In [1]:

```
pip install segmentation-models
```

```
Collecting segmentation-models
  Downloading segmentation_models-1.0.1-py3-none-any.whl (33 kB)
Collecting efficientnet==1.0.0
  Downloading efficientnet-1.0.0-py3-none-any.whl (17 kB)
Collecting image-classifiers==1.0.0
  Downloading image_classifiers-1.0.0-py3-none-any.whl (19 kB)
Collecting keras-applications<=1.0.8,>=1.0.7
  Downloading Keras_Applications-1.0.8-py3-none-any.whl (50 kB)
     |████████████████████████████████| 50 kB 4.4 MB/s
Requirement already satisfied: scikit-image in /usr/local/lib/python3.7/dist-packages (from efficientnet==1.0.0->segmentation-models)
(0.16.2)
Requirement already satisfied: h5py in /usr/local/lib/python3.7/dist-packages (from keras-applications<=1.0.8,>=1.0.7->segmentation-m
odels) (3.1.0)
Requirement already satisfied: numpy>=1.9.1 in /usr/local/lib/python3.7/dist-packages (from keras-applications<=1.0.8,>=1.0.7->segmen
tation-models) (1.19.5)
Requirement already satisfied: cached-property in /usr/local/lib/python3.7/dist-packages (from h5py->keras-applications<=1.0.8,>=1.0.
7->segmentation-models) (1.5.2)
Requirement already satisfied: matplotlib!=3.0.0,>=2.0.0 in /usr/local/lib/python3.7/dist-packages (from scikit-image->efficientnet==
1.0.0->segmentation-models) (3.2.2)
Requirement already satisfied: imageio>=2.3.0 in /usr/local/lib/python3.7/dist-packages (from scikit-image->efficientnet==1.0.0->segm
entation-models) (2.4.1)
Requirement already satisfied: pillow>=4.3.0 in /usr/local/lib/python3.7/dist-packages (from scikit-image->efficientnet==1.0.0->segme
ntation-models) (7.1.2)
Requirement already satisfied: PyWavelets>=0.4.0 in /usr/local/lib/python3.7/dist-packages (from scikit-image->efficientnet==1.0.0->s
egmentation-models) (1.1.1)
Requirement already satisfied: networkx>=2.0 in /usr/local/lib/python3.7/dist-packages (from scikit-image->efficientnet==1.0.0->segme
ntation-models) (2.6.3)
Requirement already satisfied: scipy>=0.19.0 in /usr/local/lib/python3.7/dist-packages (from scikit-image->efficientnet==1.0.0->segme
ntation-models) (1.4.1)
Requirement already satisfied: python-dateutil>=2.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib!=3.0.0,>=2.0.0->scikit
-image->efficientnet==1.0.0->segmentation-models) (2.8.2)
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib!=3
.0.0,>=2.0.0->scikit-image->efficientnet==1.0.0->segmentation-models) (2.4.7)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.7/dist-packages (from matplotlib!=3.0.0,>=2.0.0->scikit-image->
efficientnet==1.0.0->segmentation-models) (0.10.0)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib!=3.0.0,>=2.0.0->scikit-im
age->efficientnet==1.0.0->segmentation-models) (1.3.2)
Requirement already satisfied: six in /usr/local/lib/python3.7/dist-packages (from cycler>=0.10->matplotlib!=3.0.0,>=2.0.0->scikit-im
age->efficientnet==1.0.0->segmentation-models) (1.15.0)
Installing collected packages: keras-applications, image-classifiers, efficientnet, segmentation-models
Successfully installed efficientnet-1.0.0 image-classifiers-1.0.0 keras-applications-1.0.8 segmentation-models-1.0.1
```

In [2]:

```python
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
import os
import pickle
import matplotlib.patches as patches
import re
import random
from sklearn.model_selection import train_test_split
import cv2
import seaborn as sns
import warnings
warnings.filterwarnings("ignore")
from keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.utils import plot_model
from PIL import Image
import tensorflow as tf
import keras
from keras import backend as K
from keras.models import Model,load_model
from keras.regularizers import l2
import datetime
%load_ext tensorboard
import segmentation_models
from segmentation_models import Unet
from segmentation_models import get_preprocessing
import imgaug.augmenters as iaa
import segmentation_models as sm
sm.set_framework('tf.keras')
```

```
sm.framework()
from tensorflow.keras.losses import binary_crossentropy
```

```
Segmentation Models: using `keras` framework.
```

In [3]:

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

```
Mounted at /content/drive
```

In [4]:

```
with open('/content/drive//My Drive/Steel_Detection /data.pkl','rb') as f:
    train=pickle.load(f)
```

In [5]:

```
train.head()
```

	image_id	rle_1	rle_2	rle_3	rle_4	defect	stratify	defect_1	defect_2	defect_3	defect_4	total_defects
0	0002cc93b.jpg	29102 12 29346 24 29602 24 29858 24 30114 24 3...				1	1	1	0	0	0	1
1	00031f466.jpg					0	0	0	0	0	0	0
2	000418bfc.jpg					0	0	0	0	0	0	0
3	000789191.jpg					0	0	0	0	0	0	0
4	0007a71bf.jpg			18661 28 18863 82 19091 110 19347 110 19603 11...		1	3	0	0	1	0	1

In [6]:

```
train.shape
```

```
(12568, 12)
```

In [5]:

```
#https://scikit-learn.org/stable/modules/generated/sklearn.model_selection.train_test_split.html
x_train,x_test=train_test_split(train,test_size=0.10,stratify=train['stratify'],random_state=0)
x_train,x_val=train_test_split(x_train,test_size=0.20,stratify=x_train['stratify'],random_state=0)
print("x_train {}".format(x_train.shape),"  x_val {}".format(x_val.shape)," x_test {}".format(x_test.shape))
print("="*100)

train_1=x_train[x_train['defect_1']==1][['image_id','rle_1']].rename(columns={'image_id':'image_id','rle_1':'rle'})
train_2=x_train[x_train['defect_2']==1][['image_id','rle_2']].rename(columns={'image_id':'image_id','rle_2':'rle'})
train_3=x_train[x_train['defect_3']==1][['image_id','rle_3']].rename(columns={'image_id':'image_id','rle_3':'rle'})
train_4=x_train[x_train['defect_4']==1][['image_id','rle_4']].rename(columns={'image_id':'image_id','rle_4':'rle'})
print("train_1 {}".format(train_1.shape)," train_2 {}".format(train_2.shape)," train_3 {}".format(train_3.shape)," train_4 {}".format(train_4.shape))
print("="*100)

val_1=x_val[x_val['defect_1']==1][['image_id','rle_1']].rename(columns={'image_id':'image_id','rle_1':'rle'})
val_2=x_val[x_val['defect_2']==1][['image_id','rle_2']].rename(columns={'image_id':'image_id','rle_2':'rle'})
val_3=x_val[x_val['defect_3']==1][['image_id','rle_3']].rename(columns={'image_id':'image_id','rle_3':'rle'})
val_4=x_val[x_val['defect_4']==1][['image_id','rle_4']].rename(columns={'image_id':'image_id','rle_4':'rle'})
print("val_1 {}".format(val_1.shape)," val_2 {}".format(val_2.shape)," val_3 {}".format(val_3.shape)," val_4 {}".format(val_4.shape))
```

```
print("="*100)

test_1=x_test[x_test['defect_1']==1][['image_id','rle_1']].rename(columns={'image_id':'image_id
','rle_1':'rle'})
test_2=x_test[x_test['defect_2']==1][['image_id','rle_2']].rename(columns={'image_id':'image_id
','rle_2':'rle'})
test_3=x_test[x_test['defect_3']==1][['image_id','rle_3']].rename(columns={'image_id':'image_id
','rle_3':'rle'})
test_4=x_test[x_test['defect_4']==1][['image_id','rle_4']].rename(columns={'image_id':'image_id
','rle_4':'rle'})
print("test_1 {}".format(test_1.shape)," test_2 {}".format(test_2.shape)," test_3 {}".format(
test_3.shape)," test_4 {}".format(test_4.shape))
```

```
x_train (9048, 12)   x_val (2263, 12)  x_test (1257, 12)
====================================================================================================
train_1 (646, 2)  train_2 (174, 2)  train_3 (3714, 2)  train_4 (581, 2)
====================================================================================================
val_1 (161, 2)  val_2 (50, 2)  val_3 (924, 2)  val_4 (142, 2)
====================================================================================================
test_1 (90, 2)  test_2 (23, 2)  test_3 (512, 2)  test_4 (78, 2)
```

- Data is divided with respect to 4 defects because different segmentation model is trained for each 4 defects .

In [6]:

```
#https://stackoverflow.com/questions/31273652/how-to-calculate-dice-coefficient-for-measuring
-accuracy-of-image-segmentation-i
def dice_coef(y_true,y_pred):
    y_true_f=tf.reshape(tf.dtypes.cast(y_true, tf.float32),[-1])
    y_pred_f=tf.reshape(tf.dtypes.cast(y_pred, tf.float32),[-1])
    intersection=tf.reduce_sum(y_true_f*y_pred_f)
    return (2. * intersection + 1.) / (tf.reduce_sum(y_true_f) + tf.reduce_sum(y_pred_f) + 1.
)

#https://stackoverflow.com/questions/49785133/keras-dice-coefficient-loss-function-is-negativ
e-and-increasing-with-epochs
def dice_loss(y_true, y_pred):
    y_true_f = tf.reshape(y_true, [-1])
    y_pred_f = tf.reshape(y_pred, [-1])
    return (1-dice_coefficient(y_true, y_pred))

#defining function for calculation of loss function: binary cross entropy + dice loss
def bce_dice_loss(y_true, y_pred):
    y_true_f = tf.reshape(y_true, [-1])
    y_pred_f = tf.reshape(y_pred, [-1])
    return binary_crossentropy(y_true, y_pred) + (1-dice_coef(y_true, y_pred))
```

In [7]:

```
#https://www.kaggle.com/paulorzp/rle-functions-run-lenght-encode-decode
def rle_to_mask(rle):
    # CONVERT RLE TO MASK
    if (pd.isnull(rle))|(rle=='')|(rle=='-1'):
        return np.zeros((256,800),dtype=np.uint8)  #If the EncodedPixels string is empty an e
mpty mask is returned

    height=256
    width=1600
    mask=np.zeros(width*height,dtype=np.uint8)

    array=np.asarray([int(x) for x in rle.split()])
    starts=array[0::2]-1
    lengths=array[1::2]
    for index,start in enumerate(starts):
        mask[int(start):int(start+lengths[index])]=1

    return mask.reshape((height,width),order='F')[::,::2]
```

- The imgaug library provides a very useful feature called Augmentation pipeline. Such a pipeline is a sequence of steps that can be applied in a fixed or random order. This also gives the flexibility to apply certain transformations to a few images and other transformations to other images.

other transformations to other images.

- https://www.kaggle.com/parulpandey/overview-of-popular-image-augmentation-packages

In [8]:

```
"""
Implementing custom data generator
#https://towardsdatascience.com/implementing-custom-data-generators-in-keras-de56f013581c
#https://www.kaggle.com/cdeotte/keras-unet-with-eda
"""
class train_DataGenerator(keras.utils.all_utils.Sequence):

  def __init__(self,dataframe,batch_size=4,shuffle=True,preprocess=None,info={}):
    self.batch_size = batch_size
    self.df = dataframe
    self.indices = self.df.index.tolist()
    self.preprocess = preprocess
    self.shuffle = shuffle
    self.on_epoch_end()

  def __len__(self):
    return len(self.indices) // (self.batch_size)

  def __getitem__(self, index):
    index = self.index[index * self.batch_size:(index + 1) * self.batch_size]
    batch = [self.indices[k] for k in index]

    X, y = self.__get_data(batch)
    return X, y

  def on_epoch_end(self):
    self.index = np.arange(len(self.indices))
    if self.shuffle == True:
      np.random.shuffle(self.index)

  def __get_data(self, batch):
    train_datagen = ImageDataGenerator()
    #https://www.geeksforgeeks.org/python-select-random-value-from-a-list/

    X=np.empty((self.batch_size,256,800,3),dtype=np.float32) # image place-holders
    Y=np.empty((self.batch_size,256,800,1),dtype=np.int8)# 1 mask place-holders

    for i,id in enumerate(batch):
      X[i,] = Image.open('/content/drive//My Drive/Steel_Detection /train_images/' + str(self
.df['image_id'].loc[id])).resize((800,256))
      Y[i,:,:,0]=rle_to_mask(self.df['rle'].loc[id])

    t=random.choice([0,0,20,30,40])
    z=random.choice([0.9,1])
    flip=random.choice(['True','False'])
    """
    https://theailearner.com/2019/07/06/imagedatagenerator-apply_transform-method/
    https://www.tensorflow.org/api_docs/python/tf/keras/preprocessing/image/ImageDataGenerato
r
    tx and ty: These are the shifts in the vertical and the horizontal directions respectivel
y.
    For instance,tx=20 will shift the image vertically by 20 pixels
    zx and zy: This zooms the image in the vertical and horizontal directions respectively.
    If less than 1, the image is zoomed in otherwise zoomed out."""

    param={'flip_horizontal':flip,'flip_vertical':flip,'tx':t,'ty':t,'zx':z,'zy':z,}
    for i,e in enumerate(X):
      X[i] = train_datagen.apply_transform(e,transform_parameters=param)
    for i,f in enumerate(Y):
      Y[i] = train_datagen.apply_transform(f,transform_parameters=param)

    # preprocess input
```

```python
        if self.preprocess!=None: X = self.preprocess(X)

        return X,Y
```

In [9]:

```python
# Implementing custom data generator
#https://towardsdatascience.com/implementing-custom-data-generators-in-keras-de56f013581c
class test_DataGenerator(keras.utils.all_utils.Sequence):

  def __init__(self,dataframe,batch_size=1,shuffle=False,preprocess=None,info={}):
    self.batch_size = batch_size
    self.df = dataframe
    self.indices = self.df.index.tolist()
    self.preprocess = preprocess
    self.shuffle = shuffle
    self.on_epoch_end()

  def __len__(self):
    return len(self.indices) // (self.batch_size)

  def __getitem__(self, index):
    index = self.index[index * self.batch_size:(index + 1) * self.batch_size]
    batch = [self.indices[k] for k in index]

    X, y = self.__get_data(batch)
    return X, y

  def on_epoch_end(self):
    self.index = np.arange(len(self.indices))
    if self.shuffle == True:
      np.random.shuffle(self.index)

  def __get_data(self, batch):
    X = np.empty((self.batch_size,256,800,3),dtype=np.float32) # image place-holders
    Y = np.empty((self.batch_size,256,800,1),dtype=np.int8)# 1 mask place-holders

    for i, id in enumerate(batch):
      X[i,] = Image.open('/content/drive//My Drive/Steel_Detection /train_images/' + str(self
.df['image_id'].loc[id])).resize((800,256))
      Y[i,:,:,0]=rle_to_mask(self.df['rle'].loc[id])

      # preprocess input
    if self.preprocess!=None: X = self.preprocess(X)

    return X,Y
```

- Load UNET with pre-training on Imagenet data with backbone model as efficientnetb5.

