


```
In [1]:
# This Python 3 environment comes with many helpful analytics libraries
# It is defined by the kaggle/python docker image: https://github.com/kaggle/docker-python
# For example, here's several helpful packages to load in

import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)

# Input data files are available in the "../input/" directory.
# For example, running this (by clicking run or pressing Shift+Enter)
# import os
# print(os.listdir("../input"))

# Any results you write to the current directory are saved as output.

['humpback-whale-identification', 'whales-cropped', 'oversampling']
```

```
In [2]:
HW = 'humpback-whale-identification'
# TRAIN = '../input/humpback-whale-identification/train/'
TRAIN_CROPPED = "whales-cropped/cropped_train/cropped_train/"
TRAIN_CROPPED_IN = '../input/' + TRAIN_CROPPED

# TEST = '../input/humpback-whale-identification/test/'
TEST_CROPPED = "whales-cropped/cropped_test/cropped_test/"
TEST_CROPPED_IN = '../input/' + TEST_CROPPED

LABELS = '../input/humpback-whale-identification/train.csv'
LABELS_OVERSAMPLED = '../input/oversampling/oversampled_train_and_validation.csv'

SAMPLE_SUB = '../input/humpback-whale-identification/sample_submission.csv'

train = pd.read_csv(LABELS)
print("With new_whale:")
train.head()
```

With new_whale:

Out[2]:

	Image	Id
0	0000e88ab.jpg	w_f48451c
1	0001f9222.jpg	w_c3d896a
2	00029d126.jpg	w_20df2c5
3	00050a15a.jpg	new_whale
4	0005c1ef8.jpg	new_whale

```
In [3]:
MODEL_F = 'Model_InceptionResNetV2_flow.h5'
WEIGHTS_F = 'Weights_InceptionResNetV2_flow.h5'
MODEL = '../input/inceptionresnetv2-oversampling/' + MODEL_F
WEIGHTS = '../input/inceptionresnetv2-oversampling/' + WEIGHTS_F
```

```
In [4]:
train.describe()
```

Out[4]:

	Image	Id
count	25361	25361

unique	25361	5005
top	88baeec3e.jpg	new_whale
freq	1	9664

In [5]:

```
import random
from IPython.display import Image
print("Example whale image")

#show sample image
name = random.choice(train['Image'])
print(name)
Image(filename = TRAIN_CROPPED_IN + name)
```

Example whale image
3c999ac78.jpg

Out[5]:



In [6]:

```
whales_train = pd.read_csv(LABELS_OVERSAMPLED)
print("Without new_whale:")
whales_train.head()
```

Without new_whale:

Out[6]:

	Image	Id
0	74cd18adc.jpg	w_b3e445e
1	dbeb7e38a.jpg	w_8157927
2	49cf95c56.jpg	w_3c58b68
3	8a05a853c.jpg	w_180e241
4	471e75940.jpg	w_700ebb4

In [7]:

```
unique_labels = np.unique(whales_train.Id.values)
labels_list = unique_labels
print("Labels list:")
print(np.shape(labels_list))
print(labels_list[:20])
```

Labels list:

(5004,)

[L_32221201.jpg 3222_521.jpg 3227_541.jpg 3228111.jpg 322_3121.jpg 322

```
[ 'w_0003639' 'w_0003c59' 'w_0027efa' 'w_00289b1' 'w_002c810' 'w_003  
'w_003bae6' 'w_00656c0' 'w_0066399' 'w_007fea' 'w_00904a7' 'w_009  
'w_00a41ba' 'w_00b3dc2' 'w_00d50c9' 'w_00d5466' 'w_00d5e98' 'w_00f  
'w_010f858' 'w_0115c24' ]
```

In [8]:

```
import matplotlib.pyplot as plt
import matplotlib.image as mpimg
from matplotlib.pyplot import imshow

from sklearn.preprocessing import LabelEncoder
from sklearn.preprocessing import OneHotEncoder

from keras import layers
from keras.preprocessing import image
from keras.preprocessing.image import ImageDataGenerator

# from keras.applications.imagenet_utils import preprocess_input
from keras.applications.inception_resnet_v2 import preprocess_input
from keras.applications.inception_resnet_v2 import InceptionResNetV

from keras.losses import binary_crossentropy

from keras.layers import Input, Dense, Activation, BatchNormalization
from keras.layers import AveragePooling2D, MaxPooling2D, Dropout
from keras.models import Model
from keras.metrics import top_k_categorical_accuracy

import keras.backend as K
from keras.models import Sequential
from PIL import Image
import gc
import warnings
warnings.simplefilter("ignore", category=DeprecationWarning)

%matplotlib inline
```

Using TensorFlow backend.

In [9]:

```
import keras.backend as K
from keras.callbacks import Callback

class GcCollectors(Callback):
    def __init__(self):
        super().__init__()

    def on_epoch_end(self, ep, logs=None):
        gc.collect()

    def on_epoch_begin(self, ep, logs=None):
        gc.collect()

    def on_train_begin(self, logs=None):
        gc.collect()

    def on_train_end(self, logs=None):
        gc.collect()
```

In [10]:

```
gc_collector = GcCollectors()
```

In [11]:

```
def top_5_accuracy(y_true, y_pred):
```

```

        return top_k_categorical_accuracy(y_true, y_pred, k=5)

CLASSES = 5004
EPOCHS = 20
BATCH_SIZE = 32

IMAGE_HEIGHT = 299
IMAGE_WIDTH = 299
IMAGE_SHAPE = (IMAGE_HEIGHT, IMAGE_WIDTH, 3)
# setup model
base_model = InceptionResNetV2(weights='imagenet', include_top=False)

x = base_model.output
x = GlobalAveragePooling2D(name='avg_pool')(x)
x = Dropout(0.4)(x)
predictions = Dense(CLASSES, activation='softmax')(x)
model = Model(inputs=base_model.input, outputs=predictions)

# transfer learning
layers_len = len(model.layers)

# I've chosen to train all the layers
for layer in model.layers:
    layer.trainable = True

model.compile(optimizer='adam',
              loss='categorical_crossentropy',
              metrics=['accuracy', top_5_accuracy])

model.summary()

```

```

Downloading data from https://github.com/fchollet/deep-learning-models/tf_dim_ordering_tf_kernels_notop.h5
219062272/219055592 [=====] - 39s 0us/step

-----  

Layer (type)           Output Shape      Param #   Cc  

-----  

input_1 (InputLayer)    (None, 299, 299, 3)  0  

-----  

conv2d_1 (Conv2D)       (None, 149, 149, 32) 864      ir  

-----  

batch_normalization_1 (BatchNor (None, 149, 149, 32) 96      cc  

-----  

activation_1 (Activation) (None, 149, 149, 32) 0      bε  

-----  

conv2d_2 (Conv2D)       (None, 147, 147, 32) 9216     ac  

-----  

batch_normalization_2 (BatchNor (None, 147, 147, 32) 96      cc  

-----  

activation_2 (Activation) (None, 147, 147, 32) 0      bε  

-----  

conv2d_3 (Conv2D)       (None, 147, 147, 64) 18432     ac  

-----  

batch_normalization_3 (BatchNor (None, 147, 147, 64) 192      cc  

-----  

activation_3 (Activation) (None, 147, 147, 64) 0      bε  

-----  

max_pooling2d_1 (MaxPooling2D) (None, 73, 73, 64) 0      ac  

-----  

conv2d_4 (Conv2D)       (None, 73, 73, 80) 5120      mε  

-----  

batch_normalization_4 (BatchNor (None, 73, 73, 80) 240      cc  

-----  

activation_4 (Activation) (None, 73, 73, 80) 0      bε  

-----  

conv2d_5 (Conv2D)       (None, 71, 71, 192) 138240     ac

```

batch_normalization_5 (BatchNor	(None, 71, 71, 192)	576	cc
activation_5 (Activation)	(None, 71, 71, 192)	0	ba
max_pooling2d_2 (MaxPooling2D)	(None, 35, 35, 192)	0	ac
conv2d_9 (Conv2D)	(None, 35, 35, 64)	12288	ma
batch_normalization_9 (BatchNor	(None, 35, 35, 64)	192	cc
activation_9 (Activation)	(None, 35, 35, 64)	0	ba
conv2d_7 (Conv2D)	(None, 35, 35, 48)	9216	ma
conv2d_10 (Conv2D)	(None, 35, 35, 96)	55296	ac
batch_normalization_7 (BatchNor	(None, 35, 35, 48)	144	cc
batch_normalization_10 (BatchNo	(None, 35, 35, 96)	288	cc
activation_7 (Activation)	(None, 35, 35, 48)	0	ba
activation_10 (Activation)	(None, 35, 35, 96)	0	ba
average_pooling2d_1 (AveragePoo	(None, 35, 35, 192)	0	ma
conv2d_6 (Conv2D)	(None, 35, 35, 96)	18432	ma
conv2d_8 (Conv2D)	(None, 35, 35, 64)	76800	ac
conv2d_11 (Conv2D)	(None, 35, 35, 96)	82944	ac
conv2d_12 (Conv2D)	(None, 35, 35, 64)	12288	av
batch_normalization_6 (BatchNor	(None, 35, 35, 96)	288	cc
batch_normalization_8 (BatchNor	(None, 35, 35, 64)	192	cc
batch_normalization_11 (BatchNo	(None, 35, 35, 96)	288	cc
batch_normalization_12 (BatchNo	(None, 35, 35, 64)	192	cc
activation_6 (Activation)	(None, 35, 35, 96)	0	ba
activation_8 (Activation)	(None, 35, 35, 64)	0	ba
activation_11 (Activation)	(None, 35, 35, 96)	0	ba
activation_12 (Activation)	(None, 35, 35, 64)	0	ba
mixed_5b (Concatenate)	(None, 35, 35, 320)	0	ac
			ac
			ac
			ac
conv2d_16 (Conv2D)	(None, 35, 35, 32)	10240	mi
batch_normalization_16 (BatchNo	(None, 35, 35, 32)	96	cc
activation_16 (Activation)	(None, 35, 35, 32)	0	ba
conv2d_14 (Conv2D)	(None, 35, 35, 32)	10240	mi
conv2d_17 (Conv2D)	(None, 35, 35, 48)	13824	ac
batch_normalization_14 (BatchNo	(None, 35, 35, 32)	96	cc

batch_normalization_14 (BatchNo (None, 35, 35, 32))	96	cc
batch_normalization_17 (BatchNo (None, 35, 35, 48))	144	cc
activation_14 (Activation)	(None, 35, 35, 32)	0
activation_17 (Activation)	(None, 35, 35, 48)	0
conv2d_13 (Conv2D)	(None, 35, 35, 32)	10240
conv2d_15 (Conv2D)	(None, 35, 35, 32)	9216
conv2d_18 (Conv2D)	(None, 35, 35, 64)	27648
batch_normalization_13 (BatchNo (None, 35, 35, 32))	96	cc
batch_normalization_15 (BatchNo (None, 35, 35, 32))	96	cc
batch_normalization_18 (BatchNo (None, 35, 35, 64))	192	cc
activation_13 (Activation)	(None, 35, 35, 32)	0
activation_15 (Activation)	(None, 35, 35, 32)	0
activation_18 (Activation)	(None, 35, 35, 64)	0
block35_1_mixed (Concatenate)	(None, 35, 35, 128)	0
block35_1_conv (Conv2D)	(None, 35, 35, 320)	41280
block35_1 (Lambda)	(None, 35, 35, 320)	0
block35_1_ac (Activation)	(None, 35, 35, 320)	0
conv2d_22 (Conv2D)	(None, 35, 35, 32)	10240
batch_normalization_22 (BatchNo (None, 35, 35, 32))	96	cc
activation_22 (Activation)	(None, 35, 35, 32)	0
conv2d_20 (Conv2D)	(None, 35, 35, 32)	10240
conv2d_23 (Conv2D)	(None, 35, 35, 48)	13824
batch_normalization_20 (BatchNo (None, 35, 35, 32))	96	cc
batch_normalization_23 (BatchNo (None, 35, 35, 48))	144	cc
activation_20 (Activation)	(None, 35, 35, 32)	0
activation_23 (Activation)	(None, 35, 35, 48)	0
conv2d_19 (Conv2D)	(None, 35, 35, 32)	10240
conv2d_21 (Conv2D)	(None, 35, 35, 32)	9216
conv2d_24 (Conv2D)	(None, 35, 35, 64)	27648
batch_normalization_19 (BatchNo (None, 35, 35, 32))	96	cc
batch_normalization_21 (BatchNo (None, 35, 35, 32))	96	cc
batch_normalization_24 (BatchNo (None, 35, 35, 64))	192	cc

