_482[0][0]
activation_498 (Activation)	(None, 32, 32, 24)	0	batch_normalization_495[0][0]
conv2d_499 (Conv2D)	(None, 32, 32, 6)	1296	activation_498[0][0]
concatenate_483 (Concatenate)	(None, 32, 32, 30)	0	concatenate_482[0][0] conv2d_499[0][0]
batch_normalization_496 (BatchN	(None, 32, 32, 30)	120	concatenate_483[0][0]
activation_499 (Activation)	(None, 32, 32, 30)	0	batch_normalization_496[0][0]
conv2d_500 (Conv2D)	(None, 32, 32, 6)	1620	activation_499[0][0]
concatenate_484 (Concatenate)	(None, 32, 32, 36)	0	concatenate_483[0][0] conv2d_500[0][0]
batch_normalization_497 (BatchN	(None, 32, 32, 36)	144	concatenate_484[0][0]
activation_500 (Activation)	(None, 32, 32, 36)	0	batch_normalization_497[0][0]
conv2d_501 (Conv2D)	(None, 32, 32, 6)	1944	activation_500[0][0]
concatenate_485 (Concatenate)	(None, 32, 32, 42)	0	concatenate_484[0][0] conv2d_501[0][0]

batch_normalization_498 (BatchN	(None, 32, 32, 42)	168	concatenate_485[0][0]
activation_501 (Activation)	(None, 32, 32, 42)	0	batch_normalization_498[0][0]
conv2d_502 (Conv2D)	(None, 32, 32, 6)	2268	activation_501[0][0]
concatenate_486 (Concatenate)	(None, 32, 32, 48)	0	concatenate_485[0][0] conv2d_502[0][0]
batch_normalization_499 (BatchN	(None, 32, 32, 48)	192	concatenate_486[0][0]
activation_502 (Activation)	(None, 32, 32, 48)	0	batch_normalization_499[0][0]
conv2d_503 (Conv2D)	(None, 32, 32, 6)	2592	activation_502[0][0]
concatenate_487 (Concatenate)	(None, 32, 32, 54)	0	concatenate_486[0][0] conv2d_503[0][0]
batch_normalization_500 (BatchN	(None, 32, 32, 54)	216	concatenate_487[0][0]
activation_503 (Activation)	(None, 32, 32, 54)	0	batch_normalization_500[0][0]
conv2d_504 (Conv2D)	(None, 32, 32, 6)	2916	activation_503[0][0]
concatenate_488 (Concatenate)	(None, 32, 32, 60)	0	concatenate_487[0][0] conv2d_504[0][0]
batch_normalization_501 (BatchN	(None, 32, 32, 60)	240	concatenate_488[0][0]
activation_504 (Activation)	(None, 32, 32, 60)	0	batch_normalization_501[0][0]
conv2d_505 (Conv2D)	(None, 32, 32, 6)	3240	activation_504[0][0]
concatenate_489 (Concatenate)	(None, 32, 32, 66)	0	concatenate_488[0][0] conv2d_505[0][0]
batch_normalization_502 (BatchN	(None, 32, 32, 66)	264	concatenate_489[0][0]
activation_505 (Activation)	(None, 32, 32, 66)	0	batch_normalization_502[0][0]
conv2d_506 (Conv2D)	(None, 32, 32, 6)	3564	activation_505[0][0]
concatenate_490 (Concatenate)	(None, 32, 32, 72)	0	concatenate_489[0][0] conv2d_506[0][0]
batch_normalization_503 (BatchN	(None, 32, 32, 72)	288	concatenate_490[0][0]
activation_506 (Activation)	(None, 32, 32, 72)	0	batch_normalization_503[0][0]
conv2d_507 (Conv2D)	(None, 32, 32, 6)	3888	activation_506[0][0]
concatenate_491 (Concatenate)	(None, 32, 32, 78)	0	concatenate_490[0][0] conv2d_507[0][0]
batch_normalization_504 (BatchN	(None, 32, 32, 78)	312	concatenate_491[0][0]
activation_507 (Activation)	(None, 32, 32, 78)	0	batch_normalization_504[0][0]
conv2d_508 (Conv2D)	(None, 32, 32, 6)	4212	activation_507[0][0]
concatenate_492 (Concatenate)	(None, 32, 32, 84)	0	concatenate_491[0][0] conv2d_508[0][0]
batch_normalization_505 (BatchN	(None, 32, 32, 84)	336	concatenate_492[0][0]
activation_508 (Activation)	(None, 32, 32, 84)	0	batch_normalization_505[0][0]
conv2d_509 (Conv2D)	(None, 32, 32, 6)	4536	activation_508[0][0]
concatenate_493 (Concatenate)	(None, 32, 32, 90)	0	concatenate_492[0][0] conv2d_509[0][0]
batch_normalization_506 (BatchN	(None, 32, 32, 90)	360	concatenate_493[0][0]
activation_509 (Activation)	(None, 32, 32, 90)	0	batch_normalization_506[0][0]
conv2d_510 (Conv2D)	(None, 32, 32, 6)	4860	activation_509[0][0]

concatenate_494 (Concatenate)	(None, 32, 32, 96)	0	concatenate_493[0][0] conv2d_510[0][0]
batch_normalization_507 (BatchN	(None, 32, 32, 96)	384	concatenate_494[0][0]
activation_510 (Activation)	(None, 32, 32, 96)	0	batch_normalization_507[0][0]
conv2d_511 (Conv2D)	(None, 32, 32, 6)	5184	activation_510[0][0]
concatenate_495 (Concatenate)	(None, 32, 32, 102)	0	concatenate_494[0][0] conv2d_511[0][0]
batch_normalization_508 (BatchN	(None, 32, 32, 102)	408	concatenate_495[0][0]
activation_511 (Activation)	(None, 32, 32, 102)	0	batch_normalization_508[0][0]
conv2d_512 (Conv2D)	(None, 32, 32, 6)	5508	activation_511[0][0]
concatenate_496 (Concatenate)	(None, 32, 32, 108)	0	concatenate_495[0][0] conv2d_512[0][0]
batch_normalization_509 (BatchN	(None, 32, 32, 108)	432	concatenate_496[0][0]
activation_512 (Activation)	(None, 32, 32, 108)	0	batch_normalization_509[0][0]
conv2d_513 (Conv2D)	(None, 32, 32, 6)	5832	activation_512[0][0]
concatenate_497 (Concatenate)	(None, 32, 32, 114)	0	concatenate_496[0][0] conv2d_513[0][0]
batch_normalization_510 (BatchN	(None, 32, 32, 114)	456	concatenate_497[0][0]
activation_513 (Activation)	(None, 32, 32, 114)	0	batch_normalization_510[0][0]
conv2d_514 (Conv2D)	(None, 32, 32, 6)	6156	activation_513[0][0]
concatenate_498 (Concatenate)	(None, 32, 32, 120)	0	concatenate_497[0][0] conv2d_514[0][0]
batch_normalization_511 (BatchN	(None, 32, 32, 120)	480	concatenate_498[0][0]
activation_514 (Activation)	(None, 32, 32, 120)	0	batch_normalization_511[0][0]
conv2d_515 (Conv2D)	(None, 32, 32, 6)	6480	activation_514[0][0]
concatenate_499 (Concatenate)	(None, 32, 32, 126)	0	concatenate_498[0][0] conv2d_515[0][0]
batch_normalization_512 (BatchN	(None, 32, 32, 126)	504	concatenate_499[0][0]
activation_515 (Activation)	(None, 32, 32, 126)	0	batch_normalization_512[0][0]
conv2d_516 (Conv2D)	(None, 32, 32, 6)	6804	activation_515[0][0]
concatenate_500 (Concatenate)	(None, 32, 32, 132)	0	concatenate_499[0][0] conv2d_516[0][0]
batch_normalization_513 (BatchN	(None, 32, 32, 132)	528	concatenate_500[0][0]
activation_516 (Activation)	(None, 32, 32, 132)	0	batch_normalization_513[0][0]
conv2d_517 (Conv2D)	(None, 32, 32, 6)	7128	activation_516[0][0]
concatenate_501 (Concatenate)	(None, 32, 32, 138)	0	concatenate_500[0][0] conv2d_517[0][0]
batch_normalization_514 (BatchN	(None, 32, 32, 138)	552	concatenate_501[0][0]
activation_517 (Activation)	(None, 32, 32, 138)	0	batch_normalization_514[0][0]
conv2d_518 (Conv2D)	(None, 32, 32, 6)	7452	activation_517[0][0]
concatenate_502 (Concatenate)	(None, 32, 32, 144)	0	concatenate_501[0][0] conv2d_518[0][0]
batch_normalization_515 (BatchN	(None, 32, 32, 144)	576	concatenate_502[0][0]