In [10]:

```python
#https://segmentation-models.readthedocs.io/en/latest/tutorial.html
#LOAD UNET WITH PRETRAINING FROM IMAGENET
#https://segmentation-models.readthedocs.io/en/latest/tutorial.html
preprocess=get_preprocessing('efficientnetb5')
model=Unet('efficientnetb5',classes=1,activation='sigmoid',encoder_weights='imagenet')
model._name="Segmentation_Model"
model.summary()
```

```
Downloading data from https://github.com/Callidior/keras-applications/releases/download/efficientnet/efficientnet-b5_weights_tf_dim_o
rdering_tf_kernels_autoaugment_notop.h5
115515392/115515256 [==============================] - 1s 0us/step
115523584/115515256 [==============================] - 1s 0us/step
Model: "Segmentation_Model"
__________________________________________________________________________________________________
Layer (type)                    Output Shape         Param #     Connected to
==================================================================================================
input_1 (InputLayer)            [(None, None, None,  0

__________________________________________________________________________________________________
stem_conv (Conv2D)              (None, None, None, 4 1296        input_1[0][0]

__________________________________________________________________________________________________
stem_bn (BatchNormalization)    (None, None, None, 4 192         stem_conv[0][0]
```

```
__________________________________________________________________________________________________
stem_activation (Activation)    (None, None, None, 4 0           stem_bn[0][0]
__________________________________________________________________________________________________
block1a_dwconv (DepthwiseConv2D (None, None, None, 4 432         stem_activation[0][0]
__________________________________________________________________________________________________
block1a_bn (BatchNormalization) (None, None, None, 4 192         block1a_dwconv[0][0]
__________________________________________________________________________________________________
block1a_activation (Activation) (None, None, None, 4 0           block1a_bn[0][0]
__________________________________________________________________________________________________
block1a_se_squeeze (GlobalAvera (None, 48)           0           block1a_activation[0][0]
__________________________________________________________________________________________________
block1a_se_reshape (Reshape)    (None, 1, 1, 48)     0           block1a_se_squeeze[0][0]
__________________________________________________________________________________________________
block1a_se_reduce (Conv2D)      (None, 1, 1, 12)     588         block1a_se_reshape[0][0]
__________________________________________________________________________________________________
block1a_se_expand (Conv2D)      (None, 1, 1, 48)     624         block1a_se_reduce[0][0]
__________________________________________________________________________________________________
block1a_se_excite (Multiply)    (None, None, None, 4 0           block1a_activation[0][0]
                                                                 block1a_se_expand[0][0]
__________________________________________________________________________________________________
block1a_project_conv (Conv2D)   (None, None, None, 2 1152        block1a_se_excite[0][0]
__________________________________________________________________________________________________
block1a_project_bn (BatchNormal (None, None, None, 2 96          block1a_project_conv[0][0]
__________________________________________________________________________________________________
block1b_dwconv (DepthwiseConv2D (None, None, None, 2 216         block1a_project_bn[0][0]
__________________________________________________________________________________________________
block1b_bn (BatchNormalization) (None, None, None, 2 96          block1b_dwconv[0][0]
__________________________________________________________________________________________________
block1b_activation (Activation) (None, None, None, 2 0           block1b_bn[0][0]
__________________________________________________________________________________________________
block1b_se_squeeze (GlobalAvera (None, 24)           0           block1b_activation[0][0]
__________________________________________________________________________________________________
block1b_se_reshape (Reshape)    (None, 1, 1, 24)     0           block1b_se_squeeze[0][0]
__________________________________________________________________________________________________
block1b_se_reduce (Conv2D)      (None, 1, 1, 6)      150         block1b_se_reshape[0][0]
__________________________________________________________________________________________________
block1b_se_expand (Conv2D)      (None, 1, 1, 24)     168         block1b_se_reduce[0][0]
__________________________________________________________________________________________________
block1b_se_excite (Multiply)    (None, None, None, 2 0           block1b_activation[0][0]
                                                                 block1b_se_expand[0][0]
__________________________________________________________________________________________________
block1b_project_conv (Conv2D)   (None, None, None, 2 576         block1b_se_excite[0][0]
__________________________________________________________________________________________________
block1b_project_bn (BatchNormal (None, None, None, 2 96          block1b_project_conv[0][0]
__________________________________________________________________________________________________
block1b_drop (FixedDropout)     (None, None, None, 2 0           block1b_project_bn[0][0]
__________________________________________________________________________________________________
block1b_add (Add)               (None, None, None, 2 0           block1b_drop[0][0]
                                                                 block1a_project_bn[0][0]
__________________________________________________________________________________________________
block1c_dwconv (DepthwiseConv2D (None, None, None, 2 216         block1b_add[0][0]
__________________________________________________________________________________________________
block1c_bn (BatchNormalization) (None, None, None, 2 96          block1c_dwconv[0][0]
__________________________________________________________________________________________________
block1c_activation (Activation) (None, None, None, 2 0           block1c_bn[0][0]
__________________________________________________________________________________________________
block1c_se_squeeze (GlobalAvera (None, 24)           0           block1c_activation[0][0]
__________________________________________________________________________________________________
block1c_se_reshape (Reshape)    (None, 1, 1, 24)     0           block1c_se_squeeze[0][0]
__________________________________________________________________________________________________
block1c_se_reduce (Conv2D)      (None, 1, 1, 6)      150         block1c_se_reshape[0][0]
__________________________________________________________________________________________________
block1c_se_expand (Conv2D)      (None, 1, 1, 24)     168         block1c_se_reduce[0][0]
__________________________________________________________________________________________________
block1c_se_excite (Multiply)    (None, None, None, 2 0           block1c_activation[0][0]
                                                                 block1c_se_expand[0][0]
__________________________________________________________________________________________________
block1c_project_conv (Conv2D)   (None, None, None, 2 576         block1c_se_excite[0][0]
__________________________________________________________________________________________________
block1c_project_bn (BatchNormal (None, None, None, 2 96          block1c_project_conv[0][0]
__________________________________________________________________________________________________
block1c_drop (FixedDropout)     (None, None, None, 2 0           block1c_project_bn[0][0]
__________________________________________________________________________________________________
block1c_add (Add)               (None, None, None, 2 0           block1c_drop[0][0]
                                                                 block1b_add[0][0]
__________________________________________________________________________________________________
block2a_expand_conv (Conv2D)    (None, None, None, 1 3456        block1c_add[0][0]
__________________________________________________________________________________________________
block2a_expand_bn (BatchNormali (None, None, None, 1 576         block2a_expand_conv[0][0]
__________________________________________________________________________________________________
block2a_expand_activation (Acti (None, None, None, 1 0           block2a_expand_bn[0][0]
__________________________________________________________________________________________________
block2a_dwconv (DepthwiseConv2D (None, None, None, 1 1296        block2a_expand_activation[0][0]
__________________________________________________________________________________________________
block2a_bn (BatchNormalization) (None, None, None, 1 576         block2a_dwconv[0][0]
__________________________________________________________________________________________________
block2a_activation (Activation) (None, None, None, 1 0           block2a_bn[0][0]
__________________________________________________________________________________________________
block2a_se_squeeze (GlobalAvera (None, 144)          0           block2a_activation[0][0]
__________________________________________________________________________________________________
block2a_se_reshape (Reshape)    (None, 1, 1, 144)    0           block2a_se_squeeze[0][0]
```

```
__________________________________________________________________________________________________
block2a_se_reduce (Conv2D)      (None, 1, 1, 6)      870         block2a_se_reshape[0][0]
__________________________________________________________________________________________________
block2a_se_expand (Conv2D)      (None, 1, 1, 144)    1008        block2a_se_reduce[0][0]
__________________________________________________________________________________________________
block2a_se_excite (Multiply)    (None, None, None, 1 0           block2a_activation[0][0]
                                                                 block2a_se_expand[0][0]
__________________________________________________________________________________________________
block2a_project_conv (Conv2D)   (None, None, None, 4 5760        block2a_se_excite[0][0]
__________________________________________________________________________________________________
block2a_project_bn (BatchNormal (None, None, None, 4 160         block2a_project_conv[0][0]
__________________________________________________________________________________________________
block2b_expand_conv (Conv2D)    (None, None, None, 2 9600        block2a_project_bn[0][0]
__________________________________________________________________________________________________
block2b_expand_bn (BatchNormali (None, None, None, 2 960         block2b_expand_conv[0][0]
__________________________________________________________________________________________________
block2b_expand_activation (Acti (None, None, None, 2 0           block2b_expand_bn[0][0]
__________________________________________________________________________________________________
block2b_dwconv (DepthwiseConv2D (None, None, None, 2 2160        block2b_expand_activation[0][0]
__________________________________________________________________________________________________
block2b_bn (BatchNormalization) (None, None, None, 2 960         block2b_dwconv[0][0]
__________________________________________________________________________________________________
block2b_activation (Activation) (None, None, None, 2 0           block2b_bn[0][0]
__________________________________________________________________________________________________
block2b_se_squeeze (GlobalAvera (None, 240)          0           block2b_activation[0][0]
__________________________________________________________________________________________________
block2b_se_reshape (Reshape)    (None, 1, 1, 240)    0           block2b_se_squeeze[0][0]
__________________________________________________________________________________________________
block2b_se_reduce (Conv2D)      (None, 1, 1, 10)     2410        block2b_se_reshape[0][0]
__________________________________________________________________________________________________
block2b_se_expand (Conv2D)      (None, 1, 1, 240)    2640        block2b_se_reduce[0][0]
__________________________________________________________________________________________________
block2b_se_excite (Multiply)    (None, None, None, 2 0           block2b_activation[0][0]
                                                                 block2b_se_expand[0][0]
__________________________________________________________________________________________________
block2b_project_conv (Conv2D)   (None, None, None, 4 9600        block2b_se_excite[0][0]
__________________________________________________________________________________________________
block2b_project_bn (BatchNormal (None, None, None, 4 160         block2b_project_conv[0][0]
__________________________________________________________________________________________________
block2b_drop (FixedDropout)     (None, None, None, 4 0           block2b_project_bn[0][0]
__________________________________________________________________________________________________
block2b_add (Add)               (None, None, None, 4 0           block2b_drop[0][0]
                                                                 block2a_project_bn[0][0]
__________________________________________________________________________________________________
block2c_expand_conv (Conv2D)    (None, None, None, 2 9600        block2b_add[0][0]
__________________________________________________________________________________________________
block2c_expand_bn (BatchNormali (None, None, None, 2 960         block2c_expand_conv[0][0]
__________________________________________________________________________________________________
block2c_expand_activation (Acti (None, None, None, 2 0           block2c_expand_bn[0][0]
__________________________________________________________________________________________________
block2c_dwconv (DepthwiseConv2D (None, None, None, 2 2160        block2c_expand_activation[0][0]
__________________________________________________________________________________________________
block2c_bn (BatchNormalization) (None, None, None, 2 960         block2c_dwconv[0][0]
__________________________________________________________________________________________________
block2c_activation (Activation) (None, None, None, 2 0           block2c_bn[0][0]
__________________________________________________________________________________________________
block2c_se_squeeze (GlobalAvera (None, 240)          0           block2c_activation[0][0]
__________________________________________________________________________________________________
block2c_se_reshape (Reshape)    (None, 1, 1, 240)    0           block2c_se_squeeze[0][0]
__________________________________________________________________________________________________
block2c_se_reduce (Conv2D)      (None, 1, 1, 10)     2410        block2c_se_reshape[0][0]
__________________________________________________________________________________________________
block2c_se_expand (Conv2D)      (None, 1, 1, 240)    2640        block2c_se_reduce[0][0]
__________________________________________________________________________________________________
block2c_se_excite (Multiply)    (None, None, None, 2 0           block2c_activation[0][0]
                                                                 block2c_se_expand[0][0]
__________________________________________________________________________________________________
block2c_project_conv (Conv2D)   (None, None, None, 4 9600        block2c_se_excite[0][0]
__________________________________________________________________________________________________
block2c_project_bn (BatchNormal (None, None, None, 4 160         block2c_project_conv[0][0]
__________________________________________________________________________________________________
block2c_drop (FixedDropout)     (None, None, None, 4 0           block2c_project_bn[0][0]
__________________________________________________________________________________________________
block2c_add (Add)               (None, None, None, 4 0           block2c_drop[0][0]
                                                                 block2b_add[0][0]
__________________________________________________________________________________________________
block2d_expand_conv (Conv2D)    (None, None, None, 2 9600        block2c_add[0][0]
__________________________________________________________________________________________________
block2d_expand_bn (BatchNormali (None, None, None, 2 960         block2d_expand_conv[0][0]
__________________________________________________________________________________________________
block2d_expand_activation (Acti (None, None, None, 2 0           block2d_expand_bn[0][0]
__________________________________________________________________________________________________
block2d_dwconv (DepthwiseConv2D (None, None, None, 2 2160        block2d_expand_activation[0][0]
__________________________________________________________________________________________________
block2d_bn (BatchNormalization) (None, None, None, 2 960         block2d_dwconv[0][0]
__________________________________________________________________________________________________
block2d_activation (Activation) (None, None, None, 2 0           block2d_bn[0][0]
__________________________________________________________________________________________________
block2d_se_squeeze (GlobalAvera (None, 240)          0           block2d_activation[0][0]
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block2d_se_reshape (Reshape)    (None, 1, 1, 240)    0           block2d_se_squeeze[0][0]
__________________________________________________________________________________________________
block2d_se_reduce (Conv2D)      (None, 1, 1, 10)     2410        block2d_se_reshape[0][0]
__________________________________________________________________________________________________
block2d_se_expand (Conv2D)      (None, 1, 1, 240)    2640        block2d_se_reduce[0][0]
__________________________________________________________________________________________________
block2d_se_excite (Multiply)    (None, None, None, 2 0           block2d_activation[0][0]
                                                                 block2d_se_expand[0][0]
__________________________________________________________________________________________________
block2d_project_conv (Conv2D)   (None, None, None, 4 9600        block2d_se_excite[0][0]
__________________________________________________________________________________________________
block2d_project_bn (BatchNormal (None, None, None, 4 160         block2d_project_conv[0][0]
__________________________________________________________________________________________________
block2d_drop (FixedDropout)     (None, None, None, 4 0           block2d_project_bn[0][0]
__________________________________________________________________________________________________
block2d_add (Add)               (None, None, None, 4 0           block2d_drop[0][0]
                                                                 block2c_add[0][0]
__________________________________________________________________________________________________
block2e_expand_conv (Conv2D)    (None, None, None, 2 9600        block2d_add[0][0]
__________________________________________________________________________________________________
block2e_expand_bn (BatchNormali (None, None, None, 2 960         block2e_expand_conv[0][0]
__________________________________________________________________________________________________
block2e_expand_activation (Acti (None, None, None, 2 0           block2e_expand_bn[0][0]
__________________________________________________________________________________________________
block2e_dwconv (DepthwiseConv2D (None, None, None, 2 2160        block2e_expand_activation[0][0]
__________________________________________________________________________________________________
block2e_bn (BatchNormalization) (None, None, None, 2 960         block2e_dwconv[0][0]
__________________________________________________________________________________________________
block2e_activation (Activation) (None, None, None, 2 0           block2e_bn[0][0]
__________________________________________________________________________________________________
block2e_se_squeeze (GlobalAvera (None, 240)          0           block2e_activation[0][0]
__________________________________________________________________________________________________
block2e_se_reshape (Reshape)    (None, 1, 1, 240)    0           block2e_se_squeeze[0][0]
__________________________________________________________________________________________________
block2e_se_reduce (Conv2D)      (None, 1, 1, 10)     2410        block2e_se_reshape[0][0]
__________________________________________________________________________________________________
block2e_se_expand (Conv2D)      (None, 1, 1, 240)    2640        block2e_se_reduce[0][0]
__________________________________________________________________________________________________
block2e_se_excite (Multiply)    (None, None, None, 2 0           block2e_activation[0][0]
                                                                 block2e_se_expand[0][0]
__________________________________________________________________________________________________
block2e_project_conv (Conv2D)   (None, None, None, 4 9600        block2e_se_excite[0][0]
__________________________________________________________________________________________________
block2e_project_bn (BatchNormal (None, None, None, 4 160         block2e_project_conv[0][0]
__________________________________________________________________________________________________
block2e_drop (FixedDropout)     (None, None, None, 4 0           block2e_project_bn[0][0]
__________________________________________________________________________________________________
block2e_add (Add)               (None, None, None, 4 0           block2e_drop[0][0]
                                                                 block2d_add[0][0]
__________________________________________________________________________________________________
block3a_expand_conv (Conv2D)    (None, None, None, 2 9600        block2e_add[0][0]
__________________________________________________________________________________________________
block3a_expand_bn (BatchNormali (None, None, None, 2 960         block3a_expand_conv[0][0]
__________________________________________________________________________________________________
block3a_expand_activation (Acti (None, None, None, 2 0           block3a_expand_bn[0][0]
__________________________________________________________________________________________________
block3a_dwconv (DepthwiseConv2D (None, None, None, 2 6000        block3a_expand_activation[0][0]
__________________________________________________________________________________________________
block3a_bn (BatchNormalization) (None, None, None, 2 960         block3a_dwconv[0][0]
__________________________________________________________________________________________________
block3a_activation (Activation) (None, None, None, 2 0           block3a_bn[0][0]
__________________________________________________________________________________________________
block3a_se_squeeze (GlobalAvera (None, 240)          0           block3a_activation[0][0]
__________________________________________________________________________________________________
block3a_se_reshape (Reshape)    (None, 1, 1, 240)    0           block3a_se_squeeze[0][0]
__________________________________________________________________________________________________
block3a_se_reduce (Conv2D)      (None, 1, 1, 10)     2410        block3a_se_reshape[0][0]
__________________________________________________________________________________________________
block3a_se_expand (Conv2D)      (None, 1, 1, 240)    2640        block3a_se_reduce[0][0]
__________________________________________________________________________________________________
block3a_se_excite (Multiply)    (None, None, None, 2 0           block3a_activation[0][0]
                                                                 block3a_se_expand[0][0]
__________________________________________________________________________________________________
block3a_project_conv (Conv2D)   (None, None, None, 6 15360       block3a_se_excite[0][0]
__________________________________________________________________________________________________
block3a_project_bn (BatchNormal (None, None, None, 6 256         block3a_project_conv[0][0]
__________________________________________________________________________________________________
block3b_expand_conv (Conv2D)    (None, None, None, 3 24576       block3a_project_bn[0][0]
__________________________________________________________________________________________________
block3b_expand_bn (BatchNormali (None, None, None, 3 1536        block3b_expand_conv[0][0]
__________________________________________________________________________________________________
block3b_expand_activation (Acti (None, None, None, 3 0           block3b_expand_bn[0][0]
__________________________________________________________________________________________________
block3b_dwconv (DepthwiseConv2D (None, None, None, 3 9600        block3b_expand_activation[0][0]
__________________________________________________________________________________________________
block3b_bn (BatchNormalization) (None, None, None, 3 1536        block3b_dwconv[0][0]
__________________________________________________________________________________________________
block3b_activation (Activation) (None, None, None, 3 0           block3b_bn[0][0]
__________________________________________________________________________________________________
block3b_se_squeeze (GlobalAvera (None, 384)          0           block3b_activation[0][0]
```