activation_19 (Activation)	(None, 35, 35, 32)	0	bε
activation_21 (Activation)	(None, 35, 35, 32)	0	bε
activation_24 (Activation)	(None, 35, 35, 64)	0	bε
block35_2_mixed (Concatenate)	(None, 35, 35, 128)	0	ac ac ac
block35_2_conv (Conv2D)	(None, 35, 35, 320)	41280	bl
block35_2 (Lambda)	(None, 35, 35, 320)	0	bl bl
block35_2_ac (Activation)	(None, 35, 35, 320)	0	bl
conv2d_28 (Conv2D)	(None, 35, 35, 32)	10240	bl
batch_normalization_28 (BatchNo)	(None, 35, 35, 32)	96	cc
activation_28 (Activation)	(None, 35, 35, 32)	0	bε
conv2d_26 (Conv2D)	(None, 35, 35, 32)	10240	bl
conv2d_29 (Conv2D)	(None, 35, 35, 48)	13824	ac
batch_normalization_26 (BatchNo)	(None, 35, 35, 32)	96	cc
batch_normalization_29 (BatchNo)	(None, 35, 35, 48)	144	cc
activation_26 (Activation)	(None, 35, 35, 32)	0	bε
activation_29 (Activation)	(None, 35, 35, 48)	0	bε
conv2d_25 (Conv2D)	(None, 35, 35, 32)	10240	bl
conv2d_27 (Conv2D)	(None, 35, 35, 32)	9216	ac
conv2d_30 (Conv2D)	(None, 35, 35, 64)	27648	ac
batch_normalization_25 (BatchNo)	(None, 35, 35, 32)	96	cc
batch_normalization_27 (BatchNo)	(None, 35, 35, 32)	96	cc
batch_normalization_30 (BatchNo)	(None, 35, 35, 64)	192	cc
activation_25 (Activation)	(None, 35, 35, 32)	0	bε
activation_27 (Activation)	(None, 35, 35, 32)	0	bε
activation_30 (Activation)	(None, 35, 35, 64)	0	bε
block35_3_mixed (Concatenate)	(None, 35, 35, 128)	0	ac ac ac
block35_3_conv (Conv2D)	(None, 35, 35, 320)	41280	bl
block35_3 (Lambda)	(None, 35, 35, 320)	0	bl bl
block35_3_ac (Activation)	(None, 35, 35, 320)	0	bl
conv2d_34 (Conv2D)	(None, 35, 35, 32)	10240	bl

batch_normalization_34 (BatchNorm)	(None, 35, 35, 32)	96	cc
activation_34 (Activation)	(None, 35, 35, 32)	0	be
conv2d_32 (Conv2D)	(None, 35, 35, 32)	10240	bl
conv2d_35 (Conv2D)	(None, 35, 35, 48)	13824	ac
batch_normalization_32 (BatchNorm)	(None, 35, 35, 32)	96	cc
batch_normalization_35 (BatchNorm)	(None, 35, 35, 48)	144	cc
activation_32 (Activation)	(None, 35, 35, 32)	0	be
activation_35 (Activation)	(None, 35, 35, 48)	0	be
conv2d_31 (Conv2D)	(None, 35, 35, 32)	10240	bl
conv2d_33 (Conv2D)	(None, 35, 35, 32)	9216	ac
conv2d_36 (Conv2D)	(None, 35, 35, 64)	27648	ac
batch_normalization_31 (BatchNorm)	(None, 35, 35, 32)	96	cc
batch_normalization_33 (BatchNorm)	(None, 35, 35, 32)	96	cc
batch_normalization_36 (BatchNorm)	(None, 35, 35, 64)	192	cc
activation_31 (Activation)	(None, 35, 35, 32)	0	be
activation_33 (Activation)	(None, 35, 35, 32)	0	be
activation_36 (Activation)	(None, 35, 35, 64)	0	be
block35_4_mixed (Concatenate)	(None, 35, 35, 128)	0	ac
			ac
			ac
block35_4_conv (Conv2D)	(None, 35, 35, 320)	41280	bl
block35_4 (Lambda)	(None, 35, 35, 320)	0	bl
			bl
block35_4_ac (Activation)	(None, 35, 35, 320)	0	bl
conv2d_40 (Conv2D)	(None, 35, 35, 32)	10240	bl
batch_normalization_40 (BatchNorm)	(None, 35, 35, 32)	96	cc
activation_40 (Activation)	(None, 35, 35, 32)	0	be
conv2d_38 (Conv2D)	(None, 35, 35, 32)	10240	bl
conv2d_41 (Conv2D)	(None, 35, 35, 48)	13824	ac
batch_normalization_38 (BatchNorm)	(None, 35, 35, 32)	96	cc
batch_normalization_41 (BatchNorm)	(None, 35, 35, 48)	144	cc
activation_38 (Activation)	(None, 35, 35, 32)	0	be
activation_41 (Activation)	(None, 35, 35, 48)	0	be
conv2d_37 (Conv2D)	(None, 35, 35, 32)	10240	bl
conv2d_39 (Conv2D)	(None, 35, 35, 32)	9216	ac

conv2d_42 (Conv2D)	(None, 35, 35, 64)	27648	ac
batch_normalization_37 (BatchNo	(None, 35, 35, 32)	96	cc
batch_normalization_39 (BatchNo	(None, 35, 35, 32)	96	cc
batch_normalization_42 (BatchNo	(None, 35, 35, 64)	192	cc
activation_37 (Activation)	(None, 35, 35, 32)	0	bε
activation_39 (Activation)	(None, 35, 35, 32)	0	bε
activation_42 (Activation)	(None, 35, 35, 64)	0	bε
block35_5_mixed (Concatenate)	(None, 35, 35, 128)	0	ac
			ac
			ac
block35_5_conv (Conv2D)	(None, 35, 35, 320)	41280	bl
block35_5 (Lambda)	(None, 35, 35, 320)	0	bl
			bl
block35_5_ac (Activation)	(None, 35, 35, 320)	0	bl
conv2d_46 (Conv2D)	(None, 35, 35, 32)	10240	bl
batch_normalization_46 (BatchNo	(None, 35, 35, 32)	96	cc
activation_46 (Activation)	(None, 35, 35, 32)	0	bε
conv2d_44 (Conv2D)	(None, 35, 35, 32)	10240	bl
conv2d_47 (Conv2D)	(None, 35, 35, 48)	13824	ac
batch_normalization_44 (BatchNo	(None, 35, 35, 32)	96	cc
batch_normalization_47 (BatchNo	(None, 35, 35, 48)	144	cc
activation_44 (Activation)	(None, 35, 35, 32)	0	bε
activation_47 (Activation)	(None, 35, 35, 48)	0	bε
conv2d_43 (Conv2D)	(None, 35, 35, 32)	10240	bl
conv2d_45 (Conv2D)	(None, 35, 35, 32)	9216	ac
conv2d_48 (Conv2D)	(None, 35, 35, 64)	27648	ac
batch_normalization_43 (BatchNo	(None, 35, 35, 32)	96	cc
batch_normalization_45 (BatchNo	(None, 35, 35, 32)	96	cc
batch_normalization_48 (BatchNo	(None, 35, 35, 64)	192	cc
activation_43 (Activation)	(None, 35, 35, 32)	0	bε
activation_45 (Activation)	(None, 35, 35, 32)	0	bε
activation_48 (Activation)	(None, 35, 35, 64)	0	bε
block35_6_mixed (Concatenate)	(None, 35, 35, 128)	0	ac
			ac
			ac
block35_6_conv (Conv2D)	(None, 35, 35, 320)	41280	bl

block35_6 (Lambda)	(None, 35, 35, 320)	0	bl bl
block35_6_ac (Activation)	(None, 35, 35, 320)	0	bl
conv2d_52 (Conv2D)	(None, 35, 35, 32)	10240	bl
batch_normalization_52 (BatchNo)	(None, 35, 35, 32)	96	cc
activation_52 (Activation)	(None, 35, 35, 32)	0	be
conv2d_50 (Conv2D)	(None, 35, 35, 32)	10240	bl
conv2d_53 (Conv2D)	(None, 35, 35, 48)	13824	ac
batch_normalization_50 (BatchNo)	(None, 35, 35, 32)	96	cc
batch_normalization_53 (BatchNo)	(None, 35, 35, 48)	144	cc
activation_50 (Activation)	(None, 35, 35, 32)	0	be
activation_53 (Activation)	(None, 35, 35, 48)	0	be
conv2d_49 (Conv2D)	(None, 35, 35, 32)	10240	bl
conv2d_51 (Conv2D)	(None, 35, 35, 32)	9216	ac
conv2d_54 (Conv2D)	(None, 35, 35, 64)	27648	ac
batch_normalization_49 (BatchNo)	(None, 35, 35, 32)	96	cc
batch_normalization_51 (BatchNo)	(None, 35, 35, 32)	96	cc
batch_normalization_54 (BatchNo)	(None, 35, 35, 64)	192	cc
activation_49 (Activation)	(None, 35, 35, 32)	0	be
activation_51 (Activation)	(None, 35, 35, 32)	0	be
activation_54 (Activation)	(None, 35, 35, 64)	0	be
block35_7_mixed (Concatenate)	(None, 35, 35, 128)	0	ac ac ac
block35_7_conv (Conv2D)	(None, 35, 35, 320)	41280	bl
block35_7 (Lambda)	(None, 35, 35, 320)	0	bl bl
block35_7_ac (Activation)	(None, 35, 35, 320)	0	bl
conv2d_58 (Conv2D)	(None, 35, 35, 32)	10240	bl
batch_normalization_58 (BatchNo)	(None, 35, 35, 32)	96	cc
activation_58 (Activation)	(None, 35, 35, 32)	0	be
conv2d_56 (Conv2D)	(None, 35, 35, 32)	10240	bl
conv2d_59 (Conv2D)	(None, 35, 35, 48)	13824	ac
batch_normalization_56 (BatchNo)	(None, 35, 35, 32)	96	cc
batch_normalization_59 (BatchNo)	(None, 35, 35, 48)	144	cc