activation_518 (Activation)	(None, 32, 32, 144)	0	batch_normalization_515[0][0]
conv2d_519 (Conv2D)	(None, 32, 32, 6)	7776	activation_518[0][0]
concatenate_503 (Concatenate)	(None, 32, 32, 150)	0	concatenate_502[0][0] conv2d_519[0][0]
batch_normalization_516 (BatchN	(None, 32, 32, 150)	600	concatenate_503[0][0]
activation_519 (Activation)	(None, 32, 32, 150)	0	batch_normalization_516[0][0]
conv2d_520 (Conv2D)	(None, 32, 32, 6)	8100	activation_519[0][0]
concatenate_504 (Concatenate)	(None, 32, 32, 156)	0	concatenate_503[0][0] conv2d_520[0][0]
batch_normalization_517 (BatchN	(None, 32, 32, 156)	624	concatenate_504[0][0]
activation_520 (Activation)	(None, 32, 32, 156)	0	batch_normalization_517[0][0]
conv2d_521 (Conv2D)	(None, 32, 32, 6)	8424	activation_520[0][0]
concatenate_505 (Concatenate)	(None, 32, 32, 162)	0	concatenate_504[0][0] conv2d_521[0][0]
batch_normalization_518 (BatchN	(None, 32, 32, 162)	648	concatenate_505[0][0]
activation_521 (Activation)	(None, 32, 32, 162)	0	batch_normalization_518[0][0]
conv2d_522 (Conv2D)	(None, 32, 32, 6)	8748	activation_521[0][0]
concatenate_506 (Concatenate)	(None, 32, 32, 168)	0	concatenate_505[0][0] conv2d_522[0][0]
batch_normalization_519 (BatchN	(None, 32, 32, 168)	672	concatenate_506[0][0]
activation_522 (Activation)	(None, 32, 32, 168)	0	batch_normalization_519[0][0]
conv2d_523 (Conv2D)	(None, 32, 32, 6)	9072	activation_522[0][0]
concatenate_507 (Concatenate)	(None, 32, 32, 174)	0	concatenate_506[0][0] conv2d_523[0][0]
batch_normalization_520 (BatchN	(None, 32, 32, 174)	696	concatenate_507[0][0]
activation_523 (Activation)	(None, 32, 32, 174)	0	batch_normalization_520[0][0]
conv2d_524 (Conv2D)	(None, 32, 32, 6)	9396	activation_523[0][0]
concatenate_508 (Concatenate)	(None, 32, 32, 180)	0	concatenate_507[0][0] conv2d_524[0][0]
batch_normalization_521 (BatchN	(None, 32, 32, 180)	720	concatenate_508[0][0]
activation_524 (Activation)	(None, 32, 32, 180)	0	batch_normalization_521[0][0]
conv2d_525 (Conv2D)	(None, 32, 32, 6)	9720	activation_524[0][0]
concatenate_509 (Concatenate)	(None, 32, 32, 186)	0	concatenate_508[0][0] conv2d_525[0][0]
batch_normalization_522 (BatchN	(None, 32, 32, 186)	744	concatenate_509[0][0]
activation_525 (Activation)	(None, 32, 32, 186)	0	batch_normalization_522[0][0]
conv2d_526 (Conv2D)	(None, 32, 32, 6)	10044	activation_525[0][0]
concatenate_510 (Concatenate)	(None, 32, 32, 192)	0	concatenate_509[0][0] conv2d_526[0][0]
batch_normalization_523 (BatchN	(None, 32, 32, 192)	768	concatenate_510[0][0]
activation_526 (Activation)	(None, 32, 32, 192)	0	batch_normalization_523[0][0]
conv2d_527 (Conv2D)	(None, 32, 32, 6)	10368	activation_526[0][0]

concatenate_511 (Concatenate)	(None, 32, 32, 198)	0	concatenate_510[0][0] conv2d_527[0][0]
batch_normalization_524 (BatchN	(None, 32, 32, 198)	792	concatenate_511[0][0]
activation_527 (Activation)	(None, 32, 32, 198)	0	batch_normalization_524[0][0]
conv2d_528 (Conv2D)	(None, 32, 32, 6)	10692	activation_527[0][0]
concatenate_512 (Concatenate)	(None, 32, 32, 204)	0	concatenate_511[0][0] conv2d_528[0][0]
batch_normalization_525 (BatchN	(None, 32, 32, 204)	816	concatenate_512[0][0]
activation_528 (Activation)	(None, 32, 32, 204)	0	batch_normalization_525[0][0]
conv2d_529 (Conv2D)	(None, 32, 32, 6)	11016	activation_528[0][0]
concatenate_513 (Concatenate)	(None, 32, 32, 210)	0	concatenate_512[0][0] conv2d_529[0][0]
batch_normalization_526 (BatchN	(None, 32, 32, 210)	840	concatenate_513[0][0]
activation_529 (Activation)	(None, 32, 32, 210)	0	batch_normalization_526[0][0]
conv2d_530 (Conv2D)	(None, 32, 32, 6)	11340	activation_529[0][0]
concatenate_514 (Concatenate)	(None, 32, 32, 216)	0	concatenate_513[0][0] conv2d_530[0][0]
batch_normalization_527 (BatchN	(None, 32, 32, 216)	864	concatenate_514[0][0]
activation_530 (Activation)	(None, 32, 32, 216)	0	batch_normalization_527[0][0]
conv2d_531 (Conv2D)	(None, 32, 32, 6)	11664	activation_530[0][0]
concatenate_515 (Concatenate)	(None, 32, 32, 222)	0	concatenate_514[0][0] conv2d_531[0][0]
batch_normalization_528 (BatchN	(None, 32, 32, 222)	888	concatenate_515[0][0]
activation_531 (Activation)	(None, 32, 32, 222)	0	batch_normalization_528[0][0]
conv2d_532 (Conv2D)	(None, 32, 32, 6)	11988	activation_531[0][0]
concatenate_516 (Concatenate)	(None, 32, 32, 228)	0	concatenate_515[0][0] conv2d_532[0][0]
batch_normalization_529 (BatchN	(None, 32, 32, 228)	912	concatenate_516[0][0]
activation_532 (Activation)	(None, 32, 32, 228)	0	batch_normalization_529[0][0]
conv2d_533 (Conv2D)	(None, 32, 32, 6)	12312	activation_532[0][0]
concatenate_517 (Concatenate)	(None, 32, 32, 234)	0	concatenate_516[0][0] conv2d_533[0][0]
batch_normalization_530 (BatchN	(None, 32, 32, 234)	936	concatenate_517[0][0]
activation_533 (Activation)	(None, 32, 32, 234)	0	batch_normalization_530[0][0]
conv2d_534 (Conv2D)	(None, 32, 32, 6)	12636	activation_533[0][0]
concatenate_518 (Concatenate)	(None, 32, 32, 240)	0	concatenate_517[0][0] conv2d_534[0][0]
batch_normalization_531 (BatchN	(None, 32, 32, 240)	960	concatenate_518[0][0]
activation_534 (Activation)	(None, 32, 32, 240)	0	batch_normalization_531[0][0]
conv2d_535 (Conv2D)	(None, 32, 32, 6)	12960	activation_534[0][0]
concatenate_519 (Concatenate)	(None, 32, 32, 246)	0	concatenate_518[0][0] conv2d_535[0][0]
batch_normalization_532 (BatchN	(None, 32, 32, 246)	984	concatenate_519[0][0]

activation_535 (Activation)	(None, 32, 32, 246)	0	batch_normalization_532[0][0]
conv2d_536 (Conv2D)	(None, 32, 32, 6)	13284	activation_535[0][0]
concatenate_520 (Concatenate)	(None, 32, 32, 252)	0	concatenate_519[0][0] conv2d_536[0][0]
batch_normalization_533 (BatchN	(None, 32, 32, 252)	1008	concatenate_520[0][0]
activation_536 (Activation)	(None, 32, 32, 252)	0	batch_normalization_533[0][0]
conv2d_537 (Conv2D)	(None, 32, 32, 6)	1512	activation_536[0][0]
average_pooling2d_13 (AveragePo	(None, 16, 16, 6)	0	conv2d_537[0][0]
batch_normalization_534 (BatchN	(None, 16, 16, 6)	24	average_pooling2d_13[0][0]
activation_537 (Activation)	(None, 16, 16, 6)	0	batch_normalization_534[0][0]
conv2d_538 (Conv2D)	(None, 16, 16, 6)	324	activation_537[0][0]
concatenate_521 (Concatenate)	(None, 16, 16, 12)	0	average_pooling2d_13[0][0] conv2d_538[0][0]
batch_normalization_535 (BatchN	(None, 16, 16, 12)	48	concatenate_521[0][0]
activation_538 (Activation)	(None, 16, 16, 12)	0	batch_normalization_535[0][0]
conv2d_539 (Conv2D)	(None, 16, 16, 6)	648	activation_538[0][0]
concatenate_522 (Concatenate)	(None, 16, 16, 18)	0	concatenate_521[0][0] conv2d_539[0][0]
batch_normalization_536 (BatchN	(None, 16, 16, 18)	72	concatenate_522[0][0]
activation_539 (Activation)	(None, 16, 16, 18)	0	batch_normalization_536[0][0]
conv2d_540 (Conv2D)	(None, 16, 16, 6)	972	activation_539[0][0]
concatenate_523 (Concatenate)	(None, 16, 16, 24)	0	concatenate_522[0][0] conv2d_540[0][0]
batch_normalization_537 (BatchN	(None, 16, 16, 24)	96	concatenate_523[0][0]
activation_540 (Activation)	(None, 16, 16, 24)	0	batch_normalization_537[0][0]
conv2d_541 (Conv2D)	(None, 16, 16, 6)	1296	activation_540[0][0]
concatenate_524 (Concatenate)	(None, 16, 16, 30)	0	concatenate_523[0][0] conv2d_541[0][0]
batch_normalization_538 (BatchN	(None, 16, 16, 30)	120	concatenate_524[0][0]
activation_541 (Activation)	(None, 16, 16, 30)	0	batch_normalization_538[0][0]
conv2d_542 (Conv2D)	(None, 16, 16, 6)	1620	activation_541[0][0]
concatenate_525 (Concatenate)	(None, 16, 16, 36)	0	concatenate_524[0][0] conv2d_542[0][0]
batch_normalization_539 (BatchN	(None, 16, 16, 36)	144	concatenate_525[0][0]
activation_542 (Activation)	(None, 16, 16, 36)	0	batch_normalization_539[0][0]
conv2d_543 (Conv2D)	(None, 16, 16, 6)	1944	activation_542[0][0]
concatenate_526 (Concatenate)	(None, 16, 16, 42)	0	concatenate_525[0][0] conv2d_543[0][0]
batch_normalization_540 (BatchN	(None, 16, 16, 42)	168	concatenate_526[0][0]
activation_543 (Activation)	(None, 16, 16, 42)	0	batch_normalization_540[0][0]
conv2d_544 (Conv2D)	(None, 16, 16, 6)	2268	activation_543[0][0]
concatenate_527 (Concatenate)	(None, 16, 16, 48)	0	concatenate_526[0][0] conv2d_544[0][0]