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__________________________________________________________________________________________________
block3b_se_reshape (Reshape)    (None, 1, 1, 384)    0           block3b_se_squeeze[0][0]
__________________________________________________________________________________________________
block3b_se_reduce (Conv2D)      (None, 1, 1, 16)     6160        block3b_se_reshape[0][0]
__________________________________________________________________________________________________
block3b_se_expand (Conv2D)      (None, 1, 1, 384)    6528        block3b_se_reduce[0][0]
__________________________________________________________________________________________________
block3b_se_excite (Multiply)    (None, None, None, 3 0           block3b_activation[0][0]
                                                                 block3b_se_expand[0][0]
__________________________________________________________________________________________________
block3b_project_conv (Conv2D)   (None, None, None, 6 24576       block3b_se_excite[0][0]
__________________________________________________________________________________________________
block3b_project_bn (BatchNormal (None, None, None, 6 256         block3b_project_conv[0][0]
__________________________________________________________________________________________________
block3b_drop (FixedDropout)     (None, None, None, 6 0           block3b_project_bn[0][0]
__________________________________________________________________________________________________
block3b_add (Add)               (None, None, None, 6 0           block3b_drop[0][0]
                                                                 block3a_project_bn[0][0]
__________________________________________________________________________________________________
block3c_expand_conv (Conv2D)    (None, None, None, 3 24576       block3b_add[0][0]
__________________________________________________________________________________________________
block3c_expand_bn (BatchNormali (None, None, None, 3 1536        block3c_expand_conv[0][0]
__________________________________________________________________________________________________
block3c_expand_activation (Acti (None, None, None, 3 0           block3c_expand_bn[0][0]
__________________________________________________________________________________________________
block3c_dwconv (DepthwiseConv2D (None, None, None, 3 9600        block3c_expand_activation[0][0]
__________________________________________________________________________________________________
block3c_bn (BatchNormalization) (None, None, None, 3 1536        block3c_dwconv[0][0]
__________________________________________________________________________________________________
block3c_activation (Activation) (None, None, None, 3 0           block3c_bn[0][0]
__________________________________________________________________________________________________
block3c_se_squeeze (GlobalAvera (None, 384)          0           block3c_activation[0][0]
__________________________________________________________________________________________________
block3c_se_reshape (Reshape)    (None, 1, 1, 384)    0           block3c_se_squeeze[0][0]
__________________________________________________________________________________________________
block3c_se_reduce (Conv2D)      (None, 1, 1, 16)     6160        block3c_se_reshape[0][0]
__________________________________________________________________________________________________
block3c_se_expand (Conv2D)      (None, 1, 1, 384)    6528        block3c_se_reduce[0][0]
__________________________________________________________________________________________________
block3c_se_excite (Multiply)    (None, None, None, 3 0           block3c_activation[0][0]
                                                                 block3c_se_expand[0][0]
__________________________________________________________________________________________________
block3c_project_conv (Conv2D)   (None, None, None, 6 24576       block3c_se_excite[0][0]
__________________________________________________________________________________________________
block3c_project_bn (BatchNormal (None, None, None, 6 256         block3c_project_conv[0][0]
__________________________________________________________________________________________________
block3c_drop (FixedDropout)     (None, None, None, 6 0           block3c_project_bn[0][0]
__________________________________________________________________________________________________
block3c_add (Add)               (None, None, None, 6 0           block3c_drop[0][0]
                                                                 block3b_add[0][0]
__________________________________________________________________________________________________
block3d_expand_conv (Conv2D)    (None, None, None, 3 24576       block3c_add[0][0]
__________________________________________________________________________________________________
block3d_expand_bn (BatchNormali (None, None, None, 3 1536        block3d_expand_conv[0][0]
__________________________________________________________________________________________________
block3d_expand_activation (Acti (None, None, None, 3 0           block3d_expand_bn[0][0]
__________________________________________________________________________________________________
block3d_dwconv (DepthwiseConv2D (None, None, None, 3 9600        block3d_expand_activation[0][0]
__________________________________________________________________________________________________
block3d_bn (BatchNormalization) (None, None, None, 3 1536        block3d_dwconv[0][0]
__________________________________________________________________________________________________
block3d_activation (Activation) (None, None, None, 3 0           block3d_bn[0][0]
__________________________________________________________________________________________________
block3d_se_squeeze (GlobalAvera (None, 384)          0           block3d_activation[0][0]
__________________________________________________________________________________________________
block3d_se_reshape (Reshape)    (None, 1, 1, 384)    0           block3d_se_squeeze[0][0]
__________________________________________________________________________________________________
block3d_se_reduce (Conv2D)      (None, 1, 1, 16)     6160        block3d_se_reshape[0][0]
__________________________________________________________________________________________________
block3d_se_expand (Conv2D)      (None, 1, 1, 384)    6528        block3d_se_reduce[0][0]
__________________________________________________________________________________________________
block3d_se_excite (Multiply)    (None, None, None, 3 0           block3d_activation[0][0]
                                                                 block3d_se_expand[0][0]
__________________________________________________________________________________________________
block3d_project_conv (Conv2D)   (None, None, None, 6 24576       block3d_se_excite[0][0]
__________________________________________________________________________________________________
block3d_project_bn (BatchNormal (None, None, None, 6 256         block3d_project_conv[0][0]
__________________________________________________________________________________________________
block3d_drop (FixedDropout)     (None, None, None, 6 0           block3d_project_bn[0][0]
__________________________________________________________________________________________________
block3d_add (Add)               (None, None, None, 6 0           block3d_drop[0][0]
                                                                 block3c_add[0][0]
__________________________________________________________________________________________________
block3e_expand_conv (Conv2D)    (None, None, None, 3 24576       block3d_add[0][0]
__________________________________________________________________________________________________
block3e_expand_bn (BatchNormali (None, None, None, 3 1536        block3e_expand_conv[0][0]
__________________________________________________________________________________________________
block3e_expand_activation (Acti (None, None, None, 3 0           block3e_expand_bn[0][0]
__________________________________________________________________________________________________
block3e_dwconv (DepthwiseConv2D (None, None, None, 3 9600        block3e_expand_activation[0][0]
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__________________________________________________________________________________________________
block3e_bn (BatchNormalization) (None, None, None, 3 1536        block3e_dwconv[0][0]
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block3e_activation (Activation) (None, None, None, 3 0           block3e_bn[0][0]
__________________________________________________________________________________________________
block3e_se_squeeze (GlobalAvera (None, 384)          0           block3e_activation[0][0]
__________________________________________________________________________________________________
block3e_se_reshape (Reshape)    (None, 1, 1, 384)    0           block3e_se_squeeze[0][0]
__________________________________________________________________________________________________
block3e_se_reduce (Conv2D)      (None, 1, 1, 16)     6160        block3e_se_reshape[0][0]
__________________________________________________________________________________________________
block3e_se_expand (Conv2D)      (None, 1, 1, 384)    6528        block3e_se_reduce[0][0]
__________________________________________________________________________________________________
block3e_se_excite (Multiply)    (None, None, None, 3 0           block3e_activation[0][0]
                                                                 block3e_se_expand[0][0]
__________________________________________________________________________________________________
block3e_project_conv (Conv2D)   (None, None, None, 6 24576       block3e_se_excite[0][0]
__________________________________________________________________________________________________
block3e_project_bn (BatchNormal (None, None, None, 6 256         block3e_project_conv[0][0]
__________________________________________________________________________________________________
block3e_drop (FixedDropout)     (None, None, None, 6 0           block3e_project_bn[0][0]
__________________________________________________________________________________________________
block3e_add (Add)               (None, None, None, 6 0           block3e_drop[0][0]
                                                                 block3d_add[0][0]
__________________________________________________________________________________________________
block4a_expand_conv (Conv2D)    (None, None, None, 3 24576       block3e_add[0][0]
__________________________________________________________________________________________________
block4a_expand_bn (BatchNormali (None, None, None, 3 1536        block4a_expand_conv[0][0]
__________________________________________________________________________________________________
block4a_expand_activation (Acti (None, None, None, 3 0           block4a_expand_bn[0][0]
__________________________________________________________________________________________________
block4a_dwconv (DepthwiseConv2D (None, None, None, 3 3456        block4a_expand_activation[0][0]
__________________________________________________________________________________________________
block4a_bn (BatchNormalization) (None, None, None, 3 1536        block4a_dwconv[0][0]
__________________________________________________________________________________________________
block4a_activation (Activation) (None, None, None, 3 0           block4a_bn[0][0]
__________________________________________________________________________________________________
block4a_se_squeeze (GlobalAvera (None, 384)          0           block4a_activation[0][0]
__________________________________________________________________________________________________
block4a_se_reshape (Reshape)    (None, 1, 1, 384)    0           block4a_se_squeeze[0][0]
__________________________________________________________________________________________________
block4a_se_reduce (Conv2D)      (None, 1, 1, 16)     6160        block4a_se_reshape[0][0]
__________________________________________________________________________________________________
block4a_se_expand (Conv2D)      (None, 1, 1, 384)    6528        block4a_se_reduce[0][0]
__________________________________________________________________________________________________
block4a_se_excite (Multiply)    (None, None, None, 3 0           block4a_activation[0][0]
                                                                 block4a_se_expand[0][0]
__________________________________________________________________________________________________
block4a_project_conv (Conv2D)   (None, None, None, 1 49152       block4a_se_excite[0][0]
__________________________________________________________________________________________________
block4a_project_bn (BatchNormal (None, None, None, 1 512         block4a_project_conv[0][0]
__________________________________________________________________________________________________
block4b_expand_conv (Conv2D)    (None, None, None, 7 98304       block4a_project_bn[0][0]
__________________________________________________________________________________________________
block4b_expand_bn (BatchNormali (None, None, None, 7 3072        block4b_expand_conv[0][0]
__________________________________________________________________________________________________
block4b_expand_activation (Acti (None, None, None, 7 0           block4b_expand_bn[0][0]
__________________________________________________________________________________________________
block4b_dwconv (DepthwiseConv2D (None, None, None, 7 6912        block4b_expand_activation[0][0]
__________________________________________________________________________________________________
block4b_bn (BatchNormalization) (None, None, None, 7 3072        block4b_dwconv[0][0]
__________________________________________________________________________________________________
block4b_activation (Activation) (None, None, None, 7 0           block4b_bn[0][0]
__________________________________________________________________________________________________
block4b_se_squeeze (GlobalAvera (None, 768)          0           block4b_activation[0][0]
__________________________________________________________________________________________________
block4b_se_reshape (Reshape)    (None, 1, 1, 768)    0           block4b_se_squeeze[0][0]
__________________________________________________________________________________________________
block4b_se_reduce (Conv2D)      (None, 1, 1, 32)     24608       block4b_se_reshape[0][0]
__________________________________________________________________________________________________
block4b_se_expand (Conv2D)      (None, 1, 1, 768)    25344       block4b_se_reduce[0][0]
__________________________________________________________________________________________________
block4b_se_excite (Multiply)    (None, None, None, 7 0           block4b_activation[0][0]
                                                                 block4b_se_expand[0][0]
__________________________________________________________________________________________________
block4b_project_conv (Conv2D)   (None, None, None, 1 98304       block4b_se_excite[0][0]
__________________________________________________________________________________________________
block4b_project_bn (BatchNormal (None, None, None, 1 512         block4b_project_conv[0][0]
__________________________________________________________________________________________________
block4b_drop (FixedDropout)     (None, None, None, 1 0           block4b_project_bn[0][0]
__________________________________________________________________________________________________
block4b_add (Add)               (None, None, None, 1 0           block4b_drop[0][0]
                                                                 block4a_project_bn[0][0]
__________________________________________________________________________________________________
block4c_expand_conv (Conv2D)    (None, None, None, 7 98304       block4b_add[0][0]
__________________________________________________________________________________________________
block4c_expand_bn (BatchNormali (None, None, None, 7 3072        block4c_expand_conv[0][0]
__________________________________________________________________________________________________
block4c_expand_activation (Acti (None, None, None, 7 0           block4c_expand_bn[0][0]
__________________________________________________________________________________________________
block4c_dwconv (DepthwiseConv2D (None, None, None, 7 6912        block4c_expand_activation[0][0]
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block4c_dwconv (DepthwiseConv2D (None, None, None, 7 6912        block4c_expand_activation[0][0]
__________________________________________________________________________________________________
block4c_bn (BatchNormalization) (None, None, None, 7 3072        block4c_dwconv[0][0]
__________________________________________________________________________________________________
block4c_activation (Activation) (None, None, None, 7 0           block4c_bn[0][0]
__________________________________________________________________________________________________
block4c_se_squeeze (GlobalAvera (None, 768)          0           block4c_activation[0][0]
__________________________________________________________________________________________________
block4c_se_reshape (Reshape)    (None, 1, 1, 768)    0           block4c_se_squeeze[0][0]
__________________________________________________________________________________________________
block4c_se_reduce (Conv2D)      (None, 1, 1, 32)     24608       block4c_se_reshape[0][0]
__________________________________________________________________________________________________
block4c_se_expand (Conv2D)      (None, 1, 1, 768)    25344       block4c_se_reduce[0][0]
__________________________________________________________________________________________________
block4c_se_excite (Multiply)    (None, None, None, 7 0           block4c_activation[0][0]
                                                                 block4c_se_expand[0][0]
__________________________________________________________________________________________________
block4c_project_conv (Conv2D)   (None, None, None, 1 98304       block4c_se_excite[0][0]
__________________________________________________________________________________________________
block4c_project_bn (BatchNormal (None, None, None, 1 512         block4c_project_conv[0][0]
__________________________________________________________________________________________________
block4c_drop (FixedDropout)     (None, None, None, 1 0           block4c_project_bn[0][0]
__________________________________________________________________________________________________
block4c_add (Add)               (None, None, None, 1 0           block4c_drop[0][0]
                                                                 block4b_add[0][0]
__________________________________________________________________________________________________
block4d_expand_conv (Conv2D)    (None, None, None, 7 98304       block4c_add[0][0]
__________________________________________________________________________________________________
block4d_expand_bn (BatchNormali (None, None, None, 7 3072        block4d_expand_conv[0][0]
__________________________________________________________________________________________________
block4d_expand_activation (Acti (None, None, None, 7 0           block4d_expand_bn[0][0]
__________________________________________________________________________________________________
block4d_dwconv (DepthwiseConv2D (None, None, None, 7 6912        block4d_expand_activation[0][0]
__________________________________________________________________________________________________
block4d_bn (BatchNormalization) (None, None, None, 7 3072        block4d_dwconv[0][0]
__________________________________________________________________________________________________
block4d_activation (Activation) (None, None, None, 7 0           block4d_bn[0][0]
__________________________________________________________________________________________________
block4d_se_squeeze (GlobalAvera (None, 768)          0           block4d_activation[0][0]
__________________________________________________________________________________________________
block4d_se_reshape (Reshape)    (None, 1, 1, 768)    0           block4d_se_squeeze[0][0]
__________________________________________________________________________________________________
block4d_se_reduce (Conv2D)      (None, 1, 1, 32)     24608       block4d_se_reshape[0][0]
__________________________________________________________________________________________________
block4d_se_expand (Conv2D)      (None, 1, 1, 768)    25344       block4d_se_reduce[0][0]
__________________________________________________________________________________________________
block4d_se_excite (Multiply)    (None, None, None, 7 0           block4d_activation[0][0]
                                                                 block4d_se_expand[0][0]
__________________________________________________________________________________________________
block4d_project_conv (Conv2D)   (None, None, None, 1 98304       block4d_se_excite[0][0]
__________________________________________________________________________________________________
block4d_project_bn (BatchNormal (None, None, None, 1 512         block4d_project_conv[0][0]
__________________________________________________________________________________________________
block4d_drop (FixedDropout)     (None, None, None, 1 0           block4d_project_bn[0][0]
__________________________________________________________________________________________________
block4d_add (Add)               (None, None, None, 1 0           block4d_drop[0][0]
                                                                 block4c_add[0][0]
__________________________________________________________________________________________________
block4e_expand_conv (Conv2D)    (None, None, None, 7 98304       block4d_add[0][0]
__________________________________________________________________________________________________
block4e_expand_bn (BatchNormali (None, None, None, 7 3072        block4e_expand_conv[0][0]
__________________________________________________________________________________________________
block4e_expand_activation (Acti (None, None, None, 7 0           block4e_expand_bn[0][0]
__________________________________________________________________________________________________
block4e_dwconv (DepthwiseConv2D (None, None, None, 7 6912        block4e_expand_activation[0][0]
__________________________________________________________________________________________________
block4e_bn (BatchNormalization) (None, None, None, 7 3072        block4e_dwconv[0][0]
__________________________________________________________________________________________________
block4e_activation (Activation) (None, None, None, 7 0           block4e_bn[0][0]
__________________________________________________________________________________________________
block4e_se_squeeze (GlobalAvera (None, 768)          0           block4e_activation[0][0]
__________________________________________________________________________________________________
block4e_se_reshape (Reshape)    (None, 1, 1, 768)    0           block4e_se_squeeze[0][0]
__________________________________________________________________________________________________
block4e_se_reduce (Conv2D)      (None, 1, 1, 32)     24608       block4e_se_reshape[0][0]
__________________________________________________________________________________________________
block4e_se_expand (Conv2D)      (None, 1, 1, 768)    25344       block4e_se_reduce[0][0]
__________________________________________________________________________________________________
block4e_se_excite (Multiply)    (None, None, None, 7 0           block4e_activation[0][0]
                                                                 block4e_se_expand[0][0]
__________________________________________________________________________________________________
block4e_project_conv (Conv2D)   (None, None, None, 1 98304       block4e_se_excite[0][0]
__________________________________________________________________________________________________
block4e_project_bn (BatchNormal (None, None, None, 1 512         block4e_project_conv[0][0]
__________________________________________________________________________________________________
block4e_drop (FixedDropout)     (None, None, None, 1 0           block4e_project_bn[0][0]
__________________________________________________________________________________________________
block4e_add (Add)               (None, None, None, 1 0           block4e_drop[0][0]
                                                                 block4d_add[0][0]
__________________________________________________________________________________________________
block4f_expand_conv (Conv2D)    (None, None, None, 7 98304       block4e_add[0][0]
```