activation_56 (Activation)	(None, 35, 35, 32)	0	ba
activation_59 (Activation)	(None, 35, 35, 48)	0	ba
conv2d_55 (Conv2D)	(None, 35, 35, 32)	10240	bl
conv2d_57 (Conv2D)	(None, 35, 35, 32)	9216	ac
conv2d_60 (Conv2D)	(None, 35, 35, 64)	27648	ac
batch_normalization_55 (BatchNo	(None, 35, 35, 32)	96	cc
batch_normalization_57 (BatchNo	(None, 35, 35, 32)	96	cc
batch_normalization_60 (BatchNo	(None, 35, 35, 64)	192	cc
activation_55 (Activation)	(None, 35, 35, 32)	0	ba
activation_57 (Activation)	(None, 35, 35, 32)	0	ba
activation_60 (Activation)	(None, 35, 35, 64)	0	ba
block35_8_mixed (Concatenate)	(None, 35, 35, 128)	0	ac
			ac
			ac
block35_8_conv (Conv2D)	(None, 35, 35, 320)	41280	bl
block35_8 (Lambda)	(None, 35, 35, 320)	0	bl
			bl
block35_8_ac (Activation)	(None, 35, 35, 320)	0	bl
conv2d_64 (Conv2D)	(None, 35, 35, 32)	10240	bl
batch_normalization_64 (BatchNo	(None, 35, 35, 32)	96	cc
activation_64 (Activation)	(None, 35, 35, 32)	0	ba
conv2d_62 (Conv2D)	(None, 35, 35, 32)	10240	bl
conv2d_65 (Conv2D)	(None, 35, 35, 48)	13824	ac
batch_normalization_62 (BatchNo	(None, 35, 35, 32)	96	cc
batch_normalization_65 (BatchNo	(None, 35, 35, 48)	144	cc
activation_62 (Activation)	(None, 35, 35, 32)	0	ba
activation_65 (Activation)	(None, 35, 35, 48)	0	ba
conv2d_61 (Conv2D)	(None, 35, 35, 32)	10240	bl
conv2d_63 (Conv2D)	(None, 35, 35, 32)	9216	ac
conv2d_66 (Conv2D)	(None, 35, 35, 64)	27648	ac
batch_normalization_61 (BatchNo	(None, 35, 35, 32)	96	cc
batch_normalization_63 (BatchNo	(None, 35, 35, 32)	96	cc
batch_normalization_66 (BatchNo	(None, 35, 35, 64)	192	cc
activation_61 (Activation)	(None, 35, 35, 32)	0	ba
activation_63 (Activation)	(None, 35, 35, 32)	0	ba

activation_66 (Activation)	(None, 35, 35, 64)	0	be
block35_9_mixed (Concatenate)	(None, 35, 35, 128)	0	ac
		ac	
		ac	
block35_9_conv (Conv2D)	(None, 35, 35, 320)	41280	bl
block35_9 (Lambda)	(None, 35, 35, 320)	0	bl
		bl	
block35_9_ac (Activation)	(None, 35, 35, 320)	0	bl
conv2d_70 (Conv2D)	(None, 35, 35, 32)	10240	bl
batch_normalization_70 (BatchNo	(None, 35, 35, 32)	96	cc
activation_70 (Activation)	(None, 35, 35, 32)	0	be
conv2d_68 (Conv2D)	(None, 35, 35, 32)	10240	bl
conv2d_71 (Conv2D)	(None, 35, 35, 48)	13824	ac
batch_normalization_68 (BatchNo	(None, 35, 35, 32)	96	cc
batch_normalization_71 (BatchNo	(None, 35, 35, 48)	144	cc
activation_68 (Activation)	(None, 35, 35, 32)	0	be
activation_71 (Activation)	(None, 35, 35, 48)	0	be
conv2d_67 (Conv2D)	(None, 35, 35, 32)	10240	bl
conv2d_69 (Conv2D)	(None, 35, 35, 32)	9216	ac
conv2d_72 (Conv2D)	(None, 35, 35, 64)	27648	ac
batch_normalization_67 (BatchNo	(None, 35, 35, 32)	96	cc
batch_normalization_69 (BatchNo	(None, 35, 35, 32)	96	cc
batch_normalization_72 (BatchNo	(None, 35, 35, 64)	192	cc
activation_67 (Activation)	(None, 35, 35, 32)	0	be
activation_69 (Activation)	(None, 35, 35, 32)	0	be
activation_72 (Activation)	(None, 35, 35, 64)	0	be
block35_10_mixed (Concatenate)	(None, 35, 35, 128)	0	ac
		ac	
		ac	
block35_10_conv (Conv2D)	(None, 35, 35, 320)	41280	bl
block35_10 (Lambda)	(None, 35, 35, 320)	0	bl
		bl	
block35_10_ac (Activation)	(None, 35, 35, 320)	0	bl
conv2d_74 (Conv2D)	(None, 35, 35, 256)	81920	bl
batch_normalization_74 (BatchNo	(None, 35, 35, 256)	768	cc
activation_74 (Activation)	(None, 35, 35, 256)	0	be

conv2d_75 (Conv2D)	(None, 35, 35, 256)	589824	ac
batch_normalization_75 (BatchNo	(None, 35, 35, 256)	768	cc
activation_75 (Activation)	(None, 35, 35, 256)	0	be
conv2d_73 (Conv2D)	(None, 17, 17, 384)	1105920	bl
conv2d_76 (Conv2D)	(None, 17, 17, 384)	884736	ac
batch_normalization_73 (BatchNo	(None, 17, 17, 384)	1152	cc
batch_normalization_76 (BatchNo	(None, 17, 17, 384)	1152	cc
activation_73 (Activation)	(None, 17, 17, 384)	0	be
activation_76 (Activation)	(None, 17, 17, 384)	0	be
max_pooling2d_3 (MaxPooling2D)	(None, 17, 17, 320)	0	bl
mixed_6a (Concatenate)	(None, 17, 17, 1088)	0	ac
			ac
			ma
conv2d_78 (Conv2D)	(None, 17, 17, 128)	139264	mi
batch_normalization_78 (BatchNo	(None, 17, 17, 128)	384	cc
activation_78 (Activation)	(None, 17, 17, 128)	0	be
conv2d_79 (Conv2D)	(None, 17, 17, 160)	143360	ac
batch_normalization_79 (BatchNo	(None, 17, 17, 160)	480	cc
activation_79 (Activation)	(None, 17, 17, 160)	0	be
conv2d_77 (Conv2D)	(None, 17, 17, 192)	208896	mi
conv2d_80 (Conv2D)	(None, 17, 17, 192)	215040	ac
batch_normalization_77 (BatchNo	(None, 17, 17, 192)	576	cc
batch_normalization_80 (BatchNo	(None, 17, 17, 192)	576	cc
activation_77 (Activation)	(None, 17, 17, 192)	0	be
activation_80 (Activation)	(None, 17, 17, 192)	0	be
block17_1_mixed (Concatenate)	(None, 17, 17, 384)	0	ac
			ac
block17_1_conv (Conv2D)	(None, 17, 17, 1088)	418880	bl
block17_1 (Lambda)	(None, 17, 17, 1088)	0	mi
			bl
block17_1_ac (Activation)	(None, 17, 17, 1088)	0	bl
conv2d_82 (Conv2D)	(None, 17, 17, 128)	139264	bl
batch_normalization_82 (BatchNo	(None, 17, 17, 128)	384	cc
activation_82 (Activation)	(None, 17, 17, 128)	0	be
conv2d_83 (Conv2D)	(None, 17, 17, 160)	143360	ac

batch_normalization_83 (BatchNo (None, 17, 17, 160) 480	cc
activation_83 (Activation) (None, 17, 17, 160) 0	ba
conv2d_81 (Conv2D) (None, 17, 17, 192) 208896	bl
conv2d_84 (Conv2D) (None, 17, 17, 192) 215040	ac
batch_normalization_81 (BatchNo (None, 17, 17, 192) 576	cc
batch_normalization_84 (BatchNo (None, 17, 17, 192) 576	cc
activation_81 (Activation) (None, 17, 17, 192) 0	ba
activation_84 (Activation) (None, 17, 17, 192) 0	ba
block17_2_mixed (Concatenate) (None, 17, 17, 384) 0	ac
block17_2_mixed (Concatenate) (None, 17, 17, 384) 0	ac
block17_2_conv (Conv2D) (None, 17, 17, 1088) 418880	bl
block17_2 (Lambda) (None, 17, 17, 1088) 0	bl
block17_2 (Lambda) (None, 17, 17, 1088) 0	bl
block17_2_ac (Activation) (None, 17, 17, 1088) 0	bl
conv2d_86 (Conv2D) (None, 17, 17, 128) 139264	bl
batch_normalization_86 (BatchNo (None, 17, 17, 128) 384	cc
activation_86 (Activation) (None, 17, 17, 128) 0	ba
conv2d_87 (Conv2D) (None, 17, 17, 160) 143360	ac
batch_normalization_87 (BatchNo (None, 17, 17, 160) 480	cc
activation_87 (Activation) (None, 17, 17, 160) 0	ba
conv2d_85 (Conv2D) (None, 17, 17, 192) 208896	bl
conv2d_88 (Conv2D) (None, 17, 17, 192) 215040	ac
batch_normalization_85 (BatchNo (None, 17, 17, 192) 576	cc
batch_normalization_88 (BatchNo (None, 17, 17, 192) 576	cc
activation_85 (Activation) (None, 17, 17, 192) 0	ba
activation_88 (Activation) (None, 17, 17, 192) 0	ba
block17_3_mixed (Concatenate) (None, 17, 17, 384) 0	ac
block17_3_mixed (Concatenate) (None, 17, 17, 384) 0	ac
block17_3_conv (Conv2D) (None, 17, 17, 1088) 418880	bl
block17_3 (Lambda) (None, 17, 17, 1088) 0	bl
block17_3 (Lambda) (None, 17, 17, 1088) 0	bl
block17_3_ac (Activation) (None, 17, 17, 1088) 0	bl
conv2d_90 (Conv2D) (None, 17, 17, 128) 139264	bl
batch_normalization_90 (BatchNo (None, 17, 17, 128) 384	cc
activation_90 (Activation) (None, 17, 17, 128) 0	ba

conv2d_91 (Conv2D)	(None, 17, 17, 160)	143360	ac
batch_normalization_91 (BatchNo	(None, 17, 17, 160)	480	cc
activation_91 (Activation)	(None, 17, 17, 160)	0	be
conv2d_89 (Conv2D)	(None, 17, 17, 192)	208896	bl
conv2d_92 (Conv2D)	(None, 17, 17, 192)	215040	ac
batch_normalization_89 (BatchNo	(None, 17, 17, 192)	576	cc
batch_normalization_92 (BatchNo	(None, 17, 17, 192)	576	cc
activation_89 (Activation)	(None, 17, 17, 192)	0	be
activation_92 (Activation)	(None, 17, 17, 192)	0	be
block17_4_mixed (Concatenate)	(None, 17, 17, 384)	0	ac ac
block17_4_conv (Conv2D)	(None, 17, 17, 1088)	418880	bl
block17_4 (Lambda)	(None, 17, 17, 1088)	0	bl bl
block17_4_ac (Activation)	(None, 17, 17, 1088)	0	bl
conv2d_94 (Conv2D)	(None, 17, 17, 128)	139264	bl
batch_normalization_94 (BatchNo	(None, 17, 17, 128)	384	cc
activation_94 (Activation)	(None, 17, 17, 128)	0	be
conv2d_95 (Conv2D)	(None, 17, 17, 160)	143360	ac
batch_normalization_95 (BatchNo	(None, 17, 17, 160)	480	cc
activation_95 (Activation)	(None, 17, 17, 160)	0	be
conv2d_93 (Conv2D)	(None, 17, 17, 192)	208896	bl
conv2d_96 (Conv2D)	(None, 17, 17, 192)	215040	ac
batch_normalization_93 (BatchNo	(None, 17, 17, 192)	576	cc
batch_normalization_96 (BatchNo	(None, 17, 17, 192)	576	cc
activation_93 (Activation)	(None, 17, 17, 192)	0	be
activation_96 (Activation)	(None, 17, 17, 192)	0	be
block17_5_mixed (Concatenate)	(None, 17, 17, 384)	0	ac ac
block17_5_conv (Conv2D)	(None, 17, 17, 1088)	418880	bl
block17_5 (Lambda)	(None, 17, 17, 1088)	0	bl bl
block17_5_ac (Activation)	(None, 17, 17, 1088)	0	bl
conv2d_98 (Conv2D)	(None, 17, 17, 128)	139264	bl
batch_normalization_98 (BatchNo	(None, 17, 17, 128)	384	cc
activation_98 (Activation)	(None, 17, 17, 128)	0	bl