batch_normalization_541 (BatchN	(None, 16, 16, 48)	192	concatenate_527[0][0]
activation_544 (Activation)	(None, 16, 16, 48)	0	batch_normalization_541[0][0]
conv2d_545 (Conv2D)	(None, 16, 16, 6)	2592	activation_544[0][0]
concatenate_528 (Concatenate)	(None, 16, 16, 54)	0	concatenate_527[0][0] conv2d_545[0][0]
batch_normalization_542 (BatchN	(None, 16, 16, 54)	216	concatenate_528[0][0]
activation_545 (Activation)	(None, 16, 16, 54)	0	batch_normalization_542[0][0]
conv2d_546 (Conv2D)	(None, 16, 16, 6)	2916	activation_545[0][0]
concatenate_529 (Concatenate)	(None, 16, 16, 60)	0	concatenate_528[0][0] conv2d_546[0][0]
batch_normalization_543 (BatchN	(None, 16, 16, 60)	240	concatenate_529[0][0]
activation_546 (Activation)	(None, 16, 16, 60)	0	batch_normalization_543[0][0]
conv2d_547 (Conv2D)	(None, 16, 16, 6)	3240	activation_546[0][0]
concatenate_530 (Concatenate)	(None, 16, 16, 66)	0	concatenate_529[0][0] conv2d_547[0][0]
batch_normalization_544 (BatchN	(None, 16, 16, 66)	264	concatenate_530[0][0]
activation_547 (Activation)	(None, 16, 16, 66)	0	batch_normalization_544[0][0]
conv2d_548 (Conv2D)	(None, 16, 16, 6)	3564	activation_547[0][0]
concatenate_531 (Concatenate)	(None, 16, 16, 72)	0	concatenate_530[0][0] conv2d_548[0][0]
batch_normalization_545 (BatchN	(None, 16, 16, 72)	288	concatenate_531[0][0]
activation_548 (Activation)	(None, 16, 16, 72)	0	batch_normalization_545[0][0]
conv2d_549 (Conv2D)	(None, 16, 16, 6)	3888	activation_548[0][0]
concatenate_532 (Concatenate)	(None, 16, 16, 78)	0	concatenate_531[0][0] conv2d_549[0][0]
batch_normalization_546 (BatchN	(None, 16, 16, 78)	312	concatenate_532[0][0]
activation_549 (Activation)	(None, 16, 16, 78)	0	batch_normalization_546[0][0]
conv2d_550 (Conv2D)	(None, 16, 16, 6)	4212	activation_549[0][0]
concatenate_533 (Concatenate)	(None, 16, 16, 84)	0	concatenate_532[0][0] conv2d_550[0][0]
batch_normalization_547 (BatchN	(None, 16, 16, 84)	336	concatenate_533[0][0]
activation_550 (Activation)	(None, 16, 16, 84)	0	batch_normalization_547[0][0]
conv2d_551 (Conv2D)	(None, 16, 16, 6)	4536	activation_550[0][0]
concatenate_534 (Concatenate)	(None, 16, 16, 90)	0	concatenate_533[0][0] conv2d_551[0][0]
batch_normalization_548 (BatchN	(None, 16, 16, 90)	360	concatenate_534[0][0]
activation_551 (Activation)	(None, 16, 16, 90)	0	batch_normalization_548[0][0]
conv2d_552 (Conv2D)	(None, 16, 16, 6)	4860	activation_551[0][0]
concatenate_535 (Concatenate)	(None, 16, 16, 96)	0	concatenate_534[0][0] conv2d_552[0][0]
batch_normalization_549 (BatchN	(None, 16, 16, 96)	384	concatenate_535[0][0]
activation_552 (Activation)	(None, 16, 16, 96)	0	batch_normalization_549[0][0]

conv2d_553 (Conv2D)	(None, 16, 16, 6)	5184	activation_552[0][0]
concatenate_536 (Concatenate)	(None, 16, 16, 102)	0	concatenate_535[0][0] conv2d_553[0][0]
batch_normalization_550 (BatchN	(None, 16, 16, 102)	408	concatenate_536[0][0]
activation_553 (Activation)	(None, 16, 16, 102)	0	batch_normalization_550[0][0]
conv2d_554 (Conv2D)	(None, 16, 16, 6)	5508	activation_553[0][0]
concatenate_537 (Concatenate)	(None, 16, 16, 108)	0	concatenate_536[0][0] conv2d_554[0][0]
batch_normalization_551 (BatchN	(None, 16, 16, 108)	432	concatenate_537[0][0]
activation_554 (Activation)	(None, 16, 16, 108)	0	batch_normalization_551[0][0]
conv2d_555 (Conv2D)	(None, 16, 16, 6)	5832	activation_554[0][0]
concatenate_538 (Concatenate)	(None, 16, 16, 114)	0	concatenate_537[0][0] conv2d_555[0][0]
batch_normalization_552 (BatchN	(None, 16, 16, 114)	456	concatenate_538[0][0]
activation_555 (Activation)	(None, 16, 16, 114)	0	batch_normalization_552[0][0]
conv2d_556 (Conv2D)	(None, 16, 16, 6)	6156	activation_555[0][0]
concatenate_539 (Concatenate)	(None, 16, 16, 120)	0	concatenate_538[0][0] conv2d_556[0][0]
batch_normalization_553 (BatchN	(None, 16, 16, 120)	480	concatenate_539[0][0]
activation_556 (Activation)	(None, 16, 16, 120)	0	batch_normalization_553[0][0]
conv2d_557 (Conv2D)	(None, 16, 16, 6)	6480	activation_556[0][0]
concatenate_540 (Concatenate)	(None, 16, 16, 126)	0	concatenate_539[0][0] conv2d_557[0][0]
batch_normalization_554 (BatchN	(None, 16, 16, 126)	504	concatenate_540[0][0]
activation_557 (Activation)	(None, 16, 16, 126)	0	batch_normalization_554[0][0]
conv2d_558 (Conv2D)	(None, 16, 16, 6)	6804	activation_557[0][0]
concatenate_541 (Concatenate)	(None, 16, 16, 132)	0	concatenate_540[0][0] conv2d_558[0][0]
batch_normalization_555 (BatchN	(None, 16, 16, 132)	528	concatenate_541[0][0]
activation_558 (Activation)	(None, 16, 16, 132)	0	batch_normalization_555[0][0]
conv2d_559 (Conv2D)	(None, 16, 16, 6)	7128	activation_558[0][0]
concatenate_542 (Concatenate)	(None, 16, 16, 138)	0	concatenate_541[0][0] conv2d_559[0][0]
batch_normalization_556 (BatchN	(None, 16, 16, 138)	552	concatenate_542[0][0]
activation_559 (Activation)	(None, 16, 16, 138)	0	batch_normalization_556[0][0]
conv2d_560 (Conv2D)	(None, 16, 16, 6)	7452	activation_559[0][0]
concatenate_543 (Concatenate)	(None, 16, 16, 144)	0	concatenate_542[0][0] conv2d_560[0][0]
batch_normalization_557 (BatchN	(None, 16, 16, 144)	576	concatenate_543[0][0]
activation_560 (Activation)	(None, 16, 16, 144)	0	batch_normalization_557[0][0]
conv2d_561 (Conv2D)	(None, 16, 16, 6)	7776	activation_560[0][0]
concatenate_544 (Concatenate)	(None, 16, 16, 150)	0	concatenate_543[0][0] conv2d_561[0][0]

batch_normalization_558 (BatchN	(None, 16, 16, 150)	600	concatenate_544[0][0]
activation_561 (Activation)	(None, 16, 16, 150)	0	batch_normalization_558[0][0]
conv2d_562 (Conv2D)	(None, 16, 16, 6)	8100	activation_561[0][0]
concatenate_545 (Concatenate)	(None, 16, 16, 156)	0	concatenate_544[0][0] conv2d_562[0][0]
batch_normalization_559 (BatchN	(None, 16, 16, 156)	624	concatenate_545[0][0]
activation_562 (Activation)	(None, 16, 16, 156)	0	batch_normalization_559[0][0]
conv2d_563 (Conv2D)	(None, 16, 16, 6)	8424	activation_562[0][0]
concatenate_546 (Concatenate)	(None, 16, 16, 162)	0	concatenate_545[0][0] conv2d_563[0][0]
batch_normalization_560 (BatchN	(None, 16, 16, 162)	648	concatenate_546[0][0]
activation_563 (Activation)	(None, 16, 16, 162)	0	batch_normalization_560[0][0]
conv2d_564 (Conv2D)	(None, 16, 16, 6)	8748	activation_563[0][0]
concatenate_547 (Concatenate)	(None, 16, 16, 168)	0	concatenate_546[0][0] conv2d_564[0][0]
batch_normalization_561 (BatchN	(None, 16, 16, 168)	672	concatenate_547[0][0]
activation_564 (Activation)	(None, 16, 16, 168)	0	batch_normalization_561[0][0]
conv2d_565 (Conv2D)	(None, 16, 16, 6)	9072	activation_564[0][0]
concatenate_548 (Concatenate)	(None, 16, 16, 174)	0	concatenate_547[0][0] conv2d_565[0][0]
batch_normalization_562 (BatchN	(None, 16, 16, 174)	696	concatenate_548[0][0]
activation_565 (Activation)	(None, 16, 16, 174)	0	batch_normalization_562[0][0]
conv2d_566 (Conv2D)	(None, 16, 16, 6)	9396	activation_565[0][0]
concatenate_549 (Concatenate)	(None, 16, 16, 180)	0	concatenate_548[0][0] conv2d_566[0][0]
batch_normalization_563 (BatchN	(None, 16, 16, 180)	720	concatenate_549[0][0]
activation_566 (Activation)	(None, 16, 16, 180)	0	batch_normalization_563[0][0]
conv2d_567 (Conv2D)	(None, 16, 16, 6)	9720	activation_566[0][0]
concatenate_550 (Concatenate)	(None, 16, 16, 186)	0	concatenate_549[0][0] conv2d_567[0][0]
batch_normalization_564 (BatchN	(None, 16, 16, 186)	744	concatenate_550[0][0]
activation_567 (Activation)	(None, 16, 16, 186)	0	batch_normalization_564[0][0]
conv2d_568 (Conv2D)	(None, 16, 16, 6)	10044	activation_567[0][0]
concatenate_551 (Concatenate)	(None, 16, 16, 192)	0	concatenate_550[0][0] conv2d_568[0][0]
batch_normalization_565 (BatchN	(None, 16, 16, 192)	768	concatenate_551[0][0]
activation_568 (Activation)	(None, 16, 16, 192)	0	batch_normalization_565[0][0]
conv2d_569 (Conv2D)	(None, 16, 16, 6)	10368	activation_568[0][0]
concatenate_552 (Concatenate)	(None, 16, 16, 198)	0	concatenate_551[0][0] conv2d_569[0][0]
batch_normalization_566 (BatchN	(None, 16, 16, 198)	792	concatenate_552[0][0]
activation_569 (Activation)	(None, 16, 16, 198)	0	batch_normalization_566[0][0]
conv2d_570 (Conv2D)	(None, 16, 16, 6)	10692	activation_569[0][0]