```
block4f_expand_conv (Conv2D)    (None, None, None, 7 98304       block4e_add[0][0]
__________________________________________________________________________________________________
block4f_expand_bn (BatchNormali (None, None, None, 7 3072        block4f_expand_conv[0][0]
__________________________________________________________________________________________________
block4f_expand_activation (Acti (None, None, None, 7 0           block4f_expand_bn[0][0]
__________________________________________________________________________________________________
block4f_dwconv (DepthwiseConv2D (None, None, None, 7 6912        block4f_expand_activation[0][0]
__________________________________________________________________________________________________
block4f_bn (BatchNormalization) (None, None, None, 7 3072        block4f_dwconv[0][0]
__________________________________________________________________________________________________
block4f_activation (Activation) (None, None, None, 7 0           block4f_bn[0][0]
__________________________________________________________________________________________________
block4f_se_squeeze (GlobalAvera (None, 768)          0           block4f_activation[0][0]
__________________________________________________________________________________________________
block4f_se_reshape (Reshape)    (None, 1, 1, 768)    0           block4f_se_squeeze[0][0]
__________________________________________________________________________________________________
block4f_se_reduce (Conv2D)      (None, 1, 1, 32)     24608       block4f_se_reshape[0][0]
__________________________________________________________________________________________________
block4f_se_expand (Conv2D)      (None, 1, 1, 768)    25344       block4f_se_reduce[0][0]
__________________________________________________________________________________________________
block4f_se_excite (Multiply)    (None, None, None, 7 0           block4f_activation[0][0]
                                                                 block4f_se_expand[0][0]
__________________________________________________________________________________________________
block4f_project_conv (Conv2D)   (None, None, None, 1 98304       block4f_se_excite[0][0]
__________________________________________________________________________________________________
block4f_project_bn (BatchNormal (None, None, None, 1 512         block4f_project_conv[0][0]
__________________________________________________________________________________________________
block4f_drop (FixedDropout)     (None, None, None, 1 0           block4f_project_bn[0][0]
__________________________________________________________________________________________________
block4f_add (Add)               (None, None, None, 1 0           block4f_drop[0][0]
                                                                 block4e_add[0][0]
__________________________________________________________________________________________________
block4g_expand_conv (Conv2D)    (None, None, None, 7 98304       block4f_add[0][0]
__________________________________________________________________________________________________
block4g_expand_bn (BatchNormali (None, None, None, 7 3072        block4g_expand_conv[0][0]
__________________________________________________________________________________________________
block4g_expand_activation (Acti (None, None, None, 7 0           block4g_expand_bn[0][0]
__________________________________________________________________________________________________
block4g_dwconv (DepthwiseConv2D (None, None, None, 7 6912        block4g_expand_activation[0][0]
__________________________________________________________________________________________________
block4g_bn (BatchNormalization) (None, None, None, 7 3072        block4g_dwconv[0][0]
__________________________________________________________________________________________________
block4g_activation (Activation) (None, None, None, 7 0           block4g_bn[0][0]
__________________________________________________________________________________________________
block4g_se_squeeze (GlobalAvera (None, 768)          0           block4g_activation[0][0]
__________________________________________________________________________________________________
block4g_se_reshape (Reshape)    (None, 1, 1, 768)    0           block4g_se_squeeze[0][0]
__________________________________________________________________________________________________
block4g_se_reduce (Conv2D)      (None, 1, 1, 32)     24608       block4g_se_reshape[0][0]
__________________________________________________________________________________________________
block4g_se_expand (Conv2D)      (None, 1, 1, 768)    25344       block4g_se_reduce[0][0]
__________________________________________________________________________________________________
block4g_se_excite (Multiply)    (None, None, None, 7 0           block4g_activation[0][0]
                                                                 block4g_se_expand[0][0]
__________________________________________________________________________________________________
block4g_project_conv (Conv2D)   (None, None, None, 1 98304       block4g_se_excite[0][0]
__________________________________________________________________________________________________
block4g_project_bn (BatchNormal (None, None, None, 1 512         block4g_project_conv[0][0]
__________________________________________________________________________________________________
block4g_drop (FixedDropout)     (None, None, None, 1 0           block4g_project_bn[0][0]
__________________________________________________________________________________________________
block4g_add (Add)               (None, None, None, 1 0           block4g_drop[0][0]
                                                                 block4f_add[0][0]
__________________________________________________________________________________________________
block5a_expand_conv (Conv2D)    (None, None, None, 7 98304       block4g_add[0][0]
__________________________________________________________________________________________________
block5a_expand_bn (BatchNormali (None, None, None, 7 3072        block5a_expand_conv[0][0]
__________________________________________________________________________________________________
block5a_expand_activation (Acti (None, None, None, 7 0           block5a_expand_bn[0][0]
__________________________________________________________________________________________________
block5a_dwconv (DepthwiseConv2D (None, None, None, 7 19200       block5a_expand_activation[0][0]
__________________________________________________________________________________________________
block5a_bn (BatchNormalization) (None, None, None, 7 3072        block5a_dwconv[0][0]
__________________________________________________________________________________________________
block5a_activation (Activation) (None, None, None, 7 0           block5a_bn[0][0]
__________________________________________________________________________________________________
block5a_se_squeeze (GlobalAvera (None, 768)          0           block5a_activation[0][0]
__________________________________________________________________________________________________
block5a_se_reshape (Reshape)    (None, 1, 1, 768)    0           block5a_se_squeeze[0][0]
__________________________________________________________________________________________________
block5a_se_reduce (Conv2D)      (None, 1, 1, 32)     24608       block5a_se_reshape[0][0]
__________________________________________________________________________________________________
block5a_se_expand (Conv2D)      (None, 1, 1, 768)    25344       block5a_se_reduce[0][0]
__________________________________________________________________________________________________
block5a_se_excite (Multiply)    (None, None, None, 7 0           block5a_activation[0][0]
                                                                 block5a_se_expand[0][0]
__________________________________________________________________________________________________
block5a_project_conv (Conv2D)   (None, None, None, 1 135168      block5a_se_excite[0][0]
__________________________________________________________________________________________________
block5a_project_bn (BatchNormal (None, None, None, 1 704         block5a_project_conv[0][0]
```

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__________________________________________________________________________________________________
block5b_expand_conv (Conv2D)    (None, None, None, 1 185856      block5a_project_bn[0][0]
__________________________________________________________________________________________________
block5b_expand_bn (BatchNormali (None, None, None, 1 4224        block5b_expand_conv[0][0]
__________________________________________________________________________________________________
block5b_expand_activation (Acti (None, None, None, 1 0           block5b_expand_bn[0][0]
__________________________________________________________________________________________________
block5b_dwconv (DepthwiseConv2D (None, None, None, 1 26400       block5b_expand_activation[0][0]
__________________________________________________________________________________________________
block5b_bn (BatchNormalization) (None, None, None, 1 4224        block5b_dwconv[0][0]
__________________________________________________________________________________________________
block5b_activation (Activation) (None, None, None, 1 0           block5b_bn[0][0]
__________________________________________________________________________________________________
block5b_se_squeeze (GlobalAvera (None, 1056)         0           block5b_activation[0][0]
__________________________________________________________________________________________________
block5b_se_reshape (Reshape)    (None, 1, 1, 1056)   0           block5b_se_squeeze[0][0]
__________________________________________________________________________________________________
block5b_se_reduce (Conv2D)      (None, 1, 1, 44)     46508       block5b_se_reshape[0][0]
__________________________________________________________________________________________________
block5b_se_expand (Conv2D)      (None, 1, 1, 1056)   47520       block5b_se_reduce[0][0]
__________________________________________________________________________________________________
block5b_se_excite (Multiply)    (None, None, None, 1 0           block5b_activation[0][0]
                                                                 block5b_se_expand[0][0]
__________________________________________________________________________________________________
block5b_project_conv (Conv2D)   (None, None, None, 1 185856      block5b_se_excite[0][0]
__________________________________________________________________________________________________
block5b_project_bn (BatchNormal (None, None, None, 1 704         block5b_project_conv[0][0]
__________________________________________________________________________________________________
block5b_drop (FixedDropout)     (None, None, None, 1 0           block5b_project_bn[0][0]
__________________________________________________________________________________________________
block5b_add (Add)               (None, None, None, 1 0           block5b_drop[0][0]
                                                                 block5a_project_bn[0][0]
__________________________________________________________________________________________________
block5c_expand_conv (Conv2D)    (None, None, None, 1 185856      block5b_add[0][0]
__________________________________________________________________________________________________
block5c_expand_bn (BatchNormali (None, None, None, 1 4224        block5c_expand_conv[0][0]
__________________________________________________________________________________________________
block5c_expand_activation (Acti (None, None, None, 1 0           block5c_expand_bn[0][0]
__________________________________________________________________________________________________
block5c_dwconv (DepthwiseConv2D (None, None, None, 1 26400       block5c_expand_activation[0][0]
__________________________________________________________________________________________________
block5c_bn (BatchNormalization) (None, None, None, 1 4224        block5c_dwconv[0][0]
__________________________________________________________________________________________________
block5c_activation (Activation) (None, None, None, 1 0           block5c_bn[0][0]
__________________________________________________________________________________________________
block5c_se_squeeze (GlobalAvera (None, 1056)         0           block5c_activation[0][0]
__________________________________________________________________________________________________
block5c_se_reshape (Reshape)    (None, 1, 1, 1056)   0           block5c_se_squeeze[0][0]
__________________________________________________________________________________________________
block5c_se_reduce (Conv2D)      (None, 1, 1, 44)     46508       block5c_se_reshape[0][0]
__________________________________________________________________________________________________
block5c_se_expand (Conv2D)      (None, 1, 1, 1056)   47520       block5c_se_reduce[0][0]
__________________________________________________________________________________________________
block5c_se_excite (Multiply)    (None, None, None, 1 0           block5c_activation[0][0]
                                                                 block5c_se_expand[0][0]
__________________________________________________________________________________________________
block5c_project_conv (Conv2D)   (None, None, None, 1 185856      block5c_se_excite[0][0]
__________________________________________________________________________________________________
block5c_project_bn (BatchNormal (None, None, None, 1 704         block5c_project_conv[0][0]
__________________________________________________________________________________________________
block5c_drop (FixedDropout)     (None, None, None, 1 0           block5c_project_bn[0][0]
__________________________________________________________________________________________________
block5c_add (Add)               (None, None, None, 1 0           block5c_drop[0][0]
                                                                 block5b_add[0][0]
__________________________________________________________________________________________________
block5d_expand_conv (Conv2D)    (None, None, None, 1 185856      block5c_add[0][0]
__________________________________________________________________________________________________
block5d_expand_bn (BatchNormali (None, None, None, 1 4224        block5d_expand_conv[0][0]
__________________________________________________________________________________________________
block5d_expand_activation (Acti (None, None, None, 1 0           block5d_expand_bn[0][0]
__________________________________________________________________________________________________
block5d_dwconv (DepthwiseConv2D (None, None, None, 1 26400       block5d_expand_activation[0][0]
__________________________________________________________________________________________________
block5d_bn (BatchNormalization) (None, None, None, 1 4224        block5d_dwconv[0][0]
__________________________________________________________________________________________________
block5d_activation (Activation) (None, None, None, 1 0           block5d_bn[0][0]
__________________________________________________________________________________________________
block5d_se_squeeze (GlobalAvera (None, 1056)         0           block5d_activation[0][0]
__________________________________________________________________________________________________
block5d_se_reshape (Reshape)    (None, 1, 1, 1056)   0           block5d_se_squeeze[0][0]
__________________________________________________________________________________________________
block5d_se_reduce (Conv2D)      (None, 1, 1, 44)     46508       block5d_se_reshape[0][0]
__________________________________________________________________________________________________
block5d_se_expand (Conv2D)      (None, 1, 1, 1056)   47520       block5d_se_reduce[0][0]
__________________________________________________________________________________________________
block5d_se_excite (Multiply)    (None, None, None, 1 0           block5d_activation[0][0]
                                                                 block5d_se_expand[0][0]
__________________________________________________________________________________________________
block5d_project_conv (Conv2D)   (None, None, None, 1 185856      block5d_se_excite[0][0]
__________________________________________________________________________________________________
block5d_project_bn (BatchNormal (None, None, None, 1 704         block5d_project_conv[0][0]
```

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__________________________________________________________________________________________________
block5d_drop (FixedDropout)     (None, None, None, 1 0           block5d_project_bn[0][0]
__________________________________________________________________________________________________
block5d_add (Add)               (None, None, None, 1 0           block5d_drop[0][0]
                                                                 block5c_add[0][0]
__________________________________________________________________________________________________
block5e_expand_conv (Conv2D)    (None, None, None, 1 185856      block5d_add[0][0]
__________________________________________________________________________________________________
block5e_expand_bn (BatchNormali (None, None, None, 1 4224        block5e_expand_conv[0][0]
__________________________________________________________________________________________________
block5e_expand_activation (Acti (None, None, None, 1 0           block5e_expand_bn[0][0]
__________________________________________________________________________________________________
block5e_dwconv (DepthwiseConv2D (None, None, None, 1 26400       block5e_expand_activation[0][0]
__________________________________________________________________________________________________
block5e_bn (BatchNormalization) (None, None, None, 1 4224        block5e_dwconv[0][0]
__________________________________________________________________________________________________
block5e_activation (Activation) (None, None, None, 1 0           block5e_bn[0][0]
__________________________________________________________________________________________________
block5e_se_squeeze (GlobalAvera (None, 1056)         0           block5e_activation[0][0]
__________________________________________________________________________________________________
block5e_se_reshape (Reshape)    (None, 1, 1, 1056)   0           block5e_se_squeeze[0][0]
__________________________________________________________________________________________________
block5e_se_reduce (Conv2D)      (None, 1, 1, 44)     46508       block5e_se_reshape[0][0]
__________________________________________________________________________________________________
block5e_se_expand (Conv2D)      (None, 1, 1, 1056)   47520       block5e_se_reduce[0][0]
__________________________________________________________________________________________________
block5e_se_excite (Multiply)    (None, None, None, 1 0           block5e_activation[0][0]
                                                                 block5e_se_expand[0][0]
__________________________________________________________________________________________________
block5e_project_conv (Conv2D)   (None, None, None, 1 185856      block5e_se_excite[0][0]
__________________________________________________________________________________________________
block5e_project_bn (BatchNormal (None, None, None, 1 704         block5e_project_conv[0][0]
__________________________________________________________________________________________________
block5e_drop (FixedDropout)     (None, None, None, 1 0           block5e_project_bn[0][0]
__________________________________________________________________________________________________
block5e_add (Add)               (None, None, None, 1 0           block5e_drop[0][0]
                                                                 block5d_add[0][0]
__________________________________________________________________________________________________
block5f_expand_conv (Conv2D)    (None, None, None, 1 185856      block5e_add[0][0]
__________________________________________________________________________________________________
block5f_expand_bn (BatchNormali (None, None, None, 1 4224        block5f_expand_conv[0][0]
__________________________________________________________________________________________________
block5f_expand_activation (Acti (None, None, None, 1 0           block5f_expand_bn[0][0]
__________________________________________________________________________________________________
block5f_dwconv (DepthwiseConv2D (None, None, None, 1 26400       block5f_expand_activation[0][0]
__________________________________________________________________________________________________
block5f_bn (BatchNormalization) (None, None, None, 1 4224        block5f_dwconv[0][0]
__________________________________________________________________________________________________
block5f_activation (Activation) (None, None, None, 1 0           block5f_bn[0][0]
__________________________________________________________________________________________________
block5f_se_squeeze (GlobalAvera (None, 1056)         0           block5f_activation[0][0]
__________________________________________________________________________________________________
block5f_se_reshape (Reshape)    (None, 1, 1, 1056)   0           block5f_se_squeeze[0][0]
__________________________________________________________________________________________________
block5f_se_reduce (Conv2D)      (None, 1, 1, 44)     46508       block5f_se_reshape[0][0]
__________________________________________________________________________________________________
block5f_se_expand (Conv2D)      (None, 1, 1, 1056)   47520       block5f_se_reduce[0][0]
__________________________________________________________________________________________________
block5f_se_excite (Multiply)    (None, None, None, 1 0           block5f_activation[0][0]
                                                                 block5f_se_expand[0][0]
__________________________________________________________________________________________________
block5f_project_conv (Conv2D)   (None, None, None, 1 185856      block5f_se_excite[0][0]
__________________________________________________________________________________________________
block5f_project_bn (BatchNormal (None, None, None, 1 704         block5f_project_conv[0][0]
__________________________________________________________________________________________________
block5f_drop (FixedDropout)     (None, None, None, 1 0           block5f_project_bn[0][0]
__________________________________________________________________________________________________
block5f_add (Add)               (None, None, None, 1 0           block5f_drop[0][0]
                                                                 block5e_add[0][0]
__________________________________________________________________________________________________
block5g_expand_conv (Conv2D)    (None, None, None, 1 185856      block5f_add[0][0]
__________________________________________________________________________________________________
block5g_expand_bn (BatchNormali (None, None, None, 1 4224        block5g_expand_conv[0][0]
__________________________________________________________________________________________________
block5g_expand_activation (Acti (None, None, None, 1 0           block5g_expand_bn[0][0]
__________________________________________________________________________________________________
block5g_dwconv (DepthwiseConv2D (None, None, None, 1 26400       block5g_expand_activation[0][0]
__________________________________________________________________________________________________
block5g_bn (BatchNormalization) (None, None, None, 1 4224        block5g_dwconv[0][0]
__________________________________________________________________________________________________
block5g_activation (Activation) (None, None, None, 1 0           block5g_bn[0][0]
__________________________________________________________________________________________________
block5g_se_squeeze (GlobalAvera (None, 1056)         0           block5g_activation[0][0]
__________________________________________________________________________________________________
block5g_se_reshape (Reshape)    (None, 1, 1, 1056)   0           block5g_se_squeeze[0][0]
__________________________________________________________________________________________________
block5g_se_reduce (Conv2D)      (None, 1, 1, 44)     46508       block5g_se_reshape[0][0]
__________________________________________________________________________________________________
block5g_se_expand (Conv2D)      (None, 1, 1, 1056)   47520       block5g_se_reduce[0][0]
__________________________________________________________________________________________________
```