activation_98 (Activation)	(None, 17, 17, 128)	0	be
conv2d_99 (Conv2D)	(None, 17, 17, 160)	143360	ac
batch_normalization_99 (BatchNo)	(None, 17, 17, 160)	480	cc
activation_99 (Activation)	(None, 17, 17, 160)	0	be
conv2d_97 (Conv2D)	(None, 17, 17, 192)	208896	bl
conv2d_100 (Conv2D)	(None, 17, 17, 192)	215040	ac
batch_normalization_97 (BatchNo)	(None, 17, 17, 192)	576	cc
batch_normalization_100 (BatchN)	(None, 17, 17, 192)	576	cc
activation_97 (Activation)	(None, 17, 17, 192)	0	be
activation_100 (Activation)	(None, 17, 17, 192)	0	be
block17_6_mixed (Concatenate)	(None, 17, 17, 384)	0	ac
			ac
block17_6_conv (Conv2D)	(None, 17, 17, 1088)	418880	bl
block17_6 (Lambda)	(None, 17, 17, 1088)	0	bl
			bl
block17_6_ac (Activation)	(None, 17, 17, 1088)	0	bl
conv2d_102 (Conv2D)	(None, 17, 17, 128)	139264	bl
batch_normalization_102 (BatchN)	(None, 17, 17, 128)	384	cc
activation_102 (Activation)	(None, 17, 17, 128)	0	be
conv2d_103 (Conv2D)	(None, 17, 17, 160)	143360	ac
batch_normalization_103 (BatchN)	(None, 17, 17, 160)	480	cc
activation_103 (Activation)	(None, 17, 17, 160)	0	be
conv2d_101 (Conv2D)	(None, 17, 17, 192)	208896	bl
conv2d_104 (Conv2D)	(None, 17, 17, 192)	215040	ac
batch_normalization_101 (BatchN)	(None, 17, 17, 192)	576	cc
batch_normalization_104 (BatchN)	(None, 17, 17, 192)	576	cc
activation_101 (Activation)	(None, 17, 17, 192)	0	be
activation_104 (Activation)	(None, 17, 17, 192)	0	be
block17_7_mixed (Concatenate)	(None, 17, 17, 384)	0	ac
			ac
block17_7_conv (Conv2D)	(None, 17, 17, 1088)	418880	bl
block17_7 (Lambda)	(None, 17, 17, 1088)	0	bl
			bl
block17_7_ac (Activation)	(None, 17, 17, 1088)	0	bl
conv2d_106 (Conv2D)	(None, 17, 17, 128)	139264	bl
batch_normalization_106 (BatchN)	(None, 17, 17, 128)	384	cc

activation_106 (Activation)	(None, 17, 17, 128)	0	bε
conv2d_107 (Conv2D)	(None, 17, 17, 160)	143360	ac
batch_normalization_107 (BatchN)	(None, 17, 17, 160)	480	cc
activation_107 (Activation)	(None, 17, 17, 160)	0	bε
conv2d_105 (Conv2D)	(None, 17, 17, 192)	208896	bl
conv2d_108 (Conv2D)	(None, 17, 17, 192)	215040	ac
batch_normalization_105 (BatchN)	(None, 17, 17, 192)	576	cc
batch_normalization_108 (BatchN)	(None, 17, 17, 192)	576	cc
activation_105 (Activation)	(None, 17, 17, 192)	0	bε
activation_108 (Activation)	(None, 17, 17, 192)	0	bε
block17_8_mixed (Concatenate)	(None, 17, 17, 384)	0	ac ac
block17_8_conv (Conv2D)	(None, 17, 17, 1088)	418880	bl
block17_8 (Lambda)	(None, 17, 17, 1088)	0	bl bl
block17_8_ac (Activation)	(None, 17, 17, 1088)	0	bl
conv2d_110 (Conv2D)	(None, 17, 17, 128)	139264	bl
batch_normalization_110 (BatchN)	(None, 17, 17, 128)	384	cc
activation_110 (Activation)	(None, 17, 17, 128)	0	bε
conv2d_111 (Conv2D)	(None, 17, 17, 160)	143360	ac
batch_normalization_111 (BatchN)	(None, 17, 17, 160)	480	cc
activation_111 (Activation)	(None, 17, 17, 160)	0	bε
conv2d_109 (Conv2D)	(None, 17, 17, 192)	208896	bl
conv2d_112 (Conv2D)	(None, 17, 17, 192)	215040	ac
batch_normalization_109 (BatchN)	(None, 17, 17, 192)	576	cc
batch_normalization_112 (BatchN)	(None, 17, 17, 192)	576	cc
activation_109 (Activation)	(None, 17, 17, 192)	0	bε
activation_112 (Activation)	(None, 17, 17, 192)	0	bε
block17_9_mixed (Concatenate)	(None, 17, 17, 384)	0	ac ac
block17_9_conv (Conv2D)	(None, 17, 17, 1088)	418880	bl
block17_9 (Lambda)	(None, 17, 17, 1088)	0	bl bl
block17_9_ac (Activation)	(None, 17, 17, 1088)	0	bl
conv2d_114 (Conv2D)	(None, 17, 17, 128)	139264	bl

batch_normalization_114 (BatchN (None, 17, 17, 128) 384	cc
activation_114 (Activation) (None, 17, 17, 128) 0	be
conv2d_115 (Conv2D) (None, 17, 17, 160) 143360	ac
batch_normalization_115 (BatchN (None, 17, 17, 160) 480	cc
activation_115 (Activation) (None, 17, 17, 160) 0	be
conv2d_113 (Conv2D) (None, 17, 17, 192) 208896	bl
conv2d_116 (Conv2D) (None, 17, 17, 192) 215040	ac
batch_normalization_113 (BatchN (None, 17, 17, 192) 576	cc
batch_normalization_116 (BatchN (None, 17, 17, 192) 576	cc
activation_113 (Activation) (None, 17, 17, 192) 0	be
activation_116 (Activation) (None, 17, 17, 192) 0	be
block17_10_mixed (Concatenate) (None, 17, 17, 384) 0	ac
	ac
block17_10_conv (Conv2D) (None, 17, 17, 1088) 418880	bl
block17_10 (Lambda) (None, 17, 17, 1088) 0	bl
	bl
block17_10_ac (Activation) (None, 17, 17, 1088) 0	bl
conv2d_118 (Conv2D) (None, 17, 17, 128) 139264	bl
batch_normalization_118 (BatchN (None, 17, 17, 128) 384	cc
activation_118 (Activation) (None, 17, 17, 128) 0	be
conv2d_119 (Conv2D) (None, 17, 17, 160) 143360	ac
batch_normalization_119 (BatchN (None, 17, 17, 160) 480	cc
activation_119 (Activation) (None, 17, 17, 160) 0	be
conv2d_117 (Conv2D) (None, 17, 17, 192) 208896	bl
conv2d_120 (Conv2D) (None, 17, 17, 192) 215040	ac
batch_normalization_117 (BatchN (None, 17, 17, 192) 576	cc
batch_normalization_120 (BatchN (None, 17, 17, 192) 576	cc
activation_117 (Activation) (None, 17, 17, 192) 0	be
activation_120 (Activation) (None, 17, 17, 192) 0	be
block17_11_mixed (Concatenate) (None, 17, 17, 384) 0	ac
	ac
block17_11_conv (Conv2D) (None, 17, 17, 1088) 418880	bl
block17_11 (Lambda) (None, 17, 17, 1088) 0	bl
	bl
block17_11_ac (Activation) (None, 17, 17, 1088) 0	bl

conv2d_122 (Conv2D)	(None, 17, 17, 128)	139264	bl
batch_normalization_122 (BatchN)	(None, 17, 17, 128)	384	cc
activation_122 (Activation)	(None, 17, 17, 128)	0	be
conv2d_123 (Conv2D)	(None, 17, 17, 160)	143360	ac
batch_normalization_123 (BatchN)	(None, 17, 17, 160)	480	cc
activation_123 (Activation)	(None, 17, 17, 160)	0	be
conv2d_121 (Conv2D)	(None, 17, 17, 192)	208896	bl
conv2d_124 (Conv2D)	(None, 17, 17, 192)	215040	ac
batch_normalization_121 (BatchN)	(None, 17, 17, 192)	576	cc
batch_normalization_124 (BatchN)	(None, 17, 17, 192)	576	cc
activation_121 (Activation)	(None, 17, 17, 192)	0	be
activation_124 (Activation)	(None, 17, 17, 192)	0	be
block17_12_mixed (Concatenate)	(None, 17, 17, 384)	0	ac
			ac
block17_12_conv (Conv2D)	(None, 17, 17, 1088)	418880	bl
block17_12 (Lambda)	(None, 17, 17, 1088)	0	bl
			bl
block17_12_ac (Activation)	(None, 17, 17, 1088)	0	bl
conv2d_126 (Conv2D)	(None, 17, 17, 128)	139264	bl
batch_normalization_126 (BatchN)	(None, 17, 17, 128)	384	cc
activation_126 (Activation)	(None, 17, 17, 128)	0	be
conv2d_127 (Conv2D)	(None, 17, 17, 160)	143360	ac
batch_normalization_127 (BatchN)	(None, 17, 17, 160)	480	cc
activation_127 (Activation)	(None, 17, 17, 160)	0	be
conv2d_125 (Conv2D)	(None, 17, 17, 192)	208896	bl
conv2d_128 (Conv2D)	(None, 17, 17, 192)	215040	ac
batch_normalization_125 (BatchN)	(None, 17, 17, 192)	576	cc
batch_normalization_128 (BatchN)	(None, 17, 17, 192)	576	cc
activation_125 (Activation)	(None, 17, 17, 192)	0	be
activation_128 (Activation)	(None, 17, 17, 192)	0	be
block17_13_mixed (Concatenate)	(None, 17, 17, 384)	0	ac
			ac
block17_13_conv (Conv2D)	(None, 17, 17, 1088)	418880	bl
block17_13 (Lambda)	(None, 17, 17, 1088)	0	bl
			bl

block17_13_ac (Activation)	(None, 17, 17, 1088) 0	b1
conv2d_130 (Conv2D)	(None, 17, 17, 128) 139264	bl
batch_normalization_130 (BatchN	(None, 17, 17, 128) 384	cc
activation_130 (Activation)	(None, 17, 17, 128) 0	be
conv2d_131 (Conv2D)	(None, 17, 17, 160) 143360	ac
batch_normalization_131 (BatchN	(None, 17, 17, 160) 480	cc
activation_131 (Activation)	(None, 17, 17, 160) 0	be
conv2d_129 (Conv2D)	(None, 17, 17, 192) 208896	bl
conv2d_132 (Conv2D)	(None, 17, 17, 192) 215040	ac
batch_normalization_129 (BatchN	(None, 17, 17, 192) 576	cc
batch_normalization_132 (BatchN	(None, 17, 17, 192) 576	cc
activation_129 (Activation)	(None, 17, 17, 192) 0	be
activation_132 (Activation)	(None, 17, 17, 192) 0	be
block17_14_mixed (Concatenate)	(None, 17, 17, 384) 0	ac
		ac
block17_14_conv (Conv2D)	(None, 17, 17, 1088) 418880	bl
block17_14 (Lambda)	(None, 17, 17, 1088) 0	bl
		bl
block17_14_ac (Activation)	(None, 17, 17, 1088) 0	bl
conv2d_134 (Conv2D)	(None, 17, 17, 128) 139264	bl
batch_normalization_134 (BatchN	(None, 17, 17, 128) 384	cc
activation_134 (Activation)	(None, 17, 17, 128) 0	be
conv2d_135 (Conv2D)	(None, 17, 17, 160) 143360	ac
batch_normalization_135 (BatchN	(None, 17, 17, 160) 480	cc
activation_135 (Activation)	(None, 17, 17, 160) 0	be
conv2d_133 (Conv2D)	(None, 17, 17, 192) 208896	bl
conv2d_136 (Conv2D)	(None, 17, 17, 192) 215040	ac
batch_normalization_133 (BatchN	(None, 17, 17, 192) 576	cc
batch_normalization_136 (BatchN	(None, 17, 17, 192) 576	cc
activation_133 (Activation)	(None, 17, 17, 192) 0	be
activation_136 (Activation)	(None, 17, 17, 192) 0	be
block17_15_mixed (Concatenate)	(None, 17, 17, 384) 0	ac
		ac
block17_15_conv (Conv2D)	(None, 17, 17, 1088) 418880	bl
block17_15 (Lambda)	(None, 17, 17, 1088) 0	bl