conv2d_570 (Conv2D)	(None, 16, 16, 6)	10692	activation_569[0][0]
concatenate_553 (Concatenate)	(None, 16, 16, 204)	0	concatenate_552[0][0] conv2d_570[0][0]
batch_normalization_567 (BatchN	(None, 16, 16, 204)	816	concatenate_553[0][0]
activation_570 (Activation)	(None, 16, 16, 204)	0	batch_normalization_567[0][0]
conv2d_571 (Conv2D)	(None, 16, 16, 6)	11016	activation_570[0][0]
concatenate_554 (Concatenate)	(None, 16, 16, 210)	0	concatenate_553[0][0] conv2d_571[0][0]
batch_normalization_568 (BatchN	(None, 16, 16, 210)	840	concatenate_554[0][0]
activation_571 (Activation)	(None, 16, 16, 210)	0	batch_normalization_568[0][0]
conv2d_572 (Conv2D)	(None, 16, 16, 6)	11340	activation_571[0][0]
concatenate_555 (Concatenate)	(None, 16, 16, 216)	0	concatenate_554[0][0] conv2d_572[0][0]
batch_normalization_569 (BatchN	(None, 16, 16, 216)	864	concatenate_555[0][0]
activation_572 (Activation)	(None, 16, 16, 216)	0	batch_normalization_569[0][0]
conv2d_573 (Conv2D)	(None, 16, 16, 6)	11664	activation_572[0][0]
concatenate_556 (Concatenate)	(None, 16, 16, 222)	0	concatenate_555[0][0] conv2d_573[0][0]
batch_normalization_570 (BatchN	(None, 16, 16, 222)	888	concatenate_556[0][0]
activation_573 (Activation)	(None, 16, 16, 222)	0	batch_normalization_570[0][0]
conv2d_574 (Conv2D)	(None, 16, 16, 6)	11988	activation_573[0][0]
concatenate_557 (Concatenate)	(None, 16, 16, 228)	0	concatenate_556[0][0] conv2d_574[0][0]
batch_normalization_571 (BatchN	(None, 16, 16, 228)	912	concatenate_557[0][0]
activation_574 (Activation)	(None, 16, 16, 228)	0	batch_normalization_571[0][0]
conv2d_575 (Conv2D)	(None, 16, 16, 6)	12312	activation_574[0][0]
concatenate_558 (Concatenate)	(None, 16, 16, 234)	0	concatenate_557[0][0] conv2d_575[0][0]
batch_normalization_572 (BatchN	(None, 16, 16, 234)	936	concatenate_558[0][0]
activation_575 (Activation)	(None, 16, 16, 234)	0	batch_normalization_572[0][0]
conv2d_576 (Conv2D)	(None, 16, 16, 6)	12636	activation_575[0][0]
concatenate_559 (Concatenate)	(None, 16, 16, 240)	0	concatenate_558[0][0] conv2d_576[0][0]
batch_normalization_573 (BatchN	(None, 16, 16, 240)	960	concatenate_559[0][0]
activation_576 (Activation)	(None, 16, 16, 240)	0	batch_normalization_573[0][0]
conv2d_577 (Conv2D)	(None, 16, 16, 6)	12960	activation_576[0][0]
concatenate_560 (Concatenate)	(None, 16, 16, 246)	0	concatenate_559[0][0] conv2d_577[0][0]
batch_normalization_574 (BatchN	(None, 16, 16, 246)	984	concatenate_560[0][0]
activation_577 (Activation)	(None, 16, 16, 246)	0	batch_normalization_574[0][0]
conv2d_578 (Conv2D)	(None, 16, 16, 6)	1476	activation_577[0][0]
average_pooling2d_14 (AveragePo	(None, 8, 8, 6)	0	conv2d_578[0][0]
batch_normalization_575 (BatchN	(None, 8, 8, 6)	24	average_pooling2d_14[0][0]

activation_578 (Activation)	(None, 8, 8, 6)	0	batch_normalization_575[0][0]
conv2d_579 (Conv2D)	(None, 8, 8, 6)	324	activation_578[0][0]
concatenate_561 (Concatenate)	(None, 8, 8, 12)	0	average_pooling2d_14[0][0] conv2d_579[0][0]
batch_normalization_576 (BatchN	(None, 8, 8, 12)	48	concatenate_561[0][0]
activation_579 (Activation)	(None, 8, 8, 12)	0	batch_normalization_576[0][0]
conv2d_580 (Conv2D)	(None, 8, 8, 6)	648	activation_579[0][0]
concatenate_562 (Concatenate)	(None, 8, 8, 18)	0	concatenate_561[0][0] conv2d_580[0][0]
batch_normalization_577 (BatchN	(None, 8, 8, 18)	72	concatenate_562[0][0]
activation_580 (Activation)	(None, 8, 8, 18)	0	batch_normalization_577[0][0]
conv2d_581 (Conv2D)	(None, 8, 8, 6)	972	activation_580[0][0]
concatenate_563 (Concatenate)	(None, 8, 8, 24)	0	concatenate_562[0][0] conv2d_581[0][0]
batch_normalization_578 (BatchN	(None, 8, 8, 24)	96	concatenate_563[0][0]
activation_581 (Activation)	(None, 8, 8, 24)	0	batch_normalization_578[0][0]
conv2d_582 (Conv2D)	(None, 8, 8, 6)	1296	activation_581[0][0]
concatenate_564 (Concatenate)	(None, 8, 8, 30)	0	concatenate_563[0][0] conv2d_582[0][0]
batch_normalization_579 (BatchN	(None, 8, 8, 30)	120	concatenate_564[0][0]
activation_582 (Activation)	(None, 8, 8, 30)	0	batch_normalization_579[0][0]
conv2d_583 (Conv2D)	(None, 8, 8, 6)	1620	activation_582[0][0]
concatenate_565 (Concatenate)	(None, 8, 8, 36)	0	concatenate_564[0][0] conv2d_583[0][0]
batch_normalization_580 (BatchN	(None, 8, 8, 36)	144	concatenate_565[0][0]
activation_583 (Activation)	(None, 8, 8, 36)	0	batch_normalization_580[0][0]
conv2d_584 (Conv2D)	(None, 8, 8, 6)	1944	activation_583[0][0]
concatenate_566 (Concatenate)	(None, 8, 8, 42)	0	concatenate_565[0][0] conv2d_584[0][0]
batch_normalization_581 (BatchN	(None, 8, 8, 42)	168	concatenate_566[0][0]
activation_584 (Activation)	(None, 8, 8, 42)	0	batch_normalization_581[0][0]
conv2d_585 (Conv2D)	(None, 8, 8, 6)	2268	activation_584[0][0]
concatenate_567 (Concatenate)	(None, 8, 8, 48)	0	concatenate_566[0][0] conv2d_585[0][0]
batch_normalization_582 (BatchN	(None, 8, 8, 48)	192	concatenate_567[0][0]
activation_585 (Activation)	(None, 8, 8, 48)	0	batch_normalization_582[0][0]
conv2d_586 (Conv2D)	(None, 8, 8, 6)	2592	activation_585[0][0]
concatenate_568 (Concatenate)	(None, 8, 8, 54)	0	concatenate_567[0][0] conv2d_586[0][0]
batch_normalization_583 (BatchN	(None, 8, 8, 54)	216	concatenate_568[0][0]
activation_586 (Activation)	(None, 8, 8, 54)	0	batch_normalization_583[0][0]
conv2d_587 (Conv2D)	(None, 8, 8, 6)	2916	activation_586[0][0]
[illegible]	[illegible]	[illegible]	[illegible]