```
block5g_se_excite (Multiply)    (None, None, None, 1 0           block5g_activation[0][0]
                                                                 block5g_se_expand[0][0]
__________________________________________________________________________________________________
block5g_project_conv (Conv2D)   (None, None, None, 1 185856      block5g_se_excite[0][0]
__________________________________________________________________________________________________
block5g_project_bn (BatchNormal (None, None, None, 1 704         block5g_project_conv[0][0]
__________________________________________________________________________________________________
block5g_drop (FixedDropout)     (None, None, None, 1 0           block5g_project_bn[0][0]
__________________________________________________________________________________________________
block5g_add (Add)               (None, None, None, 1 0           block5g_drop[0][0]
                                                                 block5f_add[0][0]
__________________________________________________________________________________________________
block6a_expand_conv (Conv2D)    (None, None, None, 1 185856      block5g_add[0][0]
__________________________________________________________________________________________________
block6a_expand_bn (BatchNormali (None, None, None, 1 4224        block6a_expand_conv[0][0]
__________________________________________________________________________________________________
block6a_expand_activation (Acti (None, None, None, 1 0           block6a_expand_bn[0][0]
__________________________________________________________________________________________________
block6a_dwconv (DepthwiseConv2D (None, None, None, 1 26400       block6a_expand_activation[0][0]
__________________________________________________________________________________________________
block6a_bn (BatchNormalization) (None, None, None, 1 4224        block6a_dwconv[0][0]
__________________________________________________________________________________________________
block6a_activation (Activation) (None, None, None, 1 0           block6a_bn[0][0]
__________________________________________________________________________________________________
block6a_se_squeeze (GlobalAvera (None, 1056)         0           block6a_activation[0][0]
__________________________________________________________________________________________________
block6a_se_reshape (Reshape)    (None, 1, 1, 1056)   0           block6a_se_squeeze[0][0]
__________________________________________________________________________________________________
block6a_se_reduce (Conv2D)      (None, 1, 1, 44)     46508       block6a_se_reshape[0][0]
__________________________________________________________________________________________________
block6a_se_expand (Conv2D)      (None, 1, 1, 1056)   47520       block6a_se_reduce[0][0]
__________________________________________________________________________________________________
block6a_se_excite (Multiply)    (None, None, None, 1 0           block6a_activation[0][0]
                                                                 block6a_se_expand[0][0]
__________________________________________________________________________________________________
block6a_project_conv (Conv2D)   (None, None, None, 3 321024      block6a_se_excite[0][0]
__________________________________________________________________________________________________
block6a_project_bn (BatchNormal (None, None, None, 3 1216        block6a_project_conv[0][0]
__________________________________________________________________________________________________
block6b_expand_conv (Conv2D)    (None, None, None, 1 554496      block6a_project_bn[0][0]
__________________________________________________________________________________________________
block6b_expand_bn (BatchNormali (None, None, None, 1 7296        block6b_expand_conv[0][0]
__________________________________________________________________________________________________
block6b_expand_activation (Acti (None, None, None, 1 0           block6b_expand_bn[0][0]
__________________________________________________________________________________________________
block6b_dwconv (DepthwiseConv2D (None, None, None, 1 45600       block6b_expand_activation[0][0]
__________________________________________________________________________________________________
block6b_bn (BatchNormalization) (None, None, None, 1 7296        block6b_dwconv[0][0]
__________________________________________________________________________________________________
block6b_activation (Activation) (None, None, None, 1 0           block6b_bn[0][0]
__________________________________________________________________________________________________
block6b_se_squeeze (GlobalAvera (None, 1824)         0           block6b_activation[0][0]
__________________________________________________________________________________________________
block6b_se_reshape (Reshape)    (None, 1, 1, 1824)   0           block6b_se_squeeze[0][0]
__________________________________________________________________________________________________
block6b_se_reduce (Conv2D)      (None, 1, 1, 76)     138700      block6b_se_reshape[0][0]
__________________________________________________________________________________________________
block6b_se_expand (Conv2D)      (None, 1, 1, 1824)   140448      block6b_se_reduce[0][0]
__________________________________________________________________________________________________
block6b_se_excite (Multiply)    (None, None, None, 1 0           block6b_activation[0][0]
                                                                 block6b_se_expand[0][0]
__________________________________________________________________________________________________
block6b_project_conv (Conv2D)   (None, None, None, 3 554496      block6b_se_excite[0][0]
__________________________________________________________________________________________________
block6b_project_bn (BatchNormal (None, None, None, 3 1216        block6b_project_conv[0][0]
__________________________________________________________________________________________________
block6b_drop (FixedDropout)     (None, None, None, 3 0           block6b_project_bn[0][0]
__________________________________________________________________________________________________
block6b_add (Add)               (None, None, None, 3 0           block6b_drop[0][0]
                                                                 block6a_project_bn[0][0]
__________________________________________________________________________________________________
block6c_expand_conv (Conv2D)    (None, None, None, 1 554496      block6b_add[0][0]
__________________________________________________________________________________________________
block6c_expand_bn (BatchNormali (None, None, None, 1 7296        block6c_expand_conv[0][0]
__________________________________________________________________________________________________
block6c_expand_activation (Acti (None, None, None, 1 0           block6c_expand_bn[0][0]
__________________________________________________________________________________________________
block6c_dwconv (DepthwiseConv2D (None, None, None, 1 45600       block6c_expand_activation[0][0]
__________________________________________________________________________________________________
block6c_bn (BatchNormalization) (None, None, None, 1 7296        block6c_dwconv[0][0]
__________________________________________________________________________________________________
block6c_activation (Activation) (None, None, None, 1 0           block6c_bn[0][0]
__________________________________________________________________________________________________
block6c_se_squeeze (GlobalAvera (None, 1824)         0           block6c_activation[0][0]
__________________________________________________________________________________________________
block6c_se_reshape (Reshape)    (None, 1, 1, 1824)   0           block6c_se_squeeze[0][0]
__________________________________________________________________________________________________
block6c_se_reduce (Conv2D)      (None, 1, 1, 76)     138700      block6c_se_reshape[0][0]
__________________________________________________________________________________________________
block6c_se_expand (Conv2D)      (None, 1, 1, 1824)   140448      block6c_se_reduce[0][0]
```

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__________________________________________________________________________________________________
block6c_se_excite (Multiply)    (None, None, None, 1 0           block6c_activation[0][0]
                                                                 block6c_se_expand[0][0]
__________________________________________________________________________________________________
block6c_project_conv (Conv2D)   (None, None, None, 3 554496      block6c_se_excite[0][0]
__________________________________________________________________________________________________
block6c_project_bn (BatchNormal (None, None, None, 3 1216        block6c_project_conv[0][0]
__________________________________________________________________________________________________
block6c_drop (FixedDropout)     (None, None, None, 3 0           block6c_project_bn[0][0]
__________________________________________________________________________________________________
block6c_add (Add)               (None, None, None, 3 0           block6c_drop[0][0]
                                                                 block6b_add[0][0]
__________________________________________________________________________________________________
block6d_expand_conv (Conv2D)    (None, None, None, 1 554496      block6c_add[0][0]
__________________________________________________________________________________________________
block6d_expand_bn (BatchNormali (None, None, None, 1 7296        block6d_expand_conv[0][0]
__________________________________________________________________________________________________
block6d_expand_activation (Acti (None, None, None, 1 0           block6d_expand_bn[0][0]
__________________________________________________________________________________________________
block6d_dwconv (DepthwiseConv2D (None, None, None, 1 45600       block6d_expand_activation[0][0]
__________________________________________________________________________________________________
block6d_bn (BatchNormalization) (None, None, None, 1 7296        block6d_dwconv[0][0]
__________________________________________________________________________________________________
block6d_activation (Activation) (None, None, None, 1 0           block6d_bn[0][0]
__________________________________________________________________________________________________
block6d_se_squeeze (GlobalAvera (None, 1824)         0           block6d_activation[0][0]
__________________________________________________________________________________________________
block6d_se_reshape (Reshape)    (None, 1, 1, 1824)   0           block6d_se_squeeze[0][0]
__________________________________________________________________________________________________
block6d_se_reduce (Conv2D)      (None, 1, 1, 76)     138700      block6d_se_reshape[0][0]
__________________________________________________________________________________________________
block6d_se_expand (Conv2D)      (None, 1, 1, 1824)   140448      block6d_se_reduce[0][0]
__________________________________________________________________________________________________
block6d_se_excite (Multiply)    (None, None, None, 1 0           block6d_activation[0][0]
                                                                 block6d_se_expand[0][0]
__________________________________________________________________________________________________
block6d_project_conv (Conv2D)   (None, None, None, 3 554496      block6d_se_excite[0][0]
__________________________________________________________________________________________________
block6d_project_bn (BatchNormal (None, None, None, 3 1216        block6d_project_conv[0][0]
__________________________________________________________________________________________________
block6d_drop (FixedDropout)     (None, None, None, 3 0           block6d_project_bn[0][0]
__________________________________________________________________________________________________
block6d_add (Add)               (None, None, None, 3 0           block6d_drop[0][0]
                                                                 block6c_add[0][0]
__________________________________________________________________________________________________
block6e_expand_conv (Conv2D)    (None, None, None, 1 554496      block6d_add[0][0]
__________________________________________________________________________________________________
block6e_expand_bn (BatchNormali (None, None, None, 1 7296        block6e_expand_conv[0][0]
__________________________________________________________________________________________________
block6e_expand_activation (Acti (None, None, None, 1 0           block6e_expand_bn[0][0]
__________________________________________________________________________________________________
block6e_dwconv (DepthwiseConv2D (None, None, None, 1 45600       block6e_expand_activation[0][0]
__________________________________________________________________________________________________
block6e_bn (BatchNormalization) (None, None, None, 1 7296        block6e_dwconv[0][0]
__________________________________________________________________________________________________
block6e_activation (Activation) (None, None, None, 1 0           block6e_bn[0][0]
__________________________________________________________________________________________________
block6e_se_squeeze (GlobalAvera (None, 1824)         0           block6e_activation[0][0]
__________________________________________________________________________________________________
block6e_se_reshape (Reshape)    (None, 1, 1, 1824)   0           block6e_se_squeeze[0][0]
__________________________________________________________________________________________________
block6e_se_reduce (Conv2D)      (None, 1, 1, 76)     138700      block6e_se_reshape[0][0]
__________________________________________________________________________________________________
block6e_se_expand (Conv2D)      (None, 1, 1, 1824)   140448      block6e_se_reduce[0][0]
__________________________________________________________________________________________________
block6e_se_excite (Multiply)    (None, None, None, 1 0           block6e_activation[0][0]
                                                                 block6e_se_expand[0][0]
__________________________________________________________________________________________________
block6e_project_conv (Conv2D)   (None, None, None, 3 554496      block6e_se_excite[0][0]
__________________________________________________________________________________________________
block6e_project_bn (BatchNormal (None, None, None, 3 1216        block6e_project_conv[0][0]
__________________________________________________________________________________________________
block6e_drop (FixedDropout)     (None, None, None, 3 0           block6e_project_bn[0][0]
__________________________________________________________________________________________________
block6e_add (Add)               (None, None, None, 3 0           block6e_drop[0][0]
                                                                 block6d_add[0][0]
__________________________________________________________________________________________________
block6f_expand_conv (Conv2D)    (None, None, None, 1 554496      block6e_add[0][0]
__________________________________________________________________________________________________
block6f_expand_bn (BatchNormali (None, None, None, 1 7296        block6f_expand_conv[0][0]
__________________________________________________________________________________________________
block6f_expand_activation (Acti (None, None, None, 1 0           block6f_expand_bn[0][0]
__________________________________________________________________________________________________
block6f_dwconv (DepthwiseConv2D (None, None, None, 1 45600       block6f_expand_activation[0][0]
__________________________________________________________________________________________________
block6f_bn (BatchNormalization) (None, None, None, 1 7296        block6f_dwconv[0][0]
__________________________________________________________________________________________________
block6f_activation (Activation) (None, None, None, 1 0           block6f_bn[0][0]
__________________________________________________________________________________________________
block6f_se_squeeze (GlobalAvera (None, 1824)         0           block6f_activation[0][0]
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________________________________________________________________________________________________
block6f_se_reshape (Reshape)    (None, 1, 1, 1824)   0           block6f_se_squeeze[0][0]
________________________________________________________________________________________________
block6f_se_reduce (Conv2D)      (None, 1, 1, 76)     138700      block6f_se_reshape[0][0]
________________________________________________________________________________________________
block6f_se_expand (Conv2D)      (None, 1, 1, 1824)   140448      block6f_se_reduce[0][0]
________________________________________________________________________________________________
block6f_se_excite (Multiply)    (None, None, None, 1 0           block6f_activation[0][0]
                                                                 block6f_se_expand[0][0]
________________________________________________________________________________________________
block6f_project_conv (Conv2D)   (None, None, None, 3 554496      block6f_se_excite[0][0]
________________________________________________________________________________________________
block6f_project_bn (BatchNormal (None, None, None, 3 1216        block6f_project_conv[0][0]
________________________________________________________________________________________________
block6f_drop (FixedDropout)     (None, None, None, 3 0           block6f_project_bn[0][0]
________________________________________________________________________________________________
block6f_add (Add)               (None, None, None, 3 0           block6f_drop[0][0]
                                                                 block6e_add[0][0]
________________________________________________________________________________________________
block6g_expand_conv (Conv2D)    (None, None, None, 1 554496      block6f_add[0][0]
________________________________________________________________________________________________
block6g_expand_bn (BatchNormali (None, None, None, 1 7296        block6g_expand_conv[0][0]
________________________________________________________________________________________________
block6g_expand_activation (Acti (None, None, None, 1 0           block6g_expand_bn[0][0]
________________________________________________________________________________________________
block6g_dwconv (DepthwiseConv2D (None, None, None, 1 45600       block6g_expand_activation[0][0]
________________________________________________________________________________________________
block6g_bn (BatchNormalization) (None, None, None, 1 7296        block6g_dwconv[0][0]
________________________________________________________________________________________________
block6g_activation (Activation) (None, None, None, 1 0           block6g_bn[0][0]
________________________________________________________________________________________________
block6g_se_squeeze (GlobalAvera (None, 1824)         0           block6g_activation[0][0]
________________________________________________________________________________________________
block6g_se_reshape (Reshape)    (None, 1, 1, 1824)   0           block6g_se_squeeze[0][0]
________________________________________________________________________________________________
block6g_se_reduce (Conv2D)      (None, 1, 1, 76)     138700      block6g_se_reshape[0][0]
________________________________________________________________________________________________
block6g_se_expand (Conv2D)      (None, 1, 1, 1824)   140448      block6g_se_reduce[0][0]
________________________________________________________________________________________________
block6g_se_excite (Multiply)    (None, None, None, 1 0           block6g_activation[0][0]
                                                                 block6g_se_expand[0][0]
________________________________________________________________________________________________
block6g_project_conv (Conv2D)   (None, None, None, 3 554496      block6g_se_excite[0][0]
________________________________________________________________________________________________
block6g_project_bn (BatchNormal (None, None, None, 3 1216        block6g_project_conv[0][0]
________________________________________________________________________________________________
block6g_drop (FixedDropout)     (None, None, None, 3 0           block6g_project_bn[0][0]
________________________________________________________________________________________________
block6g_add (Add)               (None, None, None, 3 0           block6g_drop[0][0]
                                                                 block6f_add[0][0]
________________________________________________________________________________________________
block6h_expand_conv (Conv2D)    (None, None, None, 1 554496      block6g_add[0][0]
________________________________________________________________________________________________
block6h_expand_bn (BatchNormali (None, None, None, 1 7296        block6h_expand_conv[0][0]
________________________________________________________________________________________________
block6h_expand_activation (Acti (None, None, None, 1 0           block6h_expand_bn[0][0]
________________________________________________________________________________________________
block6h_dwconv (DepthwiseConv2D (None, None, None, 1 45600       block6h_expand_activation[0][0]
________________________________________________________________________________________________
block6h_bn (BatchNormalization) (None, None, None, 1 7296        block6h_dwconv[0][0]
________________________________________________________________________________________________
block6h_activation (Activation) (None, None, None, 1 0           block6h_bn[0][0]
________________________________________________________________________________________________
block6h_se_squeeze (GlobalAvera (None, 1824)         0           block6h_activation[0][0]
________________________________________________________________________________________________
block6h_se_reshape (Reshape)    (None, 1, 1, 1824)   0           block6h_se_squeeze[0][0]
________________________________________________________________________________________________
block6h_se_reduce (Conv2D)      (None, 1, 1, 76)     138700      block6h_se_reshape[0][0]
________________________________________________________________________________________________
block6h_se_expand (Conv2D)      (None, 1, 1, 1824)   140448      block6h_se_reduce[0][0]
________________________________________________________________________________________________
block6h_se_excite (Multiply)    (None, None, None, 1 0           block6h_activation[0][0]
                                                                 block6h_se_expand[0][0]
________________________________________________________________________________________________
block6h_project_conv (Conv2D)   (None, None, None, 3 554496      block6h_se_excite[0][0]
________________________________________________________________________________________________
block6h_project_bn (BatchNormal (None, None, None, 3 1216        block6h_project_conv[0][0]
________________________________________________________________________________________________
block6h_drop (FixedDropout)     (None, None, None, 3 0           block6h_project_bn[0][0]
________________________________________________________________________________________________
block6h_add (Add)               (None, None, None, 3 0           block6h_drop[0][0]
                                                                 block6g_add[0][0]
________________________________________________________________________________________________
block6i_expand_conv (Conv2D)    (None, None, None, 1 554496      block6h_add[0][0]
________________________________________________________________________________________________
block6i_expand_bn (BatchNormali (None, None, None, 1 7296        block6i_expand_conv[0][0]
________________________________________________________________________________________________
block6i_expand_activation (Acti (None, None, None, 1 0           block6i_expand_bn[0][0]
________________________________________________________________________________________________
block6i_dwconv (DepthwiseConv2D (None, None, None, 1 45600       block6i_expand_activation[0][0]
```