			b1
block17_15_ac (Activation)	(None, 17, 17, 1088) 0		bl
conv2d_138 (Conv2D)	(None, 17, 17, 128) 139264		bl
batch_normalization_138 (BatchN (None, 17, 17, 128))	384		cc
activation_138 (Activation)	(None, 17, 17, 128) 0		ba
conv2d_139 (Conv2D)	(None, 17, 17, 160) 143360		ac
batch_normalization_139 (BatchN (None, 17, 17, 160))	480		cc
activation_139 (Activation)	(None, 17, 17, 160) 0		ba
conv2d_137 (Conv2D)	(None, 17, 17, 192) 208896		bl
conv2d_140 (Conv2D)	(None, 17, 17, 192) 215040		ac
batch_normalization_137 (BatchN (None, 17, 17, 192))	576		cc
batch_normalization_140 (BatchN (None, 17, 17, 192))	576		cc
activation_137 (Activation)	(None, 17, 17, 192) 0		ba
activation_140 (Activation)	(None, 17, 17, 192) 0		ba
block17_16_mixed (Concatenate)	(None, 17, 17, 384) 0		ac
			ac
block17_16_conv (Conv2D)	(None, 17, 17, 1088) 418880		bl
block17_16 (Lambda)	(None, 17, 17, 1088) 0		bl
			bl
block17_16_ac (Activation)	(None, 17, 17, 1088) 0		bl
conv2d_142 (Conv2D)	(None, 17, 17, 128) 139264		bl
batch_normalization_142 (BatchN (None, 17, 17, 128))	384		cc
activation_142 (Activation)	(None, 17, 17, 128) 0		ba
conv2d_143 (Conv2D)	(None, 17, 17, 160) 143360		ac
batch_normalization_143 (BatchN (None, 17, 17, 160))	480		cc
activation_143 (Activation)	(None, 17, 17, 160) 0		ba
conv2d_141 (Conv2D)	(None, 17, 17, 192) 208896		bl
conv2d_144 (Conv2D)	(None, 17, 17, 192) 215040		ac
batch_normalization_141 (BatchN (None, 17, 17, 192))	576		cc
batch_normalization_144 (BatchN (None, 17, 17, 192))	576		cc
activation_141 (Activation)	(None, 17, 17, 192) 0		ba
activation_144 (Activation)	(None, 17, 17, 192) 0		ba
block17_17_mixed (Concatenate)	(None, 17, 17, 384) 0		ac
			ac
block17_17_conv (Conv2D)	(None, 17, 17, 1088) 418880		bl

block17_17 (Lambda)	(None, 17, 17, 1088) 0	b1
block17_17_ac (Activation)	(None, 17, 17, 1088) 0	b1
conv2d_146 (Conv2D)	(None, 17, 17, 128) 139264	b1
batch_normalization_146 (BatchN (None, 17, 17, 128))	384	cc
activation_146 (Activation)	(None, 17, 17, 128) 0	bε
conv2d_147 (Conv2D)	(None, 17, 17, 160) 143360	ac
batch_normalization_147 (BatchN (None, 17, 17, 160))	480	cc
activation_147 (Activation)	(None, 17, 17, 160) 0	bε
conv2d_145 (Conv2D)	(None, 17, 17, 192) 208896	b1
conv2d_148 (Conv2D)	(None, 17, 17, 192) 215040	ac
batch_normalization_145 (BatchN (None, 17, 17, 192))	576	cc
batch_normalization_148 (BatchN (None, 17, 17, 192))	576	cc
activation_145 (Activation)	(None, 17, 17, 192) 0	bε
activation_148 (Activation)	(None, 17, 17, 192) 0	bε
block17_18_mixed (Concatenate)	(None, 17, 17, 384) 0	ac
block17_18_mixed		ac
block17_18_conv (Conv2D)	(None, 17, 17, 1088) 418880	b1
block17_18 (Lambda)	(None, 17, 17, 1088) 0	b1
block17_18		b1
block17_18_ac (Activation)	(None, 17, 17, 1088) 0	b1
conv2d_150 (Conv2D)	(None, 17, 17, 128) 139264	b1
batch_normalization_150 (BatchN (None, 17, 17, 128))	384	cc
activation_150 (Activation)	(None, 17, 17, 128) 0	bε
conv2d_151 (Conv2D)	(None, 17, 17, 160) 143360	ac
batch_normalization_151 (BatchN (None, 17, 17, 160))	480	cc
activation_151 (Activation)	(None, 17, 17, 160) 0	bε
conv2d_149 (Conv2D)	(None, 17, 17, 192) 208896	b1
conv2d_152 (Conv2D)	(None, 17, 17, 192) 215040	ac
batch_normalization_149 (BatchN (None, 17, 17, 192))	576	cc
batch_normalization_152 (BatchN (None, 17, 17, 192))	576	cc
activation_149 (Activation)	(None, 17, 17, 192) 0	bε
activation_152 (Activation)	(None, 17, 17, 192) 0	bε
block17_19_mixed (Concatenate)	(None, 17, 17, 384) 0	ac
block17_19		ac

block17_19_conv (Conv2D)	(None, 17, 17, 1088)	418880	bl
block17_19 (Lambda)	(None, 17, 17, 1088)	0	bl bl
block17_19_ac (Activation)	(None, 17, 17, 1088)	0	bl
conv2d_154 (Conv2D)	(None, 17, 17, 128)	139264	bl
batch_normalization_154 (BatchN	(None, 17, 17, 128)	384	cc
activation_154 (Activation)	(None, 17, 17, 128)	0	be
conv2d_155 (Conv2D)	(None, 17, 17, 160)	143360	ac
batch_normalization_155 (BatchN	(None, 17, 17, 160)	480	cc
activation_155 (Activation)	(None, 17, 17, 160)	0	be
conv2d_153 (Conv2D)	(None, 17, 17, 192)	208896	bl
conv2d_156 (Conv2D)	(None, 17, 17, 192)	215040	ac
batch_normalization_153 (BatchN	(None, 17, 17, 192)	576	cc
batch_normalization_156 (BatchN	(None, 17, 17, 192)	576	cc
activation_153 (Activation)	(None, 17, 17, 192)	0	be
activation_156 (Activation)	(None, 17, 17, 192)	0	be
block17_20_mixed (Concatenate)	(None, 17, 17, 384)	0	ac ac
block17_20_conv (Conv2D)	(None, 17, 17, 1088)	418880	bl
block17_20 (Lambda)	(None, 17, 17, 1088)	0	bl bl
block17_20_ac (Activation)	(None, 17, 17, 1088)	0	bl
conv2d_161 (Conv2D)	(None, 17, 17, 256)	278528	bl
batch_normalization_161 (BatchN	(None, 17, 17, 256)	768	cc
activation_161 (Activation)	(None, 17, 17, 256)	0	be
conv2d_157 (Conv2D)	(None, 17, 17, 256)	278528	bl
conv2d_159 (Conv2D)	(None, 17, 17, 256)	278528	bl
conv2d_162 (Conv2D)	(None, 17, 17, 288)	663552	ac
batch_normalization_157 (BatchN	(None, 17, 17, 256)	768	cc
batch_normalization_159 (BatchN	(None, 17, 17, 256)	768	cc
batch_normalization_162 (BatchN	(None, 17, 17, 288)	864	cc
activation_157 (Activation)	(None, 17, 17, 256)	0	be
activation_159 (Activation)	(None, 17, 17, 256)	0	be
activation_162 (Activation)	(None, 17, 17, 288)	0	be
conv2d_158 (Conv2D)	(None, 8, 8, 384)	884736	ac

conv2d_160 (Conv2D)	(None, 8, 8, 288)	663552	ac
conv2d_163 (Conv2D)	(None, 8, 8, 320)	829440	ac
batch_normalization_158 (BatchN	(None, 8, 8, 384)	1152	cc
batch_normalization_160 (BatchN	(None, 8, 8, 288)	864	cc
batch_normalization_163 (BatchN	(None, 8, 8, 320)	960	cc
activation_158 (Activation)	(None, 8, 8, 384)	0	be
activation_160 (Activation)	(None, 8, 8, 288)	0	be
activation_163 (Activation)	(None, 8, 8, 320)	0	be
max_pooling2d_4 (MaxPooling2D)	(None, 8, 8, 1088)	0	bl
mixed_7a (Concatenate)	(None, 8, 8, 2080)	0	ac ac ac me
conv2d_165 (Conv2D)	(None, 8, 8, 192)	399360	mi
batch_normalization_165 (BatchN	(None, 8, 8, 192)	576	cc
activation_165 (Activation)	(None, 8, 8, 192)	0	be
conv2d_166 (Conv2D)	(None, 8, 8, 224)	129024	ac
batch_normalization_166 (BatchN	(None, 8, 8, 224)	672	cc
activation_166 (Activation)	(None, 8, 8, 224)	0	be
conv2d_164 (Conv2D)	(None, 8, 8, 192)	399360	mi
conv2d_167 (Conv2D)	(None, 8, 8, 256)	172032	ac
batch_normalization_164 (BatchN	(None, 8, 8, 192)	576	cc
batch_normalization_167 (BatchN	(None, 8, 8, 256)	768	cc
activation_164 (Activation)	(None, 8, 8, 192)	0	be
activation_167 (Activation)	(None, 8, 8, 256)	0	be
block8_1_mixed (Concatenate)	(None, 8, 8, 448)	0	ac ac
block8_1_conv (Conv2D)	(None, 8, 8, 2080)	933920	bl
block8_1 (Lambda)	(None, 8, 8, 2080)	0	mi bl
block8_1_ac (Activation)	(None, 8, 8, 2080)	0	bl
conv2d_169 (Conv2D)	(None, 8, 8, 192)	399360	bl
batch_normalization_169 (BatchN	(None, 8, 8, 192)	576	cc
activation_169 (Activation)	(None, 8, 8, 192)	0	be
conv2d_170 (Conv2D)	(None, 8, 8, 224)	129024	ac
batch_normalization_170 (BatchN	(None, 8, 8, 224)	672	cc

activation_170 (Activation)	(None, 8, 8, 224)	0	ba
conv2d_168 (Conv2D)	(None, 8, 8, 192)	399360	bl
conv2d_171 (Conv2D)	(None, 8, 8, 256)	172032	ac
batch_normalization_168 (BatchN	(None, 8, 8, 192)	576	cc
batch_normalization_171 (BatchN	(None, 8, 8, 256)	768	cc
activation_168 (Activation)	(None, 8, 8, 192)	0	ba
activation_171 (Activation)	(None, 8, 8, 256)	0	ba
block8_2_mixed (Concatenate)	(None, 8, 8, 448)	0	ac ac
block8_2_conv (Conv2D)	(None, 8, 8, 2080)	933920	bl
block8_2 (Lambda)	(None, 8, 8, 2080)	0	bl bl
block8_2_ac (Activation)	(None, 8, 8, 2080)	0	bl
conv2d_173 (Conv2D)	(None, 8, 8, 192)	399360	bl
batch_normalization_173 (BatchN	(None, 8, 8, 192)	576	cc
activation_173 (Activation)	(None, 8, 8, 192)	0	ba
conv2d_174 (Conv2D)	(None, 8, 8, 224)	129024	ac
batch_normalization_174 (BatchN	(None, 8, 8, 224)	672	cc
activation_174 (Activation)	(None, 8, 8, 224)	0	ba
conv2d_172 (Conv2D)	(None, 8, 8, 192)	399360	bl
conv2d_175 (Conv2D)	(None, 8, 8, 256)	172032	ac
batch_normalization_172 (BatchN	(None, 8, 8, 192)	576	cc
batch_normalization_175 (BatchN	(None, 8, 8, 256)	768	cc
activation_172 (Activation)	(None, 8, 8, 192)	0	ba
activation_175 (Activation)	(None, 8, 8, 256)	0	ba
block8_3_mixed (Concatenate)	(None, 8, 8, 448)	0	ac ac
block8_3_conv (Conv2D)	(None, 8, 8, 2080)	933920	bl
block8_3 (Lambda)	(None, 8, 8, 2080)	0	bl bl
block8_3_ac (Activation)	(None, 8, 8, 2080)	0	bl
conv2d_177 (Conv2D)	(None, 8, 8, 192)	399360	bl
batch_normalization_177 (BatchN	(None, 8, 8, 192)	576	cc
activation_177 (Activation)	(None, 8, 8, 192)	0	ba
conv2d_178 (Conv2D)	(None, 8, 8, 224)	129024	ac