concatenate_569 (Concatenate)	(None, 8, 8, 60)	0	concatenate_568[0][0] conv2d_587[0][0]
batch_normalization_584 (BatchN	(None, 8, 8, 60)	240	concatenate_569[0][0]
activation_587 (Activation)	(None, 8, 8, 60)	0	batch_normalization_584[0][0]
conv2d_588 (Conv2D)	(None, 8, 8, 6)	3240	activation_587[0][0]
concatenate_570 (Concatenate)	(None, 8, 8, 66)	0	concatenate_569[0][0] conv2d_588[0][0]
batch_normalization_585 (BatchN	(None, 8, 8, 66)	264	concatenate_570[0][0]
activation_588 (Activation)	(None, 8, 8, 66)	0	batch_normalization_585[0][0]
conv2d_589 (Conv2D)	(None, 8, 8, 6)	3564	activation_588[0][0]
concatenate_571 (Concatenate)	(None, 8, 8, 72)	0	concatenate_570[0][0] conv2d_589[0][0]
batch_normalization_586 (BatchN	(None, 8, 8, 72)	288	concatenate_571[0][0]
activation_589 (Activation)	(None, 8, 8, 72)	0	batch_normalization_586[0][0]
conv2d_590 (Conv2D)	(None, 8, 8, 6)	3888	activation_589[0][0]
concatenate_572 (Concatenate)	(None, 8, 8, 78)	0	concatenate_571[0][0] conv2d_590[0][0]
batch_normalization_587 (BatchN	(None, 8, 8, 78)	312	concatenate_572[0][0]
activation_590 (Activation)	(None, 8, 8, 78)	0	batch_normalization_587[0][0]
conv2d_591 (Conv2D)	(None, 8, 8, 6)	4212	activation_590[0][0]
concatenate_573 (Concatenate)	(None, 8, 8, 84)	0	concatenate_572[0][0] conv2d_591[0][0]
batch_normalization_588 (BatchN	(None, 8, 8, 84)	336	concatenate_573[0][0]
activation_591 (Activation)	(None, 8, 8, 84)	0	batch_normalization_588[0][0]
conv2d_592 (Conv2D)	(None, 8, 8, 6)	4536	activation_591[0][0]
concatenate_574 (Concatenate)	(None, 8, 8, 90)	0	concatenate_573[0][0] conv2d_592[0][0]
batch_normalization_589 (BatchN	(None, 8, 8, 90)	360	concatenate_574[0][0]
activation_592 (Activation)	(None, 8, 8, 90)	0	batch_normalization_589[0][0]
conv2d_593 (Conv2D)	(None, 8, 8, 6)	4860	activation_592[0][0]
concatenate_575 (Concatenate)	(None, 8, 8, 96)	0	concatenate_574[0][0] conv2d_593[0][0]
batch_normalization_590 (BatchN	(None, 8, 8, 96)	384	concatenate_575[0][0]
activation_593 (Activation)	(None, 8, 8, 96)	0	batch_normalization_590[0][0]
conv2d_594 (Conv2D)	(None, 8, 8, 6)	5184	activation_593[0][0]
concatenate_576 (Concatenate)	(None, 8, 8, 102)	0	concatenate_575[0][0] conv2d_594[0][0]
batch_normalization_591 (BatchN	(None, 8, 8, 102)	408	concatenate_576[0][0]
activation_594 (Activation)	(None, 8, 8, 102)	0	batch_normalization_591[0][0]
conv2d_595 (Conv2D)	(None, 8, 8, 6)	5508	activation_594[0][0]
concatenate_577 (Concatenate)	(None, 8, 8, 108)	0	concatenate_576[0][0] conv2d_595[0][0]
batch_normalization_592 (BatchN	(None, 8, 8, 108)	432	concatenate_577[0][0]

activation_595 (Activation)	(None, 8, 8, 108)	0	batch_normalization_592[0][0]
conv2d_596 (Conv2D)	(None, 8, 8, 6)	5832	activation_595[0][0]
concatenate_578 (Concatenate)	(None, 8, 8, 114)	0	concatenate_577[0][0] conv2d_596[0][0]
batch_normalization_593 (BatchN	(None, 8, 8, 114)	456	concatenate_578[0][0]
activation_596 (Activation)	(None, 8, 8, 114)	0	batch_normalization_593[0][0]
conv2d_597 (Conv2D)	(None, 8, 8, 6)	6156	activation_596[0][0]
concatenate_579 (Concatenate)	(None, 8, 8, 120)	0	concatenate_578[0][0] conv2d_597[0][0]
batch_normalization_594 (BatchN	(None, 8, 8, 120)	480	concatenate_579[0][0]
activation_597 (Activation)	(None, 8, 8, 120)	0	batch_normalization_594[0][0]
conv2d_598 (Conv2D)	(None, 8, 8, 6)	6480	activation_597[0][0]
concatenate_580 (Concatenate)	(None, 8, 8, 126)	0	concatenate_579[0][0] conv2d_598[0][0]
batch_normalization_595 (BatchN	(None, 8, 8, 126)	504	concatenate_580[0][0]
activation_598 (Activation)	(None, 8, 8, 126)	0	batch_normalization_595[0][0]
conv2d_599 (Conv2D)	(None, 8, 8, 6)	6804	activation_598[0][0]
concatenate_581 (Concatenate)	(None, 8, 8, 132)	0	concatenate_580[0][0] conv2d_599[0][0]
batch_normalization_596 (BatchN	(None, 8, 8, 132)	528	concatenate_581[0][0]
activation_599 (Activation)	(None, 8, 8, 132)	0	batch_normalization_596[0][0]
conv2d_600 (Conv2D)	(None, 8, 8, 6)	7128	activation_599[0][0]
concatenate_582 (Concatenate)	(None, 8, 8, 138)	0	concatenate_581[0][0] conv2d_600[0][0]
batch_normalization_597 (BatchN	(None, 8, 8, 138)	552	concatenate_582[0][0]
activation_600 (Activation)	(None, 8, 8, 138)	0	batch_normalization_597[0][0]
conv2d_601 (Conv2D)	(None, 8, 8, 6)	7452	activation_600[0][0]
concatenate_583 (Concatenate)	(None, 8, 8, 144)	0	concatenate_582[0][0] conv2d_601[0][0]
batch_normalization_598 (BatchN	(None, 8, 8, 144)	576	concatenate_583[0][0]
activation_601 (Activation)	(None, 8, 8, 144)	0	batch_normalization_598[0][0]
conv2d_602 (Conv2D)	(None, 8, 8, 6)	7776	activation_601[0][0]
concatenate_584 (Concatenate)	(None, 8, 8, 150)	0	concatenate_583[0][0] conv2d_602[0][0]
batch_normalization_599 (BatchN	(None, 8, 8, 150)	600	concatenate_584[0][0]
activation_602 (Activation)	(None, 8, 8, 150)	0	batch_normalization_599[0][0]
conv2d_603 (Conv2D)	(None, 8, 8, 6)	8100	activation_602[0][0]
concatenate_585 (Concatenate)	(None, 8, 8, 156)	0	concatenate_584[0][0] conv2d_603[0][0]
batch_normalization_600 (BatchN	(None, 8, 8, 156)	624	concatenate_585[0][0]
activation_603 (Activation)	(None, 8, 8, 156)	0	batch_normalization_600[0][0]
conv2d_604 (Conv2D)	(None, 8, 8, 6)	8424	activation_603[0][0]
concatenate_586 (Concatenate)	(None, 8, 8, 162)	0	concatenate_585[0][0]

			conv2d_604[0][0]
batch_normalization_601 (BatchN	(None, 8, 8, 162)	648	concatenate_586[0][0]
activation_604 (Activation)	(None, 8, 8, 162)	0	batch_normalization_601[0][0]
conv2d_605 (Conv2D)	(None, 8, 8, 6)	8748	activation_604[0][0]
concatenate_587 (Concatenate)	(None, 8, 8, 168)	0	concatenate_586[0][0] conv2d_605[0][0]
batch_normalization_602 (BatchN	(None, 8, 8, 168)	672	concatenate_587[0][0]
activation_605 (Activation)	(None, 8, 8, 168)	0	batch_normalization_602[0][0]
conv2d_606 (Conv2D)	(None, 8, 8, 6)	9072	activation_605[0][0]
concatenate_588 (Concatenate)	(None, 8, 8, 174)	0	concatenate_587[0][0] conv2d_606[0][0]
batch_normalization_603 (BatchN	(None, 8, 8, 174)	696	concatenate_588[0][0]
activation_606 (Activation)	(None, 8, 8, 174)	0	batch_normalization_603[0][0]
conv2d_607 (Conv2D)	(None, 8, 8, 6)	9396	activation_606[0][0]
concatenate_589 (Concatenate)	(None, 8, 8, 180)	0	concatenate_588[0][0] conv2d_607[0][0]
batch_normalization_604 (BatchN	(None, 8, 8, 180)	720	concatenate_589[0][0]
activation_607 (Activation)	(None, 8, 8, 180)	0	batch_normalization_604[0][0]
conv2d_608 (Conv2D)	(None, 8, 8, 6)	9720	activation_607[0][0]
concatenate_590 (Concatenate)	(None, 8, 8, 186)	0	concatenate_589[0][0] conv2d_608[0][0]
batch_normalization_605 (BatchN	(None, 8, 8, 186)	744	concatenate_590[0][0]
activation_608 (Activation)	(None, 8, 8, 186)	0	batch_normalization_605[0][0]
conv2d_609 (Conv2D)	(None, 8, 8, 6)	10044	activation_608[0][0]
concatenate_591 (Concatenate)	(None, 8, 8, 192)	0	concatenate_590[0][0] conv2d_609[0][0]
batch_normalization_606 (BatchN	(None, 8, 8, 192)	768	concatenate_591[0][0]
activation_609 (Activation)	(None, 8, 8, 192)	0	batch_normalization_606[0][0]
conv2d_610 (Conv2D)	(None, 8, 8, 6)	10368	activation_609[0][0]
concatenate_592 (Concatenate)	(None, 8, 8, 198)	0	concatenate_591[0][0] conv2d_610[0][0]
batch_normalization_607 (BatchN	(None, 8, 8, 198)	792	concatenate_592[0][0]
activation_610 (Activation)	(None, 8, 8, 198)	0	batch_normalization_607[0][0]
conv2d_611 (Conv2D)	(None, 8, 8, 6)	10692	activation_610[0][0]
concatenate_593 (Concatenate)	(None, 8, 8, 204)	0	concatenate_592[0][0] conv2d_611[0][0]
batch_normalization_608 (BatchN	(None, 8, 8, 204)	816	concatenate_593[0][0]
activation_611 (Activation)	(None, 8, 8, 204)	0	batch_normalization_608[0][0]
conv2d_612 (Conv2D)	(None, 8, 8, 6)	11016	activation_611[0][0]
concatenate_594 (Concatenate)	(None, 8, 8, 210)	0	concatenate_593[0][0] conv2d_612[0][0]
batch_normalization_609 (BatchN	(None, 8, 8, 210)	840	concatenate_594[0][0]
activation_612 (Activation)	(None, 8, 8, 210)	0	batch_normalization_609[0][0]