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__________________________________________________________________________________________________
block6i_bn (BatchNormalization) (None, None, None, 1 7296        block6i_dwconv[0][0]
__________________________________________________________________________________________________
block6i_activation (Activation) (None, None, None, 1 0           block6i_bn[0][0]
__________________________________________________________________________________________________
block6i_se_squeeze (GlobalAvera (None, 1824)         0           block6i_activation[0][0]
__________________________________________________________________________________________________
block6i_se_reshape (Reshape)    (None, 1, 1, 1824)   0           block6i_se_squeeze[0][0]
__________________________________________________________________________________________________
block6i_se_reduce (Conv2D)      (None, 1, 1, 76)     138700      block6i_se_reshape[0][0]
__________________________________________________________________________________________________
block6i_se_expand (Conv2D)      (None, 1, 1, 1824)   140448      block6i_se_reduce[0][0]
__________________________________________________________________________________________________
block6i_se_excite (Multiply)    (None, None, None, 1 0           block6i_activation[0][0]
                                                                 block6i_se_expand[0][0]
__________________________________________________________________________________________________
block6i_project_conv (Conv2D)   (None, None, None, 3 554496      block6i_se_excite[0][0]
__________________________________________________________________________________________________
block6i_project_bn (BatchNormal (None, None, None, 3 1216        block6i_project_conv[0][0]
__________________________________________________________________________________________________
block6i_drop (FixedDropout)     (None, None, None, 3 0           block6i_project_bn[0][0]
__________________________________________________________________________________________________
block6i_add (Add)               (None, None, None, 3 0           block6i_drop[0][0]
                                                                 block6h_add[0][0]
__________________________________________________________________________________________________
block7a_expand_conv (Conv2D)    (None, None, None, 1 554496      block6i_add[0][0]
__________________________________________________________________________________________________
block7a_expand_bn (BatchNormali (None, None, None, 1 7296        block7a_expand_conv[0][0]
__________________________________________________________________________________________________
block7a_expand_activation (Acti (None, None, None, 1 0           block7a_expand_bn[0][0]
__________________________________________________________________________________________________
block7a_dwconv (DepthwiseConv2D (None, None, None, 1 16416       block7a_expand_activation[0][0]
__________________________________________________________________________________________________
block7a_bn (BatchNormalization) (None, None, None, 1 7296        block7a_dwconv[0][0]
__________________________________________________________________________________________________
block7a_activation (Activation) (None, None, None, 1 0           block7a_bn[0][0]
__________________________________________________________________________________________________
block7a_se_squeeze (GlobalAvera (None, 1824)         0           block7a_activation[0][0]
__________________________________________________________________________________________________
block7a_se_reshape (Reshape)    (None, 1, 1, 1824)   0           block7a_se_squeeze[0][0]
__________________________________________________________________________________________________
block7a_se_reduce (Conv2D)      (None, 1, 1, 76)     138700      block7a_se_reshape[0][0]
__________________________________________________________________________________________________
block7a_se_expand (Conv2D)      (None, 1, 1, 1824)   140448      block7a_se_reduce[0][0]
__________________________________________________________________________________________________
block7a_se_excite (Multiply)    (None, None, None, 1 0           block7a_activation[0][0]
                                                                 block7a_se_expand[0][0]
__________________________________________________________________________________________________
block7a_project_conv (Conv2D)   (None, None, None, 5 933888      block7a_se_excite[0][0]
__________________________________________________________________________________________________
block7a_project_bn (BatchNormal (None, None, None, 5 2048        block7a_project_conv[0][0]
__________________________________________________________________________________________________
block7b_expand_conv (Conv2D)    (None, None, None, 3 1572864     block7a_project_bn[0][0]
__________________________________________________________________________________________________
block7b_expand_bn (BatchNormali (None, None, None, 3 12288       block7b_expand_conv[0][0]
__________________________________________________________________________________________________
block7b_expand_activation (Acti (None, None, None, 3 0           block7b_expand_bn[0][0]
__________________________________________________________________________________________________
block7b_dwconv (DepthwiseConv2D (None, None, None, 3 27648       block7b_expand_activation[0][0]
__________________________________________________________________________________________________
block7b_bn (BatchNormalization) (None, None, None, 3 12288       block7b_dwconv[0][0]
__________________________________________________________________________________________________
block7b_activation (Activation) (None, None, None, 3 0           block7b_bn[0][0]
__________________________________________________________________________________________________
block7b_se_squeeze (GlobalAvera (None, 3072)         0           block7b_activation[0][0]
__________________________________________________________________________________________________
block7b_se_reshape (Reshape)    (None, 1, 1, 3072)   0           block7b_se_squeeze[0][0]
__________________________________________________________________________________________________
block7b_se_reduce (Conv2D)      (None, 1, 1, 128)    393344      block7b_se_reshape[0][0]
__________________________________________________________________________________________________
block7b_se_expand (Conv2D)      (None, 1, 1, 3072)   396288      block7b_se_reduce[0][0]
__________________________________________________________________________________________________
block7b_se_excite (Multiply)    (None, None, None, 3 0           block7b_activation[0][0]
                                                                 block7b_se_expand[0][0]
__________________________________________________________________________________________________
block7b_project_conv (Conv2D)   (None, None, None, 5 1572864     block7b_se_excite[0][0]
__________________________________________________________________________________________________
block7b_project_bn (BatchNormal (None, None, None, 5 2048        block7b_project_conv[0][0]
__________________________________________________________________________________________________
block7b_drop (FixedDropout)     (None, None, None, 5 0           block7b_project_bn[0][0]
__________________________________________________________________________________________________
block7b_add (Add)               (None, None, None, 5 0           block7b_drop[0][0]
                                                                 block7a_project_bn[0][0]
__________________________________________________________________________________________________
block7c_expand_conv (Conv2D)    (None, None, None, 3 1572864     block7b_add[0][0]
__________________________________________________________________________________________________
block7c_expand_bn (BatchNormali (None, None, None, 3 12288       block7c_expand_conv[0][0]
__________________________________________________________________________________________________
block7c_expand_activation (Acti (None, None, None, 3 0           block7c_expand_bn[0][0]
__________________________________________________________________________________________________
block7c_dwconv (DepthwiseConv2D (None, None, None, 3 27648       block7c_expand_activation[0][0]
```

```
block7c_dwconv (DepthwiseConv2D (None, None, None, 3 27648       block7c_expand_activation[0][0]
__________________________________________________________________________________________________
block7c_bn (BatchNormalization) (None, None, None, 3 12288       block7c_dwconv[0][0]
__________________________________________________________________________________________________
block7c_activation (Activation) (None, None, None, 3 0           block7c_bn[0][0]
__________________________________________________________________________________________________
block7c_se_squeeze (GlobalAvera (None, 3072)         0           block7c_activation[0][0]
__________________________________________________________________________________________________
block7c_se_reshape (Reshape)    (None, 1, 1, 3072)   0           block7c_se_squeeze[0][0]
__________________________________________________________________________________________________
block7c_se_reduce (Conv2D)      (None, 1, 1, 128)    393344      block7c_se_reshape[0][0]
__________________________________________________________________________________________________
block7c_se_expand (Conv2D)      (None, 1, 1, 3072)   396288      block7c_se_reduce[0][0]
__________________________________________________________________________________________________
block7c_se_excite (Multiply)    (None, None, None, 3 0           block7c_activation[0][0]
                                                                 block7c_se_expand[0][0]
__________________________________________________________________________________________________
block7c_project_conv (Conv2D)   (None, None, None, 5 1572864     block7c_se_excite[0][0]
__________________________________________________________________________________________________
block7c_project_bn (BatchNormal (None, None, None, 5 2048        block7c_project_conv[0][0]
__________________________________________________________________________________________________
block7c_drop (FixedDropout)     (None, None, None, 5 0           block7c_project_bn[0][0]
__________________________________________________________________________________________________
block7c_add (Add)               (None, None, None, 5 0           block7c_drop[0][0]
                                                                 block7b_add[0][0]
__________________________________________________________________________________________________
top_conv (Conv2D)               (None, None, None, 2 1048576     block7c_add[0][0]
__________________________________________________________________________________________________
top_bn (BatchNormalization)     (None, None, None, 2 8192        top_conv[0][0]
__________________________________________________________________________________________________
top_activation (Activation)     (None, None, None, 2 0           top_bn[0][0]
__________________________________________________________________________________________________
decoder_stage0_upsampling (UpSa (None, None, None, 2 0           top_activation[0][0]
__________________________________________________________________________________________________
decoder_stage0_concat (Concaten (None, None, None, 3 0           decoder_stage0_upsampling[0][0]
                                                                 block6a_expand_activation[0][0]
__________________________________________________________________________________________________
decoder_stage0a_conv (Conv2D)   (None, None, None, 2 7151616     decoder_stage0_concat[0][0]
__________________________________________________________________________________________________
decoder_stage0a_bn (BatchNormal (None, None, None, 2 1024        decoder_stage0a_conv[0][0]
__________________________________________________________________________________________________
decoder_stage0a_relu (Activatio (None, None, None, 2 0           decoder_stage0a_bn[0][0]
__________________________________________________________________________________________________
decoder_stage0b_conv (Conv2D)   (None, None, None, 2 589824      decoder_stage0a_relu[0][0]
__________________________________________________________________________________________________
decoder_stage0b_bn (BatchNormal (None, None, None, 2 1024        decoder_stage0b_conv[0][0]
__________________________________________________________________________________________________
decoder_stage0b_relu (Activatio (None, None, None, 2 0           decoder_stage0b_bn[0][0]
__________________________________________________________________________________________________
decoder_stage1_upsampling (UpSa (None, None, None, 2 0           decoder_stage0b_relu[0][0]
__________________________________________________________________________________________________
decoder_stage1_concat (Concaten (None, None, None, 6 0           decoder_stage1_upsampling[0][0]
                                                                 block4a_expand_activation[0][0]
__________________________________________________________________________________________________
decoder_stage1a_conv (Conv2D)   (None, None, None, 1 737280      decoder_stage1_concat[0][0]
__________________________________________________________________________________________________
decoder_stage1a_bn (BatchNormal (None, None, None, 1 512         decoder_stage1a_conv[0][0]
__________________________________________________________________________________________________
decoder_stage1a_relu (Activatio (None, None, None, 1 0           decoder_stage1a_bn[0][0]
__________________________________________________________________________________________________
decoder_stage1b_conv (Conv2D)   (None, None, None, 1 147456      decoder_stage1a_relu[0][0]
__________________________________________________________________________________________________
decoder_stage1b_bn (BatchNormal (None, None, None, 1 512         decoder_stage1b_conv[0][0]
__________________________________________________________________________________________________
decoder_stage1b_relu (Activatio (None, None, None, 1 0           decoder_stage1b_bn[0][0]
__________________________________________________________________________________________________
decoder_stage2_upsampling (UpSa (None, None, None, 1 0           decoder_stage1b_relu[0][0]
__________________________________________________________________________________________________
decoder_stage2_concat (Concaten (None, None, None, 3 0           decoder_stage2_upsampling[0][0]
                                                                 block3a_expand_activation[0][0]
__________________________________________________________________________________________________
decoder_stage2a_conv (Conv2D)   (None, None, None, 6 211968      decoder_stage2_concat[0][0]
__________________________________________________________________________________________________
decoder_stage2a_bn (BatchNormal (None, None, None, 6 256         decoder_stage2a_conv[0][0]
__________________________________________________________________________________________________
decoder_stage2a_relu (Activatio (None, None, None, 6 0           decoder_stage2a_bn[0][0]
__________________________________________________________________________________________________
decoder_stage2b_conv (Conv2D)   (None, None, None, 6 36864       decoder_stage2a_relu[0][0]
__________________________________________________________________________________________________
decoder_stage2b_bn (BatchNormal (None, None, None, 6 256         decoder_stage2b_conv[0][0]
__________________________________________________________________________________________________
decoder_stage2b_relu (Activatio (None, None, None, 6 0           decoder_stage2b_bn[0][0]
__________________________________________________________________________________________________
decoder_stage3_upsampling (UpSa (None, None, None, 6 0           decoder_stage2b_relu[0][0]
__________________________________________________________________________________________________
decoder_stage3_concat (Concaten (None, None, None, 2 0           decoder_stage3_upsampling[0][0]
                                                                 block2a_expand_activation[0][0]
__________________________________________________________________________________________________
decoder_stage3a_conv (Conv2D)   (None, None, None, 3 59904       decoder_stage3_concat[0][0]
__________________________________________________________________________________________________
decoder_stage3a_bn (BatchNormal (None, None, None, 3 128         decoder_stage3a_conv[0][0]
```

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decoder_stage3a_relu (Activatio (None, None, None, 3 0           decoder_stage3a_bn[0][0]
__________________________________________________________________________________________________
decoder_stage3b_conv (Conv2D)   (None, None, None, 3 9216        decoder_stage3a_relu[0][0]
__________________________________________________________________________________________________
decoder_stage3b_bn (BatchNormal (None, None, None, 3 128         decoder_stage3b_conv[0][0]
__________________________________________________________________________________________________
decoder_stage3b_relu (Activatio (None, None, None, 3 0           decoder_stage3b_bn[0][0]
__________________________________________________________________________________________________
decoder_stage4_upsampling (UpSa (None, None, None, 3 0           decoder_stage3b_relu[0][0]
__________________________________________________________________________________________________
decoder_stage4a_conv (Conv2D)   (None, None, None, 1 4608        decoder_stage4_upsampling[0][0]
__________________________________________________________________________________________________
decoder_stage4a_bn (BatchNormal (None, None, None, 1 64          decoder_stage4a_conv[0][0]
__________________________________________________________________________________________________
decoder_stage4a_relu (Activatio (None, None, None, 1 0           decoder_stage4a_bn[0][0]
__________________________________________________________________________________________________
decoder_stage4b_conv (Conv2D)   (None, None, None, 1 2304        decoder_stage4a_relu[0][0]
__________________________________________________________________________________________________
decoder_stage4b_bn (BatchNormal (None, None, None, 1 64          decoder_stage4b_conv[0][0]
__________________________________________________________________________________________________
decoder_stage4b_relu (Activatio (None, None, None, 1 0           decoder_stage4b_bn[0][0]
__________________________________________________________________________________________________
final_conv (Conv2D)             (None, None, None, 1 145         decoder_stage4b_relu[0][0]
__________________________________________________________________________________________________
sigmoid (Activation)            (None, None, None, 1 0           final_conv[0][0]
==================================================================================================
Total params: 37,468,673
Trainable params: 37,293,953
Non-trainable params: 174,720
__________________________________________________________________________________________________
```

Defect_1

In [ ]:

```
train_batch=train_DataGenerator(train_1,shuffle=True,preprocess=preprocess)
valid_batch=test_DataGenerator(val_1,preprocess=preprocess)

log_dir=os.path.join("logs",datetime.datetime.now().strftime("%Y%m%d-%H%M%S"))
tensorboard=tf.keras.callbacks.TensorBoard(log_dir=log_dir,histogram_freq=1,write_graph=True,
write_grads=True)

checkpoint_filepath='/content/drive//My Drive/Steel_Detection /segmentation_defect_1.h5'
model_checkpoint_callback=tf.keras.callbacks.ModelCheckpoint(filepath=checkpoint_filepath,mon
itor='val_dice_coef',mode='max',save_best_only=True)
#https://keras.io/api/metrics/
#https://keras.io/api/losses/probabilistic_losses/#categorical_crossentropy-function
model.compile(optimizer='adam',loss=bce_dice_loss,metrics=[dice_coef])
callback=[model_checkpoint_callback,tensorboard]
#https://datascience.stackexchange.com/questions/34444/what-is-the-difference-between-fit-and
-fit-generator-in-keras
history=model.fit_generator(train_batch,validation_data=valid_batch,epochs=25,verbose=1,callb
acks=callback)
```

```
WARNING:tensorflow:`write_grads` will be ignored in TensorFlow 2.0 for the `TensorBoard` Callback.
Epoch 1/25
161/161 [==============================] - 401s 2s/step - loss: 0.7842 - dice_coef: 0.3252 - val_loss: 1.3187 - val_dice_coef: 0.2270
Epoch 2/25
161/161 [==============================] - 309s 2s/step - loss: 0.4681 - dice_coef: 0.5726 - val_loss: 0.5883 - val_dice_coef: 0.4733
Epoch 3/25
161/161 [==============================] - 308s 2s/step - loss: 0.4221 - dice_coef: 0.6153 - val_loss: 0.6416 - val_dice_coef: 0.4135
Epoch 4/25
161/161 [==============================] - 308s 2s/step - loss: 0.4222 - dice_coef: 0.6143 - val_loss: 0.4695 - val_dice_coef: 0.5744
Epoch 5/25
161/161 [==============================] - 309s 2s/step - loss: 0.3886 - dice_coef: 0.6466 - val_loss: 0.4617 - val_dice_coef: 0.5833
Epoch 6/25
161/161 [==============================] - 309s 2s/step - loss: 0.3839 - dice_coef: 0.6495 - val_loss: 0.4399 - val_dice_coef: 0.5989
Epoch 7/25
161/161 [==============================] - 308s 2s/step - loss: 0.3750 - dice_coef: 0.6586 - val_loss: 0.4763 - val_dice_coef: 0.5718
Epoch 8/25
161/161 [==============================] - 308s 2s/step - loss: 0.3642 - dice_coef: 0.6682 - val_loss: 0.4522 - val_dice_coef: 0.5918
Epoch 9/25
161/161 [==============================] - 309s 2s/step - loss: 0.3586 - dice_coef: 0.6736 - val_loss: 0.4515 - val_dice_coef: 0.5955
Epoch 10/25
161/161 [==============================] - 308s 2s/step - loss: 0.3529 - dice_coef: 0.6785 - val_loss: 0.4785 - val_dice_coef: 0.5687
Epoch 11/25
161/161 [==============================] - 308s 2s/step - loss: 0.3477 - dice_coef: 0.6826 - val_loss: 0.4635 - val_dice_coef: 0.5803
Epoch 12/25
161/161 [==============================] - 309s 2s/step - loss: 0.3376 - dice_coef: 0.6933 - val_loss: 0.4660 - val_dice_coef: 0.5814
Epoch 13/25
```

```
161/161 [==============================] - 309s 2s/step - loss: 0.3356 - dice_coef: 0.6941 - val_loss: 0.4462 - val_dice_coef: 0.5990
Epoch 14/25
161/161 [==============================] - 308s 2s/step - loss: 0.3324 - dice_coef: 0.6974 - val_loss: 0.5267 - val_dice_coef: 0.5257
Epoch 15/25
161/161 [==============================] - 308s 2s/step - loss: 0.3482 - dice_coef: 0.6822 - val_loss: 0.5011 - val_dice_coef: 0.5579
Epoch 16/25
161/161 [==============================] - 308s 2s/step - loss: 0.3238 - dice_coef: 0.7049 - val_loss: 0.4368 - val_dice_coef: 0.6082
Epoch 17/25
161/161 [==============================] - 309s 2s/step - loss: 0.3084 - dice_coef: 0.7196 - val_loss: 0.4526 - val_dice_coef: 0.5925
Epoch 18/25
161/161 [==============================] - 308s 2s/step - loss: 0.3025 - dice_coef: 0.7247 - val_loss: 0.4444 - val_dice_coef: 0.5986
Epoch 19/25
161/161 [==============================] - 308s 2s/step - loss: 0.2987 - dice_coef: 0.7278 - val_loss: 0.4328 - val_dice_coef: 0.6092
Epoch 20/25
161/161 [==============================] - 309s 2s/step - loss: 0.3029 - dice_coef: 0.7242 - val_loss: 0.4771 - val_dice_coef: 0.5746
Epoch 21/25
161/161 [==============================] - 308s 2s/step - loss: 0.3000 - dice_coef: 0.7269 - val_loss: 0.4800 - val_dice_coef: 0.5750
Epoch 22/25
161/161 [==============================] - 308s 2s/step - loss: 0.2920 - dice_coef: 0.7346 - val_loss: 0.4475 - val_dice_coef: 0.5988
Epoch 23/25
161/161 [==============================] - 310s 2s/step - loss: 0.2925 - dice_coef: 0.7342 - val_loss: 0.4296 - val_dice_coef: 0.6138
Epoch 24/25
161/161 [==============================] - 309s 2s/step - loss: 0.2776 - dice_coef: 0.7470 - val_loss: 0.4658 - val_dice_coef: 0.5899
Epoch 25/25
161/161 [==============================] - 309s 2s/step - loss: 0.2826 - dice_coef: 0.7429 - val_loss: 0.4810 - val_dice_coef: 0.5744
```

In [ ]:

```
%tensorboard --logdir logs
```

In [ ]:

```
print('Training Dataset:\n')
print(model.evaluate(test_DataGenerator(train_1,preprocess=preprocess),verbose=1))
print("="*100)
print('\nValidation Dataset:\n')
print(model.evaluate(test_DataGenerator(val_1,preprocess=preprocess),verbose=1))
print("="*100)
print('\nTest Dataset:\n')
print(model.evaluate(test_DataGenerator(test_1,preprocess=preprocess),verbose=1))
```

```
Training Dataset:

646/646 [==============================] - 86s 133ms/step - loss: 0.4497 - dice_coef: 0.6004
[0.44973498582839966, 0.6004406809806824]
====================================================================================================

Validation Dataset:

161/161 [==============================] - 21s 132ms/step - loss: 0.4810 - dice_coef: 0.5744
[0.48095887899398804, 0.5743771195411682]
====================================================================================================

Test Dataset:

90/90 [==============================] - 24s 272ms/step - loss: 0.4949 - dice_coef: 0.5632
[0.4948919415473938, 0.563205361366272]
```

- For validation,test datasets loss increases and metrics decreases as compared with train data thus better to train model for more epochs (e.g. epoch =100) which might help to reduce loss and increase dice coefficient on unseen data.