batch_normalization_178 (BatchN (None, 8, 8, 224))	672	cc
activation_178 (Activation) (None, 8, 8, 224)	0	be
conv2d_176 (Conv2D) (None, 8, 8, 192)	399360	bl
conv2d_179 (Conv2D) (None, 8, 8, 256)	172032	ac
batch_normalization_176 (BatchN (None, 8, 8, 192))	576	cc
batch_normalization_179 (BatchN (None, 8, 8, 256))	768	cc
activation_176 (Activation) (None, 8, 8, 192)	0	be
activation_179 (Activation) (None, 8, 8, 256)	0	be
block8_4_mixed (Concatenate) (None, 8, 8, 448)	0	ac
		ac
block8_4_conv (Conv2D) (None, 8, 8, 2080)	933920	bl
block8_4 (Lambda) (None, 8, 8, 2080)	0	bl
		bl
block8_4_ac (Activation) (None, 8, 8, 2080)	0	bl
conv2d_181 (Conv2D) (None, 8, 8, 192)	399360	bl
batch_normalization_181 (BatchN (None, 8, 8, 192))	576	cc
activation_181 (Activation) (None, 8, 8, 192)	0	be
conv2d_182 (Conv2D) (None, 8, 8, 224)	129024	ac
batch_normalization_182 (BatchN (None, 8, 8, 224))	672	cc
activation_182 (Activation) (None, 8, 8, 224)	0	be
conv2d_180 (Conv2D) (None, 8, 8, 192)	399360	bl
conv2d_183 (Conv2D) (None, 8, 8, 256)	172032	ac
batch_normalization_180 (BatchN (None, 8, 8, 192))	576	cc
batch_normalization_183 (BatchN (None, 8, 8, 256))	768	cc
activation_180 (Activation) (None, 8, 8, 192)	0	be
activation_183 (Activation) (None, 8, 8, 256)	0	be
block8_5_mixed (Concatenate) (None, 8, 8, 448)	0	ac
		ac
block8_5_conv (Conv2D) (None, 8, 8, 2080)	933920	bl
block8_5 (Lambda) (None, 8, 8, 2080)	0	bl
		bl
block8_5_ac (Activation) (None, 8, 8, 2080)	0	bl
conv2d_185 (Conv2D) (None, 8, 8, 192)	399360	bl
batch_normalization_185 (BatchN (None, 8, 8, 192))	576	cc
activation_185 (Activation) (None, 8, 8, 192)	0	be

conv2d_186 (Conv2D)	(None, 8, 8, 224)	129024	ac
batch_normalization_186 (BatchN	(None, 8, 8, 224)	672	cc
activation_186 (Activation)	(None, 8, 8, 224)	0	bε
conv2d_184 (Conv2D)	(None, 8, 8, 192)	399360	bl
conv2d_187 (Conv2D)	(None, 8, 8, 256)	172032	ac
batch_normalization_184 (BatchN	(None, 8, 8, 192)	576	cc
batch_normalization_187 (BatchN	(None, 8, 8, 256)	768	cc
activation_184 (Activation)	(None, 8, 8, 192)	0	bε
activation_187 (Activation)	(None, 8, 8, 256)	0	bε
block8_6_mixed (Concatenate)	(None, 8, 8, 448)	0	ac
			ac
block8_6_conv (Conv2D)	(None, 8, 8, 2080)	933920	bl
block8_6 (Lambda)	(None, 8, 8, 2080)	0	bl
			bl
block8_6_ac (Activation)	(None, 8, 8, 2080)	0	bl
conv2d_189 (Conv2D)	(None, 8, 8, 192)	399360	bl
batch_normalization_189 (BatchN	(None, 8, 8, 192)	576	cc
activation_189 (Activation)	(None, 8, 8, 192)	0	bε
conv2d_190 (Conv2D)	(None, 8, 8, 224)	129024	ac
batch_normalization_190 (BatchN	(None, 8, 8, 224)	672	cc
activation_190 (Activation)	(None, 8, 8, 224)	0	bε
conv2d_188 (Conv2D)	(None, 8, 8, 192)	399360	bl
conv2d_191 (Conv2D)	(None, 8, 8, 256)	172032	ac
batch_normalization_188 (BatchN	(None, 8, 8, 192)	576	cc
batch_normalization_191 (BatchN	(None, 8, 8, 256)	768	cc
activation_188 (Activation)	(None, 8, 8, 192)	0	bε
activation_191 (Activation)	(None, 8, 8, 256)	0	bε
block8_7_mixed (Concatenate)	(None, 8, 8, 448)	0	ac
			ac
block8_7_conv (Conv2D)	(None, 8, 8, 2080)	933920	bl
block8_7 (Lambda)	(None, 8, 8, 2080)	0	bl
			bl
block8_7_ac (Activation)	(None, 8, 8, 2080)	0	bl
conv2d_193 (Conv2D)	(None, 8, 8, 192)	399360	bl
batch_normalization_193 (BatchN	(None, 8, 8, 192)	576	cc

activation_193 (Activation)	(None, 8, 8, 192)	0	ba
conv2d_194 (Conv2D)	(None, 8, 8, 224)	129024	ac
batch_normalization_194 (BatchN	(None, 8, 8, 224)	672	cc
activation_194 (Activation)	(None, 8, 8, 224)	0	ba
conv2d_192 (Conv2D)	(None, 8, 8, 192)	399360	bl
conv2d_195 (Conv2D)	(None, 8, 8, 256)	172032	ac
batch_normalization_192 (BatchN	(None, 8, 8, 192)	576	cc
batch_normalization_195 (BatchN	(None, 8, 8, 256)	768	cc
activation_192 (Activation)	(None, 8, 8, 192)	0	ba
activation_195 (Activation)	(None, 8, 8, 256)	0	ba
block8_8_mixed (Concatenate)	(None, 8, 8, 448)	0	ac ac
block8_8_conv (Conv2D)	(None, 8, 8, 2080)	933920	bl
block8_8 (Lambda)	(None, 8, 8, 2080)	0	bl bl
block8_8_ac (Activation)	(None, 8, 8, 2080)	0	bl
conv2d_197 (Conv2D)	(None, 8, 8, 192)	399360	bl
batch_normalization_197 (BatchN	(None, 8, 8, 192)	576	cc
activation_197 (Activation)	(None, 8, 8, 192)	0	ba
conv2d_198 (Conv2D)	(None, 8, 8, 224)	129024	ac
batch_normalization_198 (BatchN	(None, 8, 8, 224)	672	cc
activation_198 (Activation)	(None, 8, 8, 224)	0	ba
conv2d_196 (Conv2D)	(None, 8, 8, 192)	399360	bl
conv2d_199 (Conv2D)	(None, 8, 8, 256)	172032	ac
batch_normalization_196 (BatchN	(None, 8, 8, 192)	576	cc
batch_normalization_199 (BatchN	(None, 8, 8, 256)	768	cc
activation_196 (Activation)	(None, 8, 8, 192)	0	ba
activation_199 (Activation)	(None, 8, 8, 256)	0	ba
block8_9_mixed (Concatenate)	(None, 8, 8, 448)	0	ac ac
block8_9_conv (Conv2D)	(None, 8, 8, 2080)	933920	bl
block8_9 (Lambda)	(None, 8, 8, 2080)	0	bl bl
block8_9_ac (Activation)	(None, 8, 8, 2080)	0	bl
conv2d_201 (Conv2D)	(None, 8, 8, 192)	399360	bl
batch_normalization_201 (BatchN	(None, 8, 8, 192)	576	cc

```

batch_normalization_201 (BatchN (None, 8, 8, 192)      576      cc
-----
activation_201 (Activation)      (None, 8, 8, 192)      0      ba
-----
conv2d_202 (Conv2D)            (None, 8, 8, 224)    129024      ac
-----
batch_normalization_202 (BatchN (None, 8, 8, 224)      672      cc
-----
activation_202 (Activation)      (None, 8, 8, 224)      0      ba
-----
conv2d_200 (Conv2D)            (None, 8, 8, 192)    399360      bl
-----
conv2d_203 (Conv2D)            (None, 8, 8, 256)    172032      ac
-----
batch_normalization_200 (BatchN (None, 8, 8, 192)      576      cc
-----
batch_normalization_203 (BatchN (None, 8, 8, 256)      768      cc
-----
activation_200 (Activation)      (None, 8, 8, 192)      0      ba
-----
activation_203 (Activation)      (None, 8, 8, 256)      0      ba
-----
block8_10_mixed (Concatenate)  (None, 8, 8, 448)      0      ac
ac
-----
block8_10_conv (Conv2D)         (None, 8, 8, 2080)   933920      bl
-----
block8_10 (Lambda)             (None, 8, 8, 2080)      0      bl
bl
-----
conv_7b (Conv2D)               (None, 8, 8, 1536)   3194880      bl
-----
conv_7b_bn (BatchNormalization) (None, 8, 8, 1536)      4608      cc
-----
conv_7b_ac (Activation)        (None, 8, 8, 1536)      0      cc
-----
avg_pool (GlobalAveragePooling2 (None, 1536)          0      cc
-----
dropout_1 (Dropout)           (None, 1536)          0      av
-----
dense_1 (Dense)               (None, 5004)        7691148      dr
=====

Total params: 62,027,884
Trainable params: 61,967,340
Non-trainable params: 60,544

```

In [12]:

```
gc.collect()
```

Out[12]:

8

Load model from disc

In [13]:

```
# from keras.models import load_model

# returns a compiled model
# identical to the previous cell
# model = load_model(MODEL, custom_objects={'top_5_accuracy': top_5_accuracy})
# print("Loaded model architecture from disk")

# model.load_weights(WEIGHTS)
```

```
# model.load_weights(WEIGHTS)
# print("Loaded model weights from disk")
# model.summary()
```

```
# gc.collect()
```

Train more on augmented data

In [14]:

```
from keras.callbacks import LambdaCallback, ModelCheckpoint
# from keras.applications.imagenet_utils import preprocess_input

ROTATE = 20
SEED = 42
gc.collect()

batch_gc_callback = LambdaCallback(
    on_epoch_begin=lambda epoch, logs: gc.collect())

checkpointer = ModelCheckpoint(filepath='weights.hdf5',
                               verbose=1, save_best_only=True)

train_datagen = ImageDataGenerator(
    preprocessing_function=preprocess_input,
    rescale=1./255,
    fill_mode='nearest',
    validation_split = 0.1,
    rotation_range=ROTATE,
    width_shift_range=0.2,
    height_shift_range=0.2,
    shear_range=0.2,
    zoom_range=0.2,
    horizontal_flip=False
)

train_generator = train_datagen.flow_from_dataframe(
    dataframe=whales_train,
    subset = "training",
    directory=TRAIN_CROPPED_IN,
    x_col="Image",
    y_col="Id",
    has_ext=True,
    seed = SEED,
    color_mode= "rgb",
    target_size=(IMAGE_HEIGHT, IMAGE_WIDTH),
    batch_size=BATCH_SIZE,
    class_mode='categorical')

validation_generator = train_datagen.flow_from_dataframe(
    dataframe=whales_train,
    subset = "validation",
    directory=TRAIN_CROPPED_IN,
    x_col="Image",
    y_col="Id",
    has_ext=True,
    seed = SEED,
    color_mode= "rgb",
    target_size=(IMAGE_HEIGHT, IMAGE_WIDTH),
    batch_size=BATCH_SIZE,
    class_mode='categorical')

gc.collect()
```

```
/opt/conda/lib/python3.6/site-packages/keras_preprocessing/image.py
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#inplace-evaluation
self.df[x_col] = self.df[x_col].astype(str)
```

```
Found 14155 images belonging to 5004 classes.
Found 1542 images belonging to 5004 classes.
```