conv2d_613 (Conv2D)	(None, 8, 8, 6)	11340	activation_612[0][0]
concatenate_595 (Concatenate)	(None, 8, 8, 216)	0	concatenate_594[0][0] conv2d_613[0][0]
batch_normalization_610 (BatchN	(None, 8, 8, 216)	864	concatenate_595[0][0]
activation_613 (Activation)	(None, 8, 8, 216)	0	batch_normalization_610[0][0]
conv2d_614 (Conv2D)	(None, 8, 8, 6)	11664	activation_613[0][0]
concatenate_596 (Concatenate)	(None, 8, 8, 222)	0	concatenate_595[0][0] conv2d_614[0][0]
batch_normalization_611 (BatchN	(None, 8, 8, 222)	888	concatenate_596[0][0]
activation_614 (Activation)	(None, 8, 8, 222)	0	batch_normalization_611[0][0]
conv2d_615 (Conv2D)	(None, 8, 8, 6)	11988	activation_614[0][0]
concatenate_597 (Concatenate)	(None, 8, 8, 228)	0	concatenate_596[0][0] conv2d_615[0][0]
batch_normalization_612 (BatchN	(None, 8, 8, 228)	912	concatenate_597[0][0]
activation_615 (Activation)	(None, 8, 8, 228)	0	batch_normalization_612[0][0]
conv2d_616 (Conv2D)	(None, 8, 8, 6)	12312	activation_615[0][0]
concatenate_598 (Concatenate)	(None, 8, 8, 234)	0	concatenate_597[0][0] conv2d_616[0][0]
batch_normalization_613 (BatchN	(None, 8, 8, 234)	936	concatenate_598[0][0]
activation_616 (Activation)	(None, 8, 8, 234)	0	batch_normalization_613[0][0]
conv2d_617 (Conv2D)	(None, 8, 8, 6)	12636	activation_616[0][0]
concatenate_599 (Concatenate)	(None, 8, 8, 240)	0	concatenate_598[0][0] conv2d_617[0][0]
batch_normalization_614 (BatchN	(None, 8, 8, 240)	960	concatenate_599[0][0]
activation_617 (Activation)	(None, 8, 8, 240)	0	batch_normalization_614[0][0]
conv2d_618 (Conv2D)	(None, 8, 8, 6)	12960	activation_617[0][0]
concatenate_600 (Concatenate)	(None, 8, 8, 246)	0	concatenate_599[0][0] conv2d_618[0][0]
batch_normalization_615 (BatchN	(None, 8, 8, 246)	984	concatenate_600[0][0]
activation_618 (Activation)	(None, 8, 8, 246)	0	batch_normalization_615[0][0]
conv2d_619 (Conv2D)	(None, 8, 8, 6)	1476	activation_618[0][0]
average_pooling2d_15 (AveragePo	(None, 4, 4, 6)	0	conv2d_619[0][0]
batch_normalization_616 (BatchN	(None, 4, 4, 6)	24	average_pooling2d_15[0][0]
activation_619 (Activation)	(None, 4, 4, 6)	0	batch_normalization_616[0][0]
conv2d_620 (Conv2D)	(None, 4, 4, 6)	324	activation_619[0][0]
concatenate_601 (Concatenate)	(None, 4, 4, 12)	0	average_pooling2d_15[0][0] conv2d_620[0][0]
batch_normalization_617 (BatchN	(None, 4, 4, 12)	48	concatenate_601[0][0]
activation_620 (Activation)	(None, 4, 4, 12)	0	batch_normalization_617[0][0]
conv2d_621 (Conv2D)	(None, 4, 4, 6)	648	activation_620[0][0]
concatenate_602 (Concatenate)	(None, 4, 4, 18)	0	concatenate_601[0][0] conv2d_621[0][0]

batch_normalization_618 (BatchN	(None, 4, 4, 18)	72	concatenate_602[0][0]
activation_621 (Activation)	(None, 4, 4, 18)	0	batch_normalization_618[0][0]
conv2d_622 (Conv2D)	(None, 4, 4, 6)	972	activation_621[0][0]
concatenate_603 (Concatenate)	(None, 4, 4, 24)	0	concatenate_602[0][0] conv2d_622[0][0]
batch_normalization_619 (BatchN	(None, 4, 4, 24)	96	concatenate_603[0][0]
activation_622 (Activation)	(None, 4, 4, 24)	0	batch_normalization_619[0][0]
conv2d_623 (Conv2D)	(None, 4, 4, 6)	1296	activation_622[0][0]
concatenate_604 (Concatenate)	(None, 4, 4, 30)	0	concatenate_603[0][0] conv2d_623[0][0]
batch_normalization_620 (BatchN	(None, 4, 4, 30)	120	concatenate_604[0][0]
activation_623 (Activation)	(None, 4, 4, 30)	0	batch_normalization_620[0][0]
conv2d_624 (Conv2D)	(None, 4, 4, 6)	1620	activation_623[0][0]
concatenate_605 (Concatenate)	(None, 4, 4, 36)	0	concatenate_604[0][0] conv2d_624[0][0]
batch_normalization_621 (BatchN	(None, 4, 4, 36)	144	concatenate_605[0][0]
activation_624 (Activation)	(None, 4, 4, 36)	0	batch_normalization_621[0][0]
conv2d_625 (Conv2D)	(None, 4, 4, 6)	1944	activation_624[0][0]
concatenate_606 (Concatenate)	(None, 4, 4, 42)	0	concatenate_605[0][0] conv2d_625[0][0]
batch_normalization_622 (BatchN	(None, 4, 4, 42)	168	concatenate_606[0][0]
activation_625 (Activation)	(None, 4, 4, 42)	0	batch_normalization_622[0][0]
conv2d_626 (Conv2D)	(None, 4, 4, 6)	2268	activation_625[0][0]
concatenate_607 (Concatenate)	(None, 4, 4, 48)	0	concatenate_606[0][0] conv2d_626[0][0]
batch_normalization_623 (BatchN	(None, 4, 4, 48)	192	concatenate_607[0][0]
activation_626 (Activation)	(None, 4, 4, 48)	0	batch_normalization_623[0][0]
conv2d_627 (Conv2D)	(None, 4, 4, 6)	2592	activation_626[0][0]
concatenate_608 (Concatenate)	(None, 4, 4, 54)	0	concatenate_607[0][0] conv2d_627[0][0]
batch_normalization_624 (BatchN	(None, 4, 4, 54)	216	concatenate_608[0][0]
activation_627 (Activation)	(None, 4, 4, 54)	0	batch_normalization_624[0][0]
conv2d_628 (Conv2D)	(None, 4, 4, 6)	2916	activation_627[0][0]
concatenate_609 (Concatenate)	(None, 4, 4, 60)	0	concatenate_608[0][0] conv2d_628[0][0]
batch_normalization_625 (BatchN	(None, 4, 4, 60)	240	concatenate_609[0][0]
activation_628 (Activation)	(None, 4, 4, 60)	0	batch_normalization_625[0][0]
conv2d_629 (Conv2D)	(None, 4, 4, 6)	3240	activation_628[0][0]
concatenate_610 (Concatenate)	(None, 4, 4, 66)	0	concatenate_609[0][0] conv2d_629[0][0]
batch_normalization_626 (BatchN	(None, 4, 4, 66)	264	concatenate_610[0][0]
activation_629 (Activation)	(None, 4, 4, 66)	0	batch_normalization_626[0][0]
conv2d_630 (Conv2D)	(None, 4, 4, 6)	3564	activation_629[0][0]

concatenate_611 (Concatenate)	(None, 4, 4, 72)	0	concatenate_610[0][0] conv2d_630[0][0]
batch_normalization_627 (BatchN	(None, 4, 4, 72)	288	concatenate_611[0][0]
activation_630 (Activation)	(None, 4, 4, 72)	0	batch_normalization_627[0][0]
conv2d_631 (Conv2D)	(None, 4, 4, 6)	3888	activation_630[0][0]
concatenate_612 (Concatenate)	(None, 4, 4, 78)	0	concatenate_611[0][0] conv2d_631[0][0]
batch_normalization_628 (BatchN	(None, 4, 4, 78)	312	concatenate_612[0][0]
activation_631 (Activation)	(None, 4, 4, 78)	0	batch_normalization_628[0][0]
conv2d_632 (Conv2D)	(None, 4, 4, 6)	4212	activation_631[0][0]
concatenate_613 (Concatenate)	(None, 4, 4, 84)	0	concatenate_612[0][0] conv2d_632[0][0]
batch_normalization_629 (BatchN	(None, 4, 4, 84)	336	concatenate_613[0][0]
activation_632 (Activation)	(None, 4, 4, 84)	0	batch_normalization_629[0][0]
conv2d_633 (Conv2D)	(None, 4, 4, 6)	4536	activation_632[0][0]
concatenate_614 (Concatenate)	(None, 4, 4, 90)	0	concatenate_613[0][0] conv2d_633[0][0]
batch_normalization_630 (BatchN	(None, 4, 4, 90)	360	concatenate_614[0][0]
activation_633 (Activation)	(None, 4, 4, 90)	0	batch_normalization_630[0][0]
conv2d_634 (Conv2D)	(None, 4, 4, 6)	4860	activation_633[0][0]
concatenate_615 (Concatenate)	(None, 4, 4, 96)	0	concatenate_614[0][0] conv2d_634[0][0]
batch_normalization_631 (BatchN	(None, 4, 4, 96)	384	concatenate_615[0][0]
activation_634 (Activation)	(None, 4, 4, 96)	0	batch_normalization_631[0][0]
conv2d_635 (Conv2D)	(None, 4, 4, 6)	5184	activation_634[0][0]
concatenate_616 (Concatenate)	(None, 4, 4, 102)	0	concatenate_615[0][0] conv2d_635[0][0]
batch_normalization_632 (BatchN	(None, 4, 4, 102)	408	concatenate_616[0][0]
activation_635 (Activation)	(None, 4, 4, 102)	0	batch_normalization_632[0][0]
conv2d_636 (Conv2D)	(None, 4, 4, 6)	5508	activation_635[0][0]
concatenate_617 (Concatenate)	(None, 4, 4, 108)	0	concatenate_616[0][0] conv2d_636[0][0]
batch_normalization_633 (BatchN	(None, 4, 4, 108)	432	concatenate_617[0][0]
activation_636 (Activation)	(None, 4, 4, 108)	0	batch_normalization_633[0][0]
conv2d_637 (Conv2D)	(None, 4, 4, 6)	5832	activation_636[0][0]
concatenate_618 (Concatenate)	(None, 4, 4, 114)	0	concatenate_617[0][0] conv2d_637[0][0]
batch_normalization_634 (BatchN	(None, 4, 4, 114)	456	concatenate_618[0][0]
activation_637 (Activation)	(None, 4, 4, 114)	0	batch_normalization_634[0][0]
conv2d_638 (Conv2D)	(None, 4, 4, 6)	6156	activation_637[0][0]
concatenate_619 (Concatenate)	(None, 4, 4, 120)	0	concatenate_618[0][0] conv2d_638[0][0]
batch_normalization_635 (BatchN	(None, 4, 4, 120)	480	concatenate_619[0][0]