In [ ]:

```
def rle2mask(rle):
    # CONVERT RLE TO MASK
    if (pd.isnull(rle))|(rle=='')|(rle=='-1'):
        return np.zeros((256,1600) ,dtype=np.uint8)

    height= 256
    width = 1600
    mask= np.zeros( width*height ,dtype=np.uint8)

    array = np.asarray([int(x) for x in rle.split()])
    starts = array[0::2]-1
    lengths = array[1::2]
    for index, start in enumerate(starts):
        mask[int(start):int(start+lengths[index])] = 1

    return mask.reshape( (height,width), order='F' )
```

In [ ]:

```
model=load_model('/content/drive//My Drive/Steel_Detection /segmentation_defect_1.h5',custom_
objects={'bce_dice_loss':bce_dice_loss,'dice_coef':dice_coef})
```

In [ ]:

```
def plot_mask(rle_defect,k,pred):
  train_folder_path='/content/drive//My Drive/Steel_Detection /train_images/'
  # Create figure and axes
  fig,ax=plt.subplots(4,3,figsize=(14,9))
  fig.suptitle('Defect_'+str(k)+'_Images',fontsize=20,fontweight='bold')
  for i in range(4):
    image_id=rle_defect[i][0]
    rle=rle_defect[i][1]
    im=Image.open(train_folder_path+str(image_id))
    ax[i,0].imshow(im)
    ax[i,0].set_title(image_id)
    mask=rle2mask(rle)
    ax[i,1].imshow(mask)
    ax[i,1].set_title("Actual Mask for "+str(image_id))
    c1=Image.fromarray(pred[i][:,:,0])
    ax[i,2].imshow(np.array(c1.resize((1600,256)))>0.5)
    ax[i,2].set_title("Predicted Mask for "+str(image_id))
  fig.set_facecolor("tan")
  plt.show()
```

Train Dataset

In [ ]:

```
train_preds=model.predict_generator(test_DataGenerator(train_1[10:14],preprocess=preprocess),
verbose=1)
```

In [ ]:

```
plot_mask(train_1[10:14].values,1,train_preds)
```

Validation Dataset

In [ ]:

```
val_preds=model.predict_generator(test_DataGenerator(val_1[10:14],preprocess=preprocess),verb
ose=1)
```

```
4/4 [==============================] - 2s 512ms/step
```

In [ ]:

```
plot_mask(val_1[10:14].values,1,val_preds)
```

Test Dataset

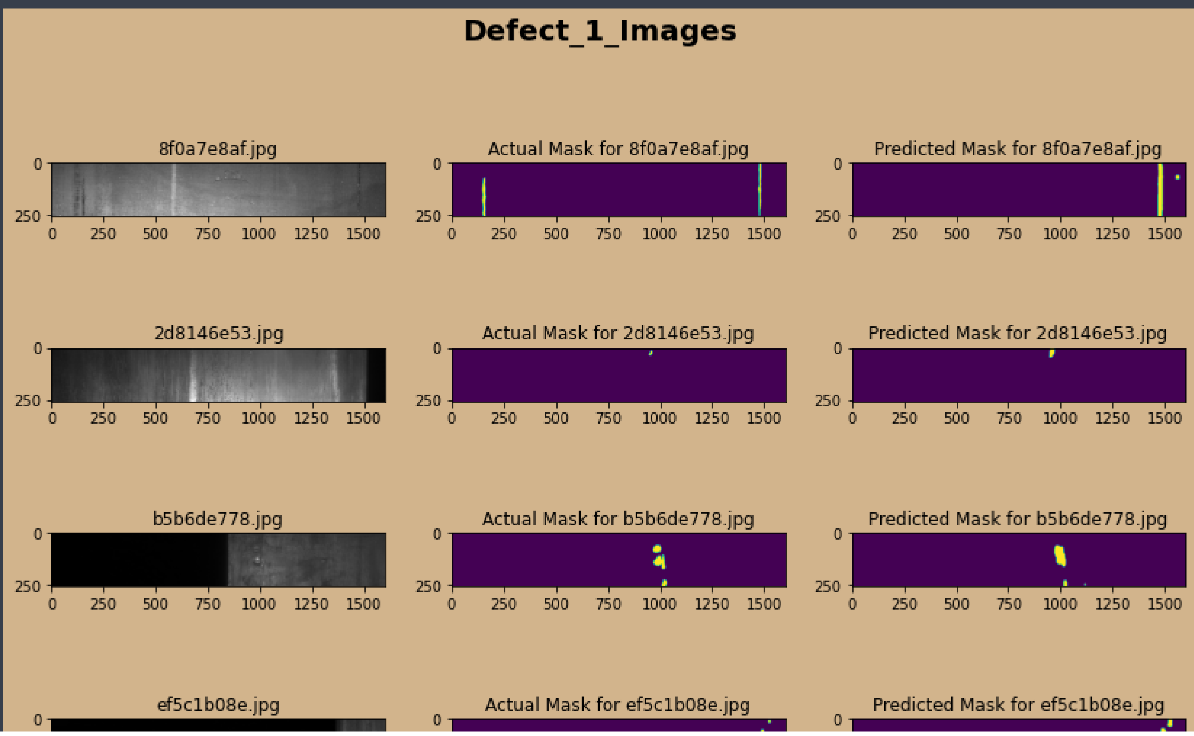
In [ ]:

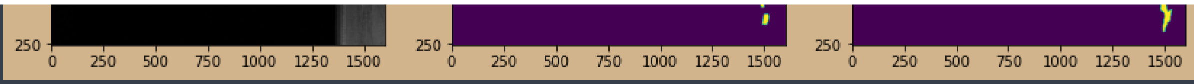
```
test_preds=model.predict_generator(test_DataGenerator(test_1[10:14],preprocess=preprocess),ve
rbose=1)
```

```
4/4 [==============================] - 2s 561ms/step
```

In [ ]:

```
plot_mask(test_1[10:14].values,1,test_preds)
```





Defect_2

In [ ]:

```
train_batch=train_DataGenerator(train_2,shuffle=True,preprocess=preprocess)
valid_batch=test_DataGenerator(val_2,preprocess=preprocess)

log_dir=os.path.join("logs",datetime.datetime.now().strftime("%Y%m%d-%H%M%S"))
tensorboard=tf.keras.callbacks.TensorBoard(log_dir=log_dir,histogram_freq=1,write_graph=True,
write_grads=True)

checkpoint_filepath='/content/drive//My Drive/Steel_Detection /segmentation_defect_2.h5'
model_checkpoint_callback=tf.keras.callbacks.ModelCheckpoint(filepath=checkpoint_filepath,mon
itor='val_dice_coef',mode='max',save_best_only=True)
#https://keras.io/api/metrics/
#https://keras.io/api/losses/probabilistic_losses/#categorical_crossentropy-function
model.compile(optimizer='adam',loss=bce_dice_loss,metrics=[dice_coef])
callback=[model_checkpoint_callback,tensorboard]
#https://datascience.stackexchange.com/questions/34444/what-is-the-difference-between-fit-and
-fit-generator-in-keras
history=model.fit_generator(train_batch,validation_data=valid_batch,epochs=25,verbose=1,callb
acks=callback)
```

```
WARNING:tensorflow:`write_grads` will be ignored in TensorFlow 2.0 for the `TensorBoard` Callback.
Epoch 1/25
43/43 [==============================] - 154s 3s/step - loss: 0.6302 - dice_coef: 0.4142 - val_loss: 0.6010 - val_dice_coef: 0.4476
Epoch 2/25
43/43 [==============================] - 84s 2s/step - loss: 0.4300 - dice_coef: 0.6002 - val_loss: 0.4826 - val_dice_coef: 0.5500
Epoch 3/25
43/43 [==============================] - 84s 2s/step - loss: 0.3890 - dice_coef: 0.6380 - val_loss: 0.4668 - val_dice_coef: 0.5685
Epoch 4/25
43/43 [==============================] - 84s 2s/step - loss: 0.3637 - dice_coef: 0.6619 - val_loss: 0.5025 - val_dice_coef: 0.5352
Epoch 5/25
43/43 [==============================] - 84s 2s/step - loss: 0.3514 - dice_coef: 0.6730 - val_loss: 0.4878 - val_dice_coef: 0.5491
Epoch 6/25
43/43 [==============================] - 84s 2s/step - loss: 0.3548 - dice_coef: 0.6706 - val_loss: 0.4747 - val_dice_coef: 0.5576
Epoch 7/25
43/43 [==============================] - 84s 2s/step - loss: 0.3529 - dice_coef: 0.6725 - val_loss: 0.4897 - val_dice_coef: 0.5503
Epoch 8/25
43/43 [==============================] - 85s 2s/step - loss: 0.3321 - dice_coef: 0.6914 - val_loss: 0.4419 - val_dice_coef: 0.5894
Epoch 9/25
43/43 [==============================] - 85s 2s/step - loss: 0.3270 - dice_coef: 0.6973 - val_loss: 0.4738 - val_dice_coef: 0.5662
Epoch 10/25
43/43 [==============================] - 86s 2s/step - loss: 0.2962 - dice_coef: 0.7251 - val_loss: 0.4800 - val_dice_coef: 0.5515
Epoch 11/25
43/43 [==============================] - 86s 2s/step - loss: 0.2969 - dice_coef: 0.7245 - val_loss: 0.4638 - val_dice_coef: 0.5685
Epoch 12/25
43/43 [==============================] - 86s 2s/step - loss: 0.2879 - dice_coef: 0.7322 - val_loss: 0.4287 - val_dice_coef: 0.6001
Epoch 13/25
43/43 [==============================] - 85s 2s/step - loss: 0.2846 - dice_coef: 0.7358 - val_loss: 0.4558 - val_dice_coef: 0.5744
Epoch 14/25
43/43 [==============================] - 86s 2s/step - loss: 0.2749 - dice_coef: 0.7448 - val_loss: 0.4269 - val_dice_coef: 0.6017
Epoch 15/25
43/43 [==============================] - 86s 2s/step - loss: 0.2726 - dice_coef: 0.7469 - val_loss: 0.5022 - val_dice_coef: 0.5291
Epoch 16/25
43/43 [==============================] - 85s 2s/step - loss: 0.2917 - dice_coef: 0.7298 - val_loss: 0.5188 - val_dice_coef: 0.5154
Epoch 17/25
43/43 [==============================] - 85s 2s/step - loss: 0.2748 - dice_coef: 0.7444 - val_loss: 0.6203 - val_dice_coef: 0.4208
Epoch 18/25
43/43 [==============================] - 84s 2s/step - loss: 0.2825 - dice_coef: 0.7386 - val_loss: 0.4412 - val_dice_coef: 0.5929
Epoch 19/25
43/43 [==============================] - 85s 2s/step - loss: 0.2609 - dice_coef: 0.7575 - val_loss: 0.4260 - val_dice_coef: 0.6026
Epoch 20/25
43/43 [==============================] - 84s 2s/step - loss: 0.2568 - dice_coef: 0.7608 - val_loss: 0.4798 - val_dice_coef: 0.5542
Epoch 21/25
43/43 [==============================] - 84s 2s/step - loss: 0.2732 - dice_coef: 0.7461 - val_loss: 0.4852 - val_dice_coef: 0.5533
Epoch 22/25
43/43 [==============================] - 84s 2s/step - loss: 0.2412 - dice_coef: 0.7764 - val_loss: 0.4529 - val_dice_coef: 0.5828
Epoch 23/25
43/43 [==============================] - 84s 2s/step - loss: 0.2365 - dice_coef: 0.7806 - val_loss: 0.4514 - val_dice_coef: 0.5848
Epoch 24/25
43/43 [==============================] - 84s 2s/step - loss: 0.2372 - dice_coef: 0.7802 - val_loss: 0.4547 - val_dice_coef: 0.5797
Epoch 25/25
43/43 [==============================] - 84s 2s/step - loss: 0.2396 - dice_coef: 0.7774 - val_loss: 0.4821 - val_dice_coef: 0.5545
```

In [ ]:

```
%tensorboard --logdir logs
```

In [13]:
```
model=load_model('/content/drive//My Drive/Steel_Detection /segmentation_defect_2.h5',custom_
objects={'bce_dice_loss':bce_dice_loss,'dice_coef':dice_coef})
```

In [14]:
```
print('Training Dataset:\n')
print(model.evaluate(test_DataGenerator(train_2,preprocess=preprocess),verbose=1))
print("="*100)
print('\nValidation Dataset:\n')
print(model.evaluate(test_DataGenerator(val_2,preprocess=preprocess),verbose=1))
print("="*100)
print('\nTest Dataset:\n')
print(model.evaluate(test_DataGenerator(test_2,preprocess=preprocess),verbose=1))
```

```
Training Dataset:

174/174 [==============================] - 81s 271ms/step - loss: 0.4510 - dice_coef: 0.5829
[0.451008677482605, 0.5829356908798218]
====================================================================================================

Validation Dataset:

50/50 [==============================] - 13s 257ms/step - loss: 0.4260 - dice_coef: 0.6026
[0.4260036051273346, 0.6026241779327393]
====================================================================================================

Test Dataset:

23/23 [==============================] - 5s 237ms/step - loss: 0.3944 - dice_coef: 0.6390
[0.394377201795578, 0.6390075087547302]
```

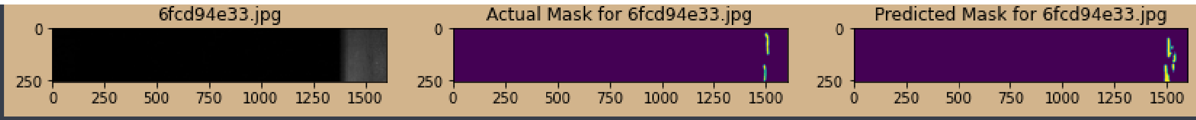
- One can observe the value of loss and metrics are similar for train,validation and test datasets thus the model is not over-fitting. On unseen data (test) dice coefficient increases and loss decreases as compared to train, validation datasets thus, model is performing really good.