Out[14]:

56

Visualize augmented data

In [15]:

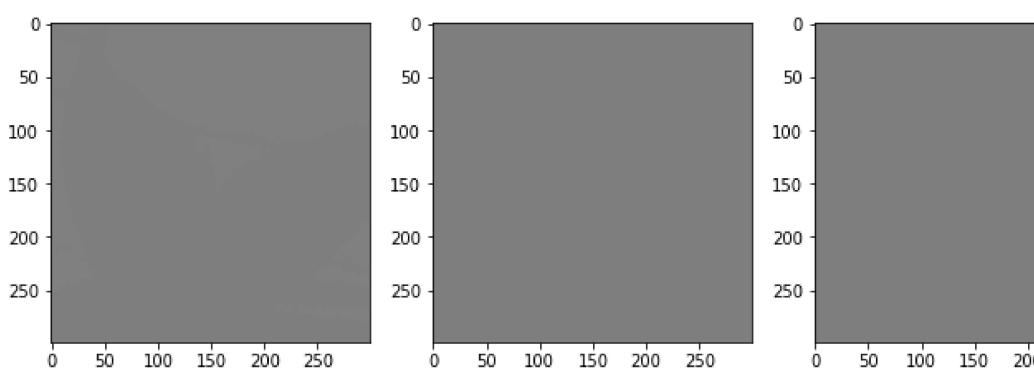
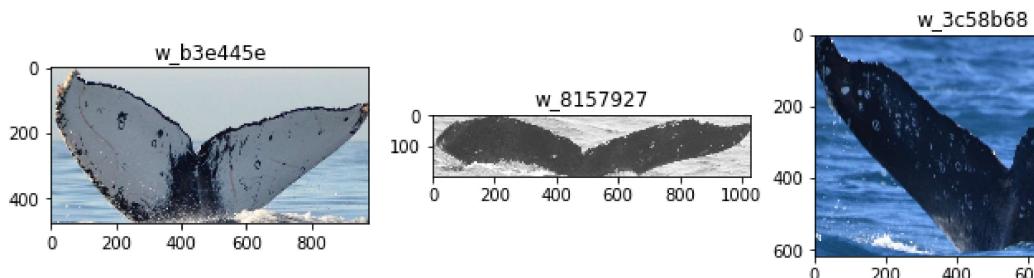
```
from skimage.io import imread
import PIL.Image as pimage

def plot_images(images_names, path):
    fig, m_axs = plt.subplots(1, len(images_names), figsize = (20, 10))
    #show the images and label them
    for ii, c_ax in enumerate(m_axs):
        img = imread(os.path.join(path, images_names[ii][0]))
        c_ax.imshow(img)
        c_ax.set_title(images_names[ii][1])

def plot_loaded_images(images_loaded, labels):
    fig, m_axs = plt.subplots(1, len(images_loaded), figsize = (20,
    #show the images and label them
    for ii, c_ax in enumerate(m_axs):
        img = pimage.fromarray(images_loaded[ii], "RGB")
        c_ax.imshow((images_loaded[ii] + 1) / 2)
        #        c_ax.set_title(labels[ii])

    #get the first 5 whale images
    images = [(whale_img, whale_label) for (whale_img, whale_label) in
    plot_images(images, TRAIN_CROPPED_IN)

    x_batch, y_batch = next(validation_generator)
    plot_loaded_images(x_batch[:5], y_batch[:5])
```



In [16]:

```

# fits the model on batches with real-time data augmentation:
STEP_SIZE_TRAIN=train_generator.n//train_generator.batch_size
STEP_SIZE_VALID=validation_generator.n//validation_generator.batch_size

# Train the loaded model
history = model.fit_generator(generator=train_generator,
                               steps_per_epoch=STEP_SIZE_TRAIN,
                               validation_data=validation_generator,
                               validation_steps=STEP_SIZE_VALID,
                               epochs=EPOCHS,
                               callbacks = [gc_collector])

```

```

Epoch 1/20
442/442 [=====] - 1341s 3s/step - loss: 8.
8.6728 - val_acc: 0.0026 - val_top_5_accuracy: 0.0169
Epoch 2/20
442/442 [=====] - 1255s 3s/step - loss: 7.
8.4316 - val_acc: 0.0026 - val_top_5_accuracy: 0.0166
Epoch 3/20
442/442 [=====] - 1255s 3s/step - loss: 7.
8.8638 - val_acc: 0.0040 - val_top_5_accuracy: 0.0146
Epoch 4/20
442/442 [=====] - 1253s 3s/step - loss: 7.
8.1549 - val_acc: 0.0079 - val_top_5_accuracy: 0.0225
Epoch 5/20
442/442 [=====] - 1255s 3s/step - loss: 7.
8.4045 - val_acc: 0.0053 - val_top_5_accuracy: 0.0132
Epoch 6/20
442/442 [=====] - 1253s 3s/step - loss: 7.
8.0543 - val_acc: 0.0172 - val_top_5_accuracy: 0.0563
Epoch 7/20
442/442 [=====] - 1251s 3s/step - loss: 6.
8.6976 - val_acc: 0.0252 - val_top_5_accuracy: 0.0583
Epoch 8/20
442/442 [=====] - 1251s 3s/step - loss: 6.
8.1723 - val_acc: 0.0331 - val_top_5_accuracy: 0.0940
Epoch 9/20
442/442 [=====] - 1251s 3s/step - loss: 6.
7.8991 - val_acc: 0.0430 - val_top_5_accuracy: 0.1192
Epoch 10/20
442/442 [=====] - 1251s 3s/step - loss: 5.
8.1535 - val_acc: 0.0245 - val_top_5_accuracy: 0.0735
Epoch 11/20
442/442 [=====] - 1249s 3s/step - loss: 5.
7.9504 - val_acc: 0.0649 - val_top_5_accuracy: 0.1536
Epoch 12/20
442/442 [=====] - 1249s 3s/step - loss: 5.
7.5224 - val_acc: 0.1086 - val_top_5_accuracy: 0.2232
Epoch 13/20
442/442 [=====] - 1248s 3s/step - loss: 4.
8.2481 - val_acc: 0.0854 - val_top_5_accuracy: 0.1768
Epoch 14/20
442/442 [=====] - 1251s 3s/step - loss: 4.
7.7713 - val_acc: 0.0921 - val_top_5_accuracy: 0.1974
Epoch 15/20
442/442 [=====] - 1252s 3s/step - loss: 3.
7.2180 - val_acc: 0.1298 - val_top_5_accuracy: 0.2424
Epoch 16/20
442/442 [=====] - 1250s 3s/step - loss: 3.
7.2929 - val_acc: 0.1503 - val_top_5_accuracy: 0.2589
Epoch 17/20
442/442 [=====] - 1251s 3s/step - loss: 2.
7.2953 - val_acc: 0.1755 - val_top_5_accuracy: 0.3026
Epoch 18/20
442/442 [=====] - 1251s 3s/step - loss: 2.
7.1088 - val_acc: 0.2172 - val_top_5_accuracy: 0.3530

```

```
Epoch 19/20
442/442 [=====] - 1251s 3s/step - loss: 2.
7.2702 - val_acc: 0.2060 - val_top_5_accuracy: 0.3371
Epoch 20/20
442/442 [=====] - 1250s 3s/step - loss: 1.
7.4828 - val_acc: 0.1828 - val_top_5_accuracy: 0.3166
```

Plot train results

```
In [17]:
```

```
def plot_accuracy(history, should_plot_val = False):
    acc = history.history['acc']
    l1 = plt.plot(acc, label='acc')

    if should_plot_val:
        val_acc = history.history['val_acc']
        l2 = plt.plot(val_acc, label='val_acc')

    plt.legend(loc=2, fontsize="small")
    plt.title('Model accuracy')
    plt.ylabel('Accuracy')
    plt.xlabel('Epoch')
    plt.show()

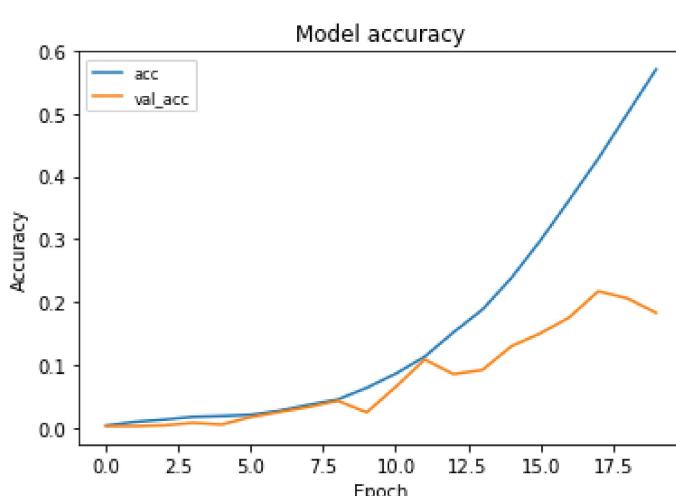
def plot_loss(history, should_plot_val = False):
    loss = history.history['loss']
    l1 = plt.plot(loss, label='loss')

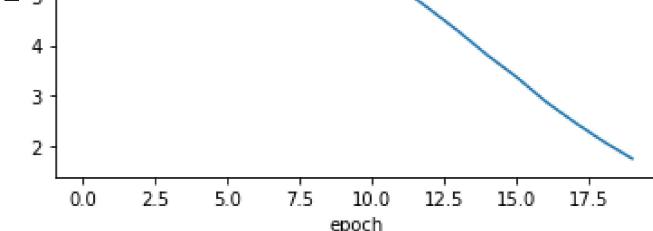
    if should_plot_val:
        val_loss = history.history['val_loss']
        plt.plot(val_loss, label='val_loss')

    plt.legend(loc=2, fontsize="small")
    plt.title('model loss')
    plt.ylabel('loss')
    plt.xlabel('epoch')
    plt.show()
```

```
In [18]:
```

```
plot_accuracy(history, True)
plot_loss(history, True)
```





In [19]:

```
model.save(MODEL_F)
print("Saved model architecture to disk")
model.save_weights(WEIGHTS_F)
print("Saved model weights to disk")
```

```
Saved model architecture to disk
Saved model weights to disk
```

In [20]:

```
test = os.listdir(TEST_CROPPED_IN)
print("Test set length: "+str(len(test)))
```

```
Test set length: 7960
```

In [21]:

```
col = ['Image']
test_df = pd.DataFrame(test, columns=col)
test_df['Id'] = ''
```

Test set prediction using generator and flow_from_dataframe

In [22]:

```
test_datagen = ImageDataGenerator(
    preprocessing_function=preprocess_input,
    rescale=1./255,
    fill_mode='nearest')

test_generator = test_datagen.flow_from_dataframe(
    dataframe=test_df,
    directory=TEST_CROPPED_IN,
    x_col="Image",
    y_col=None,
    class_mode=None,
    shuffle=False,
    color_mode="rgb",
    target_size=(IMAGE_HEIGHT, IMAGE_WIDTH),
    batch_size=1)

#we need to use .reset() here otherwise
#the other of predictions will be different
#then the expected
test_generator.reset()
predictions = model.predict_generator(test_generator, verbose = 1, st

print("Predictions shape:")
print(np.shape(predictions))
```

```
Found 7960 images.
7960/7960 [=====] - 677s 85ms/step
Predictions shape:
(7960, 5004)
```