activation_638 (Activation)	(None, 4, 4, 120)	0	batch_normalization_635[0][0]
conv2d_639 (Conv2D)	(None, 4, 4, 6)	6480	activation_638[0][0]
concatenate_620 (Concatenate)	(None, 4, 4, 126)	0	concatenate_619[0][0] conv2d_639[0][0]
batch_normalization_636 (BatchN	(None, 4, 4, 126)	504	concatenate_620[0][0]
activation_639 (Activation)	(None, 4, 4, 126)	0	batch_normalization_636[0][0]
conv2d_640 (Conv2D)	(None, 4, 4, 6)	6804	activation_639[0][0]
concatenate_621 (Concatenate)	(None, 4, 4, 132)	0	concatenate_620[0][0] conv2d_640[0][0]
batch_normalization_637 (BatchN	(None, 4, 4, 132)	528	concatenate_621[0][0]
activation_640 (Activation)	(None, 4, 4, 132)	0	batch_normalization_637[0][0]
conv2d_641 (Conv2D)	(None, 4, 4, 6)	7128	activation_640[0][0]
concatenate_622 (Concatenate)	(None, 4, 4, 138)	0	concatenate_621[0][0] conv2d_641[0][0]
batch_normalization_638 (BatchN	(None, 4, 4, 138)	552	concatenate_622[0][0]
activation_641 (Activation)	(None, 4, 4, 138)	0	batch_normalization_638[0][0]
conv2d_642 (Conv2D)	(None, 4, 4, 6)	7452	activation_641[0][0]
concatenate_623 (Concatenate)	(None, 4, 4, 144)	0	concatenate_622[0][0] conv2d_642[0][0]
batch_normalization_639 (BatchN	(None, 4, 4, 144)	576	concatenate_623[0][0]
activation_642 (Activation)	(None, 4, 4, 144)	0	batch_normalization_639[0][0]
conv2d_643 (Conv2D)	(None, 4, 4, 6)	7776	activation_642[0][0]
concatenate_624 (Concatenate)	(None, 4, 4, 150)	0	concatenate_623[0][0] conv2d_643[0][0]
batch_normalization_640 (BatchN	(None, 4, 4, 150)	600	concatenate_624[0][0]
activation_643 (Activation)	(None, 4, 4, 150)	0	batch_normalization_640[0][0]
conv2d_644 (Conv2D)	(None, 4, 4, 6)	8100	activation_643[0][0]
concatenate_625 (Concatenate)	(None, 4, 4, 156)	0	concatenate_624[0][0] conv2d_644[0][0]
batch_normalization_641 (BatchN	(None, 4, 4, 156)	624	concatenate_625[0][0]
activation_644 (Activation)	(None, 4, 4, 156)	0	batch_normalization_641[0][0]
conv2d_645 (Conv2D)	(None, 4, 4, 6)	8424	activation_644[0][0]
concatenate_626 (Concatenate)	(None, 4, 4, 162)	0	concatenate_625[0][0] conv2d_645[0][0]
batch_normalization_642 (BatchN	(None, 4, 4, 162)	648	concatenate_626[0][0]
activation_645 (Activation)	(None, 4, 4, 162)	0	batch_normalization_642[0][0]
conv2d_646 (Conv2D)	(None, 4, 4, 6)	8748	activation_645[0][0]
concatenate_627 (Concatenate)	(None, 4, 4, 168)	0	concatenate_626[0][0] conv2d_646[0][0]
batch_normalization_643 (BatchN	(None, 4, 4, 168)	672	concatenate_627[0][0]
activation_646 (Activation)	(None, 4, 4, 168)	0	batch_normalization_643[0][0]
conv2d_647 (Conv2D)	(None, 4, 4, 6)	9072	activation_646[0][0]

concatenate_628 (Concatenate)	(None, 4, 4, 174)	0	concatenate_627[0][0] conv2d_647[0][0]
batch_normalization_644 (BatchN	(None, 4, 4, 174)	696	concatenate_628[0][0]
activation_647 (Activation)	(None, 4, 4, 174)	0	batch_normalization_644[0][0]
conv2d_648 (Conv2D)	(None, 4, 4, 6)	9396	activation_647[0][0]
concatenate_629 (Concatenate)	(None, 4, 4, 180)	0	concatenate_628[0][0] conv2d_648[0][0]
batch_normalization_645 (BatchN	(None, 4, 4, 180)	720	concatenate_629[0][0]
activation_648 (Activation)	(None, 4, 4, 180)	0	batch_normalization_645[0][0]
conv2d_649 (Conv2D)	(None, 4, 4, 6)	9720	activation_648[0][0]
concatenate_630 (Concatenate)	(None, 4, 4, 186)	0	concatenate_629[0][0] conv2d_649[0][0]
batch_normalization_646 (BatchN	(None, 4, 4, 186)	744	concatenate_630[0][0]
activation_649 (Activation)	(None, 4, 4, 186)	0	batch_normalization_646[0][0]
conv2d_650 (Conv2D)	(None, 4, 4, 6)	10044	activation_649[0][0]
concatenate_631 (Concatenate)	(None, 4, 4, 192)	0	concatenate_630[0][0] conv2d_650[0][0]
batch_normalization_647 (BatchN	(None, 4, 4, 192)	768	concatenate_631[0][0]
activation_650 (Activation)	(None, 4, 4, 192)	0	batch_normalization_647[0][0]
conv2d_651 (Conv2D)	(None, 4, 4, 6)	10368	activation_650[0][0]
concatenate_632 (Concatenate)	(None, 4, 4, 198)	0	concatenate_631[0][0] conv2d_651[0][0]
batch_normalization_648 (BatchN	(None, 4, 4, 198)	792	concatenate_632[0][0]
activation_651 (Activation)	(None, 4, 4, 198)	0	batch_normalization_648[0][0]
conv2d_652 (Conv2D)	(None, 4, 4, 6)	10692	activation_651[0][0]
concatenate_633 (Concatenate)	(None, 4, 4, 204)	0	concatenate_632[0][0] conv2d_652[0][0]
batch_normalization_649 (BatchN	(None, 4, 4, 204)	816	concatenate_633[0][0]
activation_652 (Activation)	(None, 4, 4, 204)	0	batch_normalization_649[0][0]
conv2d_653 (Conv2D)	(None, 4, 4, 6)	11016	activation_652[0][0]
concatenate_634 (Concatenate)	(None, 4, 4, 210)	0	concatenate_633[0][0] conv2d_653[0][0]
batch_normalization_650 (BatchN	(None, 4, 4, 210)	840	concatenate_634[0][0]
activation_653 (Activation)	(None, 4, 4, 210)	0	batch_normalization_650[0][0]
conv2d_654 (Conv2D)	(None, 4, 4, 6)	11340	activation_653[0][0]
concatenate_635 (Concatenate)	(None, 4, 4, 216)	0	concatenate_634[0][0] conv2d_654[0][0]
batch_normalization_651 (BatchN	(None, 4, 4, 216)	864	concatenate_635[0][0]
activation_654 (Activation)	(None, 4, 4, 216)	0	batch_normalization_651[0][0]
conv2d_655 (Conv2D)	(None, 4, 4, 6)	11664	activation_654[0][0]
concatenate_636 (Concatenate)	(None, 4, 4, 222)	0	concatenate_635[0][0] conv2d_655[0][0]
batch_normalization_652 (BatchN	(None, 4, 4, 222)	888	concatenate_636[0][0]

```
activation_655 (Activation)     (None, 4, 4, 222)    0           batch_normalization_652[0][0]
conv2d_656 (Conv2D)             (None, 4, 4, 6)      11988       activation_655[0][0]
concatenate_637 (Concatenate)   (None, 4, 4, 228)    0           concatenate_636[0][0]
                                                                 conv2d_656[0][0]
batch_normalization_653 (BatchN (None, 4, 4, 228)    912         concatenate_637[0][0]
activation_656 (Activation)     (None, 4, 4, 228)    0           batch_normalization_653[0][0]
conv2d_657 (Conv2D)             (None, 4, 4, 6)      12312       activation_656[0][0]
concatenate_638 (Concatenate)   (None, 4, 4, 234)    0           concatenate_637[0][0]
                                                                 conv2d_657[0][0]
batch_normalization_654 (BatchN (None, 4, 4, 234)    936         concatenate_638[0][0]
activation_657 (Activation)     (None, 4, 4, 234)    0           batch_normalization_654[0][0]
conv2d_658 (Conv2D)             (None, 4, 4, 6)      12636       activation_657[0][0]
concatenate_639 (Concatenate)   (None, 4, 4, 240)    0           concatenate_638[0][0]
                                                                 conv2d_658[0][0]
batch_normalization_655 (BatchN (None, 4, 4, 240)    960         concatenate_639[0][0]
activation_658 (Activation)     (None, 4, 4, 240)    0           batch_normalization_655[0][0]
conv2d_659 (Conv2D)             (None, 4, 4, 6)      12960       activation_658[0][0]
concatenate_640 (Concatenate)   (None, 4, 4, 246)    0           concatenate_639[0][0]
                                                                 conv2d_659[0][0]
batch_normalization_656 (BatchN (None, 4, 4, 246)    984         concatenate_640[0][0]
activation_659 (Activation)     (None, 4, 4, 246)    0           batch_normalization_656[0][0]
average_pooling2d_16 (AveragePo (None, 2, 2, 246)    0           activation_659[0][0]
conv2d_660 (Conv2D)             (None, 2, 2, 10)     2460        average_pooling2d_16[0][0]
global_max_pooling2d_4 (GlobalM (None, 10)           0           conv2d_660[0][0]
activation_660 (Activation)     (None, 10)           0           global_max_pooling2d_4[0][0]
==================================================================================================
Total params: 1,166,568
Trainable params: 1,124,748
Non-trainable params: 41,820
__________________________________________________________________________________________________
```