Training Dataset

In [ ]:
```
train_preds=model.predict_generator(test_DataGenerator(train_2[10:14],preprocess=preprocess),
verbose=1)
```

```
4/4 [==============================] - 34s 137ms/step
```

In [ ]:
```
plot_mask(train_2[10:14].values,2,train_preds)
```



Validation Dataset

In [ ]:

```
val_preds=model.predict_generator(test_DataGenerator(val_2[10:14],preprocess=preprocess),verbose=1)
```

```
4/4 [==============================] - 0s 122ms/step
```

In [ ]:

```
plot_mask(val_2[10:14].values,2,val_preds)
```

Test Datset

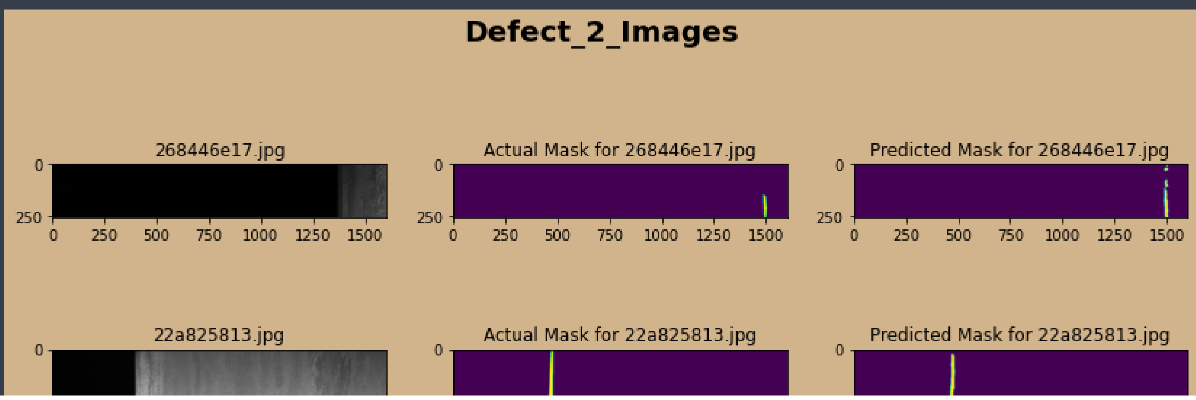
In [ ]:

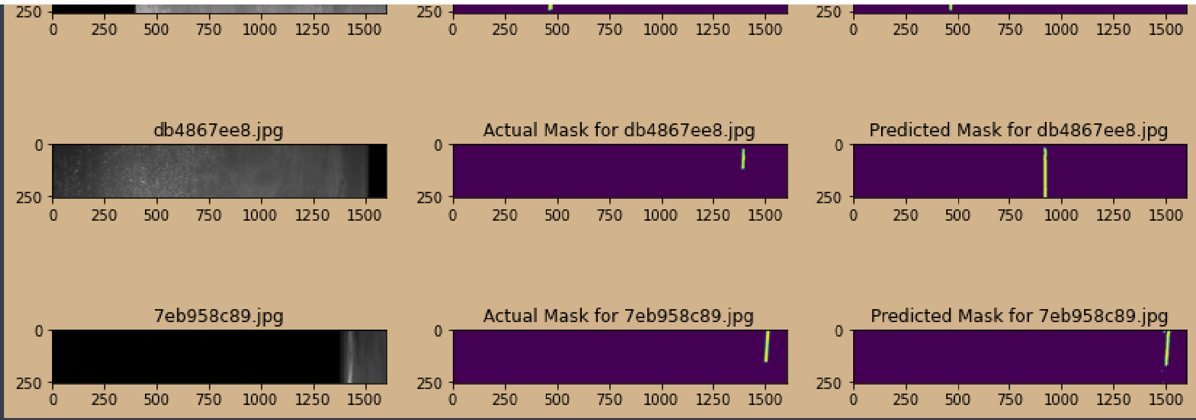
```
test_preds=model.predict_generator(test_DataGenerator(test_2[10:14],preprocess=preprocess),verbose=1)
```

```
4/4 [==============================] - 2s 510ms/step
```

In [ ]:

```
plot_mask(test_2[10:14].values,2,test_preds)
```





Defect 3

In [ ]:

```
train_batch=train_DataGenerator(train_3,shuffle=True,preprocess=preprocess)
valid_batch=test_DataGenerator(val_3,preprocess=preprocess)

log_dir=os.path.join("logs",datetime.datetime.now().strftime("%Y%m%d-%H%M%S"))
tensorboard=tf.keras.callbacks.TensorBoard(log_dir=log_dir,histogram_freq=1,write_graph=True,
write_grads=True)

checkpoint_filepath='/content/drive//My Drive/Steel_Detection /segmentation_defect_3.h5'
model_checkpoint_callback=tf.keras.callbacks.ModelCheckpoint(filepath=checkpoint_filepath,mon
itor='val_dice_coef',mode='max',save_best_only=True)
#https://keras.io/api/metrics/
#https://keras.io/api/losses/probabilistic_losses/#categorical_crossentropy-function
model.compile(optimizer='adam',loss=bce_dice_loss,metrics=[dice_coef])
callback=[model_checkpoint_callback,tensorboard]
#https://datascience.stackexchange.com/questions/34444/what-is-the-difference-between-fit-and
-fit-generator-in-keras
history=model.fit_generator(train_batch,validation_data=valid_batch,epochs=6,verbose=1,callba
cks=callback)
```

```
WARNING:tensorflow:`write_grads` will be ignored in TensorFlow 2.0 for the `TensorBoard` Callback.
Epoch 1/6
928/928 [==============================] - 1983s 2s/step - loss: 0.5785 - dice_coef: 0.5818 - val_loss: 0.5556 - val_dice_coef: 0.586
6
Epoch 2/6
928/928 [==============================] - 1790s 2s/step - loss: 0.4840 - dice_coef: 0.6461 - val_loss: 0.4853 - val_dice_coef: 0.643
0
Epoch 3/6
928/928 [==============================] - 1792s 2s/step - loss: 0.4603 - dice_coef: 0.6598 - val_loss: 0.5032 - val_dice_coef: 0.630
5
Epoch 4/6
928/928 [==============================] - 1792s 2s/step - loss: 0.4367 - dice_coef: 0.6784 - val_loss: 0.4792 - val_dice_coef: 0.635
9
Epoch 5/6
928/928 [==============================] - 1795s 2s/step - loss: 0.4259 - dice_coef: 0.6861 - val_loss: 0.4897 - val_dice_coef: 0.629
7
Epoch 6/6
928/928 [==============================] - 1795s 2s/step - loss: 0.4198 - dice_coef: 0.6891 - val_loss: 0.4793 - val_dice_coef: 0.633
3
```

In [ ]:

```
%tensorboard --logdir logs
```

In [10]:

```
model=load_model('/content/drive//My Drive/Steel_Detection /segmentation_defect_3.h5',custom_
objects={'bce_dice_loss':bce_dice_loss,'dice_coef':dice_coef})
```

In [13]:

```
print('Training Dataset:\n')
print(model.evaluate(test_DataGenerator(train_3,preprocess=preprocess),verbose=1))
print("="*100)
print('\nValidation Dataset:\n')
print(model.evaluate(test_DataGenerator(val_3,preprocess=preprocess),verbose=1))
```

```
print('='*100)
print('\nTest Dataset:\n')
print(model.evaluate(test_DataGenerator(test_3,preprocess=preprocess),verbose=1))
```

```
Training Dataset:

3714/3714 [==============================] - 1026s 267ms/step - loss: 0.4717 - dice_coef: 0.6475
[0.4716576039791107, 0.6474675536155701]
====================================================================================================

Validation Dataset:

924/924 [==============================] - 245s 266ms/step - loss: 0.4853 - dice_coef: 0.6430
[0.48533451557159424, 0.6430497765541077]
====================================================================================================

Test Dataset:

512/512 [==============================] - 130s 253ms/step - loss: 0.4731 - dice_coef: 0.6480
[0.47314369678497314, 0.6479683518409729]
```

- One can observe the value of loss and metrics are similar for train,validation and test datasets thus the model is not over-fitting. On unseen data (test) dice coefficient slightly increases and loss decreases as compared to train, validation datasets thus, model is performing really good.

Training Dataset

In [ ]:

```
train_preds=model.predict_generator(test_DataGenerator(train_3[12:16],preprocess=preprocess),
verbose=1)
```

```
4/4 [==============================] - 1s 157ms/step
```

In [ ]:

```
plot_mask(train_3[12:16].values,3,train_preds)
```

Validation Dataset

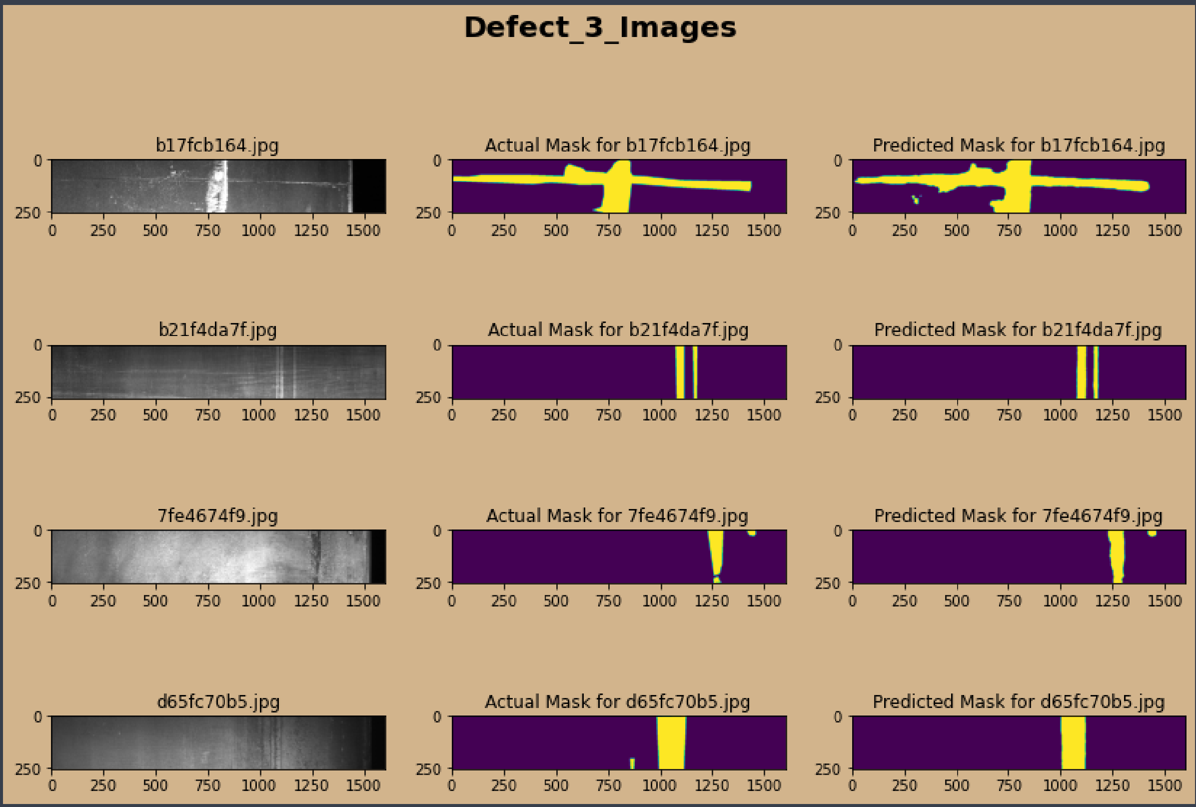
In [ ]:

```
val_preds=model.predict_generator(test_DataGenerator(val_3[12:16],preprocess=preprocess),verb
ose=1)
```

```
4/4 [==============================] - 1s 305ms/step
```

In [ ]:

```python
plot_mask(val_3[12:16].values,3,val_preds)
```



Test Dataset

In [ ]:

```python
test_preds=model.predict_generator(test_DataGenerator(test_3[12:16],preprocess=preprocess),ve
rbose=1)
```

```
4/4 [==============================] - 1s 269ms/step
```

In [ ]:

```python
plot_mask(test_3[12:16].values,3,test_preds)
```

Defect 4

In [ ]:

```
train_batch=train_DataGenerator(train_4,shuffle=True,preprocess=preprocess)
valid_batch=test_DataGenerator(val_4,preprocess=preprocess)

log_dir=os.path.join("logs",datetime.datetime.now().strftime("%Y%m%d-%H%M%S"))
tensorboard=tf.keras.callbacks.TensorBoard(log_dir=log_dir,histogram_freq=1,write_graph=True,
write_grads=True)

checkpoint_filepath='/content/drive//My Drive/Steel_Detection /segmentation_defect_4.h5'
model_checkpoint_callback=tf.keras.callbacks.ModelCheckpoint(filepath=checkpoint_filepath,mon
itor='val_dice_coef',mode='max',save_best_only=True)
#https://keras.io/api/metrics/
#https://keras.io/api/losses/probabilistic_losses/#categorical_crossentropy-function
model.compile(optimizer='adam',loss=bce_dice_loss,metrics=[dice_coef])
callback=[model_checkpoint_callback,tensorboard]
#https://datascience.stackexchange.com/questions/34444/what-is-the-difference-between-fit-and
-fit-generator-in-keras
history=model.fit_generator(train_batch,validation_data=valid_batch,epochs=25,verbose=1,callb
acks=callback)
```

```
WARNING:tensorflow:`write_grads` will be ignored in TensorFlow 2.0 for the `TensorBoard` Callback.
Epoch 1/25
145/145 [==============================] - 338s 2s/step - loss: 0.5280 - dice_coef: 0.6319 - val_loss: 0.4988 - val_dice_coef: 0.6622
Epoch 2/25
145/145 [==============================] - 277s 2s/step - loss: 0.4313 - dice_coef: 0.7002 - val_loss: 0.5453 - val_dice_coef: 0.6242
Epoch 3/25
145/145 [==============================] - 277s 2s/step - loss: 0.4110 - dice_coef: 0.7147 - val_loss: 0.4497 - val_dice_coef: 0.6834
Epoch 4/25
145/145 [==============================] - 277s 2s/step - loss: 0.3800 - dice_coef: 0.7364 - val_loss: 0.4400 - val_dice_coef: 0.6874
Epoch 5/25
145/145 [==============================] - 277s 2s/step - loss: 0.3644 - dice_coef: 0.7500 - val_loss: 0.4514 - val_dice_coef: 0.6678
Epoch 6/25
145/145 [==============================] - 277s 2s/step - loss: 0.3549 - dice_coef: 0.7582 - val_loss: 0.4386 - val_dice_coef: 0.7032
Epoch 7/25
145/145 [==============================] - 277s 2s/step - loss: 0.3353 - dice_coef: 0.7679 - val_loss: 0.4277 - val_dice_coef: 0.6866
Epoch 8/25
145/145 [==============================] - 277s 2s/step - loss: 0.3294 - dice_coef: 0.7742 - val_loss: 0.4577 - val_dice_coef: 0.6738
Epoch 9/25
145/145 [==============================] - 276s 2s/step - loss: 0.3137 - dice_coef: 0.7842 - val_loss: 0.4610 - val_dice_coef: 0.6924
Epoch 10/25
145/145 [==============================] - 277s 2s/step - loss: 0.3079 - dice_coef: 0.7865 - val_loss: 0.4030 - val_dice_coef: 0.7158
Epoch 11/25
145/145 [==============================] - 277s 2s/step - loss: 0.2936 - dice_coef: 0.7979 - val_loss: 0.4311 - val_dice_coef: 0.7041
Epoch 12/25
145/145 [==============================] - 277s 2s/step - loss: 0.2985 - dice_coef: 0.7918 - val_loss: 0.4219 - val_dice_coef: 0.7023
Epoch 13/25
145/145 [==============================] - 276s 2s/step - loss: 0.2942 - dice_coef: 0.7954 - val_loss: 0.4282 - val_dice_coef: 0.7027
Epoch 14/25
145/145 [==============================] - 277s 2s/step - loss: 0.2789 - dice_coef: 0.8079 - val_loss: 0.4295 - val_dice_coef: 0.7090
Epoch 15/25
145/145 [==============================] - 276s 2s/step - loss: 0.2654 - dice_coef: 0.8164 - val_loss: 0.4170 - val_dice_coef: 0.7129
Epoch 16/25
145/145 [==============================] - 276s 2s/step - loss: 0.2615 - dice_coef: 0.8205 - val_loss: 0.4289 - val_dice_coef: 0.7120
Epoch 17/25
145/145 [==============================] - 276s 2s/step - loss: 0.2565 - dice_coef: 0.8234 - val_loss: 0.4403 - val_dice_coef: 0.6960
Epoch 18/25
145/145 [==============================] - 276s 2s/step - loss: 0.2600 - dice_coef: 0.8199 - val_loss: 0.4720 - val_dice_coef: 0.6863
Epoch 19/25
145/145 [==============================] - 276s 2s/step - loss: 0.2432 - dice_coef: 0.8318 - val_loss: 0.4625 - val_dice_coef: 0.7023
Epoch 20/25
145/145 [==============================] - 277s 2s/step - loss: 0.2395 - dice_coef: 0.8353 - val_loss: 0.4342 - val_dice_coef: 0.7102
Epoch 21/25
145/145 [==============================] - 277s 2s/step - loss: 0.2459 - dice_coef: 0.8297 - val_loss: 0.5085 - val_dice_coef: 0.6691
Epoch 22/25
145/145 [==============================] - 278s 2s/step - loss: 0.2289 - dice_coef: 0.8411 - val_loss: 0.4458 - val_dice_coef: 0.6881
Epoch 23/25
145/145 [==============================] - 277s 2s/step - loss: 0.2354 - dice_coef: 0.8368 - val_loss: 0.4535 - val_dice_coef: 0.6974
Epoch 24/25
145/145 [==============================] - 277s 2s/step - loss: 0.2322 - dice_coef: 0.8397 - val_loss: 0.4367 - val_dice_coef: 0.7121
Epoch 25/25
145/145 [==============================] - 277s 2s/step - loss: 0.2297 - dice_coef: 0.8402 - val_loss: 0.4888 - val_dice_coef: 0.6799
```

In [ ]:

```
%tensorboard --logdir logs
```

In [11]:

```
model=load_model('/content/drive//My Drive/Steel_Detection /segmentation_defect_4.h5',custom_objects={'bce_dice_loss':bce_dice_loss,'dice_coef':dice_coef})
```

In [12]:

```
print('Training Dataset:\n')
print(model.evaluate(test_DataGenerator(train_4,preprocess=preprocess),verbose=1))
print("="*100)
print('\nValidation Dataset:\n')
print(model.evaluate(test_DataGenerator(val_4,preprocess=preprocess),verbose=1))
print("="*100)
print('\nTest Dataset:\n')
print(model.evaluate(test_DataGenerator(test_4,preprocess=preprocess),verbose=1))
```

```
Training Dataset:

581/581 [==============================] - 183s 256ms/step - loss: 0.4008 - dice_coef: 0.7202
[0.400820791721344, 0.7201958894729614]
====================================================================================================

Validation Dataset:

142/142 [==============================] - 36s 252ms/step - loss: 0.4030 - dice_coef: 0.7158
[0.40297946333885193, 0.7157671451568604]
====================================================================================================

Test Dataset:

78/78 [==============================] - 19s 248ms/step - loss: 0.4231 - dice_coef: 0.7077
[0.42307525873184204, 0.7077347636222839]
```

- For validation,test datasets loss slightly increases and metrics slightly decreases as compared with train data but overall values are similar thus model is not over-fitting. For better results on unseen data train model for more epochs (e.g. epoch =100) based on the available resources (memory).

Training Dataset

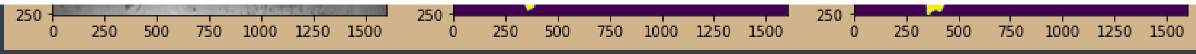
In [ ]:

```
train_preds=model.predict_generator(test_DataGenerator(train_4[14:18],preprocess=preprocess),verbose=1)
```

```
4/4 [==============================] - 6s 1s/step
```

In [ ]:

```
plot_mask(train_4[14:18].values,4,train_preds)
```



Validation Dataset