Test set predictions

```
In [23]:  
predicted_class_indices=np.argmax(predictions, axis=1)  
  
np.save("predictions.npy", predictions)  
np.save("predicted_class_indices.npy", predicted_class_indices)  
np.save('test_filenames_generator.npy', test_generator.filenames)  
np.save('train_class_indices.npy', train_generator.class_indices)  
  
print('predicted class indices:')print(predicted_class_indices)  
  
print('Indices mapping:')print(train_generator.class_indices)  
  
predicted class indices:  
[2630 4168 3745 ... 2950 364 4425]  
Indices mapping:  
{'w_b3e445e': 0, 'w_8157927': 1, 'w_3c58b68': 2, 'w_180e241': 3, 'w  
1': 7, 'w_ac835f9': 8, 'w_7d02551': 9, 'w_41301dd': 10, 'w_335bdd1'  
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3be7': 36, 'w_c0f1e04': 37, 'w_f629616': 38, 'w_329ec8b': 39, 'w_d9  
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```
In [24]:  
    print(labels_list[:7])  
    labels_with_new_whale = np.concatenate(([ 'new_whale'], labels_list))  
    print(labels_with_new_whale[:7])
```

```
[ 'w_0003639' 'w_0003c59' 'w_0027efa' 'w_00289b1' 'w_002c810' 'w_003  
' 'w_003bae6' ]  
[ 'new_whale' 'w_0003639' 'w_0003c59' 'w_0027efa' 'w_00289b1' 'w_002  
' 'w_0032a46' ]
```

```
In [25]:  
def add_new_whale_to_predictions(preds):  
    sorted_preds = np.sort(preds)  
    avg_of_max_predictions = np.average(sorted_preds[:, -1:])  
    print("Average of max probabilities column:" + str(avg_of_max_p  
best_threshold = avg_of_max_predictions  
# print(np.shape(preds))  
shape_to_add = (np.shape(preds)[0], 1)  
  
# Add a column with the best threshold probability to the predic  
column_to_add = np.zeros(shape_to_add) + best_threshold  
predictions_w_new_whale = np.concatenate([column_to_add, preds])  
return predictions_w_new_whale
```

```
In [26]:  
classes = dict((v,k) for k,v in train_generator.class_indices.items)  
  
def get_generator_class(index):  
    if index == 0:  
        return 'new_whale'  
    return classes[index-1]  
  
def create_results_csv(preds, labels_with_new_whale, test_file_name  
sample_df = pd.read_csv(SAMPLE_SUB)  
sample_images = list(sample_df.Image)  
  
print("Test file names for decoding:")  
print(test_file_names[:7])  
  
#     classes = dict((v,k) for k,v in train_generator.class_indices.:  
#     print("Generator classes:")  
#     print(classes)  
  
pred_list = [[get_generator_class(i) for i in p.argsort()[-5:]]  
print(pred_list[:10])  
  
pred_dic = dict((key, value) for (key, value) in zip(test_file_  
pred_list_for_test = [ ' '.join(pred_dic[id]) for id in sample_i  
  
print(np.shape(pred_list))  
print(np.shape(test_file_names))  
df = pd.DataFrame({'Image': sample_images, 'Id': pred_list_for_  
df.to_csv(output_filename, header=True, index=False)  
return df
```

```
In [27]:  
p = add_new_whale_to_predictions(predictions)  
test_df = create_results_csv(p, labels_with_new_whale, test_generat  
print(test_df[:10])
```

```
Average of max probabilities column:0.40474817  
Test file names for decoding:  
['00028a005.jpg', '000dcf7d8.jpg', '000e7c7df.jpg', '0019c34f4.jpg'
```

```
[['w_80124ae', 'new_whale', 'w_0e9f07a', 'w_45df6b0', 'w_f121f0c'],  
 'w_12ce4f8'], ['new_whale', 'w_6658081', 'w_3904b99', 'w_c8d5ad5',  
 'w_0655a0d', 'w_fec331a'], ['new_whale', 'w_eaa5dbb', 'w_799b208',  
 'w_0f8b8e2', 'w_70d0b3c', 'w_1ebcda9'], ['w_5b227ec', 'w_7e2eb3d',  
 'w_2623921', 'w_04f5a19', 'w_4d7df64', 'w_bc5dbf9'], ['w_a3e2d0f',  
 ['w_b5657c7', 'new_whale', 'w_8bcc197', 'w_076bb5a', 'w_01ed442']]  
(7960, 5)  
(7960, )
```

	Image	Ic
0	00028a005.jpg	w_80124ae new_whale w_0e9f07a w_45df6b0 w_f121f0c
1	000dcf7d8.jpg	w_e3956f5 new_whale w_0a155b9 w_e8658e7 w_12ce4f8
2	000e7c7df.jpg	new_whale w_6658081 w_3904b99 w_c8d5ad5 w_8d76b75
3	0019c34f4.jpg	new_whale w_0b1e4a6 w_acccb0cb w_0655a0d w_fec331e
4	001a4d292.jpg	new_whale w_eaa5dbb w_799b208 w_2623921 w_cb0aaf6
5	00247bc36.jpg	w_00f340d new_whale w_0f8b8e2 w_70d0b3c w_1ebcda9
6	0027089a4.jpg	w_5b227ec w_7e2eb3d new_whale w_faf5287 w_5665c86
7	002de4d94.jpg	new_whale w_2623921 w_04f5a19 w_4d7df64 w_bc5dbf9
8	002f52f0c.jpg	w_a3e2d0f new_whale w_2036a57 w_53feb91 w_ab8af2b
9	002fd89d4.jpg	w_b5657c7 new_whale w_8bcc197 w_076bb5a w_01ed442



InceptionResNetV2 - oversampling

Python notebook using data from [multiple data sources](#) · 61 views · multiple data sources Edit tags

^ 0

Access

Edit

...

Version 4

9 commits

forked from InceptionResNetV2

Notebook

Data

Output

Log

Comments



Notebook



Data



Output



Log



Comments

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Did you find this Kernel useful?
Show your appreciation with an upvote

0

Data

Data Sources

- ▼ 🏆 Humpback Whale Id...
 - grid sam... 7960 x 2
 - grid train... 25.4k x 2
- ▼ 📄 test.zip
 - grid 0027089a4.jpg
 - grid 00313e2d2.jpg
 - grid 004344e9f.jpg
 - grid 008a4bc86.jpg
 - grid 00ac0fcfa6.jpg
 - grid 00ff45291.jpg
 - grid 012dbdb59.jpg
 - grid 0169cec0e.jpg
 - grid 01830c9cf.jpg
 - grid 01b1ecf7b.jpg
 - ... 1000+ more
- ▼ 📄 train.zip
 - grid 002b4615d.jpg
 - grid 00600ce17.jpg



Humpback Whale Identification

Can you identify a whale by its tail?

Last Updated: 2 months ago

About this Competition

This training data contains thousands of images of humpback whale flukes. Individual whales have been identified by researchers and given an `Id`. The challenge is to predict the whale `Id` of images in the test set. What makes this such a challenge is that there are only a few examples for each of 3,000+ whale `Ids`.

File descriptions

- **train.zip** - a folder containing the training images
- **train.csv** - maps the training `Image` to the appropriate whale `Id`. Whales that are not predicted to have a `label` identified in the training data should be labeled as `new_whale`.
- **test.zip** - a folder containing the test images to predict the whale `Id`
- **sample_submission.csv** - a sample submission file in the correct format



Output Files

[New Dataset](#)[New Kernel](#)[Download All](#)

Output Files

- submission.csv
- Model_InceptionRes...
- predicted_class_indic...
- predictions.npy
- test_filenames_gener...
- train_class_indices.npy
- Weights_InceptionRe...

About this file

 [Submit to Competition](#)

This file was created from a Kernel, it does not have a description.

■ submission.csv



1	Image	Id
2	00028a005.jpg	w_80124ae new_whale w_0e9f07a w_45df6b0 w_f121f0c
3	000dcf7d8.jpg	w_e3956f5 new_whale w_0a155b9 w_e8658e7 w_12ce4f8
4	000e7c7df.jpg	new_whale w_6658081 w_3904b99 w_c8d5ad5 w_8d76b75
5	0019c34f4.jpg	new_whale w_0b1e4a6 w_accb0cb w_0655a0d w_fec331a
6	001a4d292.jpg	new_whale w_eaa5dbb w_799b208 w_2623921 w_cb0aaaf0
7	00247bc36.jpg	w_00f340d new_whale w_0f8b8e2 w_70d0b3c w_1ebcda9
8	0027089a4.jpg	w_5b227ec w_7e2eb3d new_whale w_faf5287 w_5665c80
9	002de4d94.jpg	new_whale w_2623921 w_04f5a19 w_4d7df64 w_bc5dbf9
10	002f52f0c.jpg	w_a3e2d0f new_whale w_2036a57 w_53fb0a1

Run Info

Succeeded	True	Run Time	26246.5 seconds
Exit Code	0	Queue Time	0 seconds
Docker Image Name	/python(Dockerfile)	Output Size	0
Timeout Exceeded	False	Used All Space	False
Failure Message			

Log

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Time  Line #  Log Message
3.1s    1  [NbConvertApp] Converting notebook __notebook__.ipynb to notebook
3.1s    2  [NbConvertApp] Executing notebook with kernel: python3
8.6s    3  2019-02-04 20:31:53.719942: I tensorflow/stream_executor/cuda/cuda_gpu_executor.cc:964] successful NUMA node read from SysFS had negative value (-1), but there must be at least one NUMA node, so returning NUMA node zero
8.6s    4  2019-02-04 20:31:53.720832: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1432] Found device 0 with properties:
name: Tesla K80 major: 3 minor: 7 memoryClockRate(GHz): 0.8235
pciBusID: 0000:00:04.0
totalMemory: 11.17GiB freeMemory: 11.10GiB
2019-02-04 20:31:53.720873: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1511] Adding visible gpu devices: 0
8.9s    5  2019-02-04 20:31:54.086192: I tensorflow/core/common_runtime/gpu/gpu_device.cc:982] Device interconnect StreamExecutor with strength 1 edge matrix:
2019-02-04 20:31:54.086299: I tensorflow/core/common_runtime/gpu/gpu_device.cc:988]      0
2019-02-04 20:31:54.086317: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1001] 0: N
9.0s    6  2019-02-04 20:31:54.086734: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1115] Created TensorFlow device (/job:localhost/replica:0/task:0/device:GPU:0 with 10758 MB memory) -> physical GPU (device: 0, name: Tesla K80, pci bus id: 0000:00:04.0, compute capability: 3.7)
201.6s   7  2019-02-04 20:35:06.723460: W tensorflow/core/common_runtime/bfc_allocator.cc:211] Allocator (GPU_0_bfc) ran out of memory trying to allocate 2.15GiB. The caller indicates that this is not a failure, but may mean that there could be performance gains if more memory were available.
202.3s   8  2019-02-04 20:35:07.391830: W tensorflow/core/common_runtime/bfc_allocator.cc:211] Allocator (GPU_0_bfc) ran out of memory trying to allocate 3.42GiB. The caller indicates that this is not a failure, but may mean that there could be performance gains if more memory were available.
202.3s   9  2019-02-04 20:35:07.416655: W tensorflow/core/common_runtime/bfc_allocator.cc:211] Allocator (GPU_0_bfc) ran out of memory trying to allocate 3.67GiB. The caller indicates that this is not a failure, but may mean that there could be performance gains if more memory were available.
26243.0s 10  [NbConvertApp] Writing 634238 bytes to __notebook__.ipynb
26245.3s 11  [NbConvertApp] Converting notebook __notebook__.ipynb to html
26245.9s 12  [NbConvertApp] Support files will be in __results__files/
[!NbConvertApp] Making directory __results__files
26245.9s 13  [NbConvertApp] Making directory __results__files
[!NbConvertApp] Making directory __results__files
[!NbConvertApp] Making directory __results__files
[!NbConvertApp] Making directory __results__files
[!NbConvertApp] Writing 627012 bytes to __results__.html
26245.9s 14
26245.9s 16  Complete. Exited with code 0.
```

Comments (0)



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