In [0]:

```
# determine Loss function and Optimizer
#opt = optimizers.SGD(lr=0.01, decay=1e-6, momentum=0.9)

model.compile(loss='categorical_crossentropy',
              optimizer=Adam(),
              metrics=['accuracy'])
```

In [0]:

```
# patient early stopping
from keras.callbacks import EarlyStopping
es = EarlyStopping(monitor='val_loss', mode='min', verbose=1, patience=20)
```

In [0]:

```
# ModelCheckpoint
from keras.callbacks import ModelCheckpoint
mc = ModelCheckpoint('DNST_model.h5', monitor='val_acc', mode='max', verbose=1, save_best_only=True
)
```

Training without Image augmentation

In [37]:

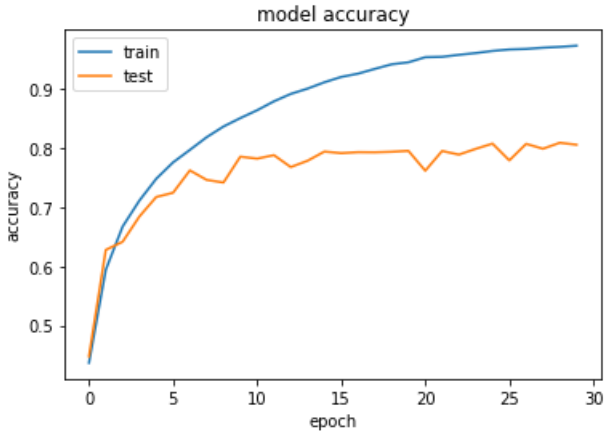
```
# train without image augmentation
history = model.fit(X_train, y_train, batch_size=32, epochs=300, validation_data=(X_test, y_test),
callbacks=[es,mc])
```

```
Train on 50000 samples, validate on 10000 samples
Epoch 1/300
50000/50000 [==============================] - 668s 13ms/step - loss: 1.5303 - accuracy: 0.4367 -
val_loss: 1.6109 - val_accuracy: 0.4477
Epoch 2/300

/usr/local/lib/python3.6/dist-packages/keras/callbacks/callbacks.py:707: RuntimeWarning: Can save
best model only with val_acc available, skipping.
  'skipping.' % (self.monitor), RuntimeWarning)

50000/50000 [==============================] - 655s 13ms/step - loss: 1.1288 - accuracy: 0.5941 -
val_loss: 1.0419 - val_accuracy: 0.6278
Epoch 3/300
50000/50000 [==============================] - 655s 13ms/step - loss: 0.9377 - accuracy: 0.6672 -
val_loss: 1.0300 - val_accuracy: 0.6415
Epoch 4/300
50000/50000 [==============================] - 654s 13ms/step - loss: 0.8157 - accuracy: 0.7113 -
val_loss: 0.9225 - val_accuracy: 0.6843
Epoch 5/300
50000/50000 [==============================] - 654s 13ms/step - loss: 0.7165 - accuracy: 0.7480 -
val_loss: 0.8278 - val_accuracy: 0.7172
Epoch 6/300
50000/50000 [==============================] - 654s 13ms/step - loss: 0.6391 - accuracy: 0.7757 -
val_loss: 0.8180 - val_accuracy: 0.7244
Epoch 7/300
50000/50000 [==============================] - 653s 13ms/step - loss: 0.5789 - accuracy: 0.7969 -
val_loss: 0.7024 - val_accuracy: 0.7622
Epoch 8/300
50000/50000 [==============================] - 652s 13ms/step - loss: 0.5239 - accuracy: 0.8184 -
val_loss: 0.7611 - val_accuracy: 0.7461
Epoch 9/300
50000/50000 [==============================] - 648s 13ms/step - loss: 0.4706 - accuracy: 0.8364 -
val_loss: 0.7992 - val_accuracy: 0.7417
Epoch 10/300
50000/50000 [==============================] - 647s 13ms/step - loss: 0.4289 - accuracy: 0.8506 -
val_loss: 0.6547 - val_accuracy: 0.7854
Epoch 11/300
50000/50000 [==============================] - 646s 13ms/step - loss: 0.3860 - accuracy: 0.8639 -
val_loss: 0.6744 - val_accuracy: 0.7821
Epoch 12/300
50000/50000 [==============================] - 648s 13ms/step - loss: 0.3489 - accuracy: 0.8790 -
val_loss: 0.6710 - val_accuracy: 0.7880
Epoch 13/300
50000/50000 [==============================] - 628s 13ms/step - loss: 0.3104 - accuracy: 0.8915 -
val_loss: 0.7904 - val_accuracy: 0.7678
Epoch 14/300
50000/50000 [==============================] - 612s 12ms/step - loss: 0.2819 - accuracy: 0.9005 -
val_loss: 0.7309 - val_accuracy: 0.7785
Epoch 15/300
50000/50000 [==============================] - 612s 12ms/step - loss: 0.2551 - accuracy: 0.9112 -
val_loss: 0.6875 - val_accuracy: 0.7940
Epoch 16/300
50000/50000 [==============================] - 629s 13ms/step - loss: 0.2266 - accuracy: 0.9202 -
val_loss: 0.7201 - val_accuracy: 0.7914
Epoch 17/300
50000/50000 [==============================] - 640s 13ms/step - loss: 0.2095 - accuracy: 0.9258 -
val_loss: 0.7470 - val_accuracy: 0.7930
Epoch 18/300
50000/50000 [==============================] - 651s 13ms/step - loss: 0.1867 - accuracy: 0.9339 -
val_loss: 0.7833 - val_accuracy: 0.7928
Epoch 19/300
50000/50000 [==============================] - 615s 12ms/step - loss: 0.1653 - accuracy: 0.9416 -
val_loss: 0.8046 - val_accuracy: 0.7937
Epoch 20/300
50000/50000 [==============================] - 609s 12ms/step - loss: 0.1559 - accuracy: 0.9450 -
val_loss: 0.8063 - val_accuracy: 0.7952
```

```
Epoch 21/300
50000/50000 [==============================] - 604s 12ms/step - loss: 0.1348 - accuracy: 0.9536 -
val_loss: 1.1073 - val_accuracy: 0.7616
Epoch 22/300
50000/50000 [==============================] - 603s 12ms/step - loss: 0.1294 - accuracy: 0.9543 -
val_loss: 0.8301 - val_accuracy: 0.7950
Epoch 23/300
50000/50000 [==============================] - 604s 12ms/step - loss: 0.1199 - accuracy: 0.9576 -
val_loss: 0.8889 - val_accuracy: 0.7889
Epoch 24/300
50000/50000 [==============================] - 609s 12ms/step - loss: 0.1130 - accuracy: 0.9606 -
val_loss: 0.9028 - val_accuracy: 0.7986
Epoch 25/300
50000/50000 [==============================] - 607s 12ms/step - loss: 0.1033 - accuracy: 0.9642 -
val_loss: 0.8670 - val_accuracy: 0.8075
Epoch 26/300
50000/50000 [==============================] - 620s 12ms/step - loss: 0.0972 - accuracy: 0.9667 -
val_loss: 1.0539 - val_accuracy: 0.7791
Epoch 27/300
50000/50000 [==============================] - 616s 12ms/step - loss: 0.0946 - accuracy: 0.9676 -
val_loss: 0.8945 - val_accuracy: 0.8071
Epoch 28/300
50000/50000 [==============================] - 613s 12ms/step - loss: 0.0868 - accuracy: 0.9697 -
val_loss: 0.9698 - val_accuracy: 0.7988
Epoch 29/300
50000/50000 [==============================] - 614s 12ms/step - loss: 0.0859 - accuracy: 0.9711 -
val_loss: 0.8893 - val_accuracy: 0.8089
Epoch 30/300
50000/50000 [==============================] - 611s 12ms/step - loss: 0.0782 - accuracy: 0.9730 -
val_loss: 0.9062 - val_accuracy: 0.8056
Epoch 00030: early stopping
```

In [40]:

```
plothist(history)
```



In [41]:

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

```
10000/10000 [==============================] - 25s 3ms/step
Test loss: 0.9062438956022263
Test accuracy: 0.8055999875068665
```

In [42]:

```
# Save the trained weights in to .h5 format
model.save("DNST_model.h5")
print("Saved model to disk")
```

```
Saved model to disk
```

Summary: training wihtout image augmentation, have got accuracy :80.13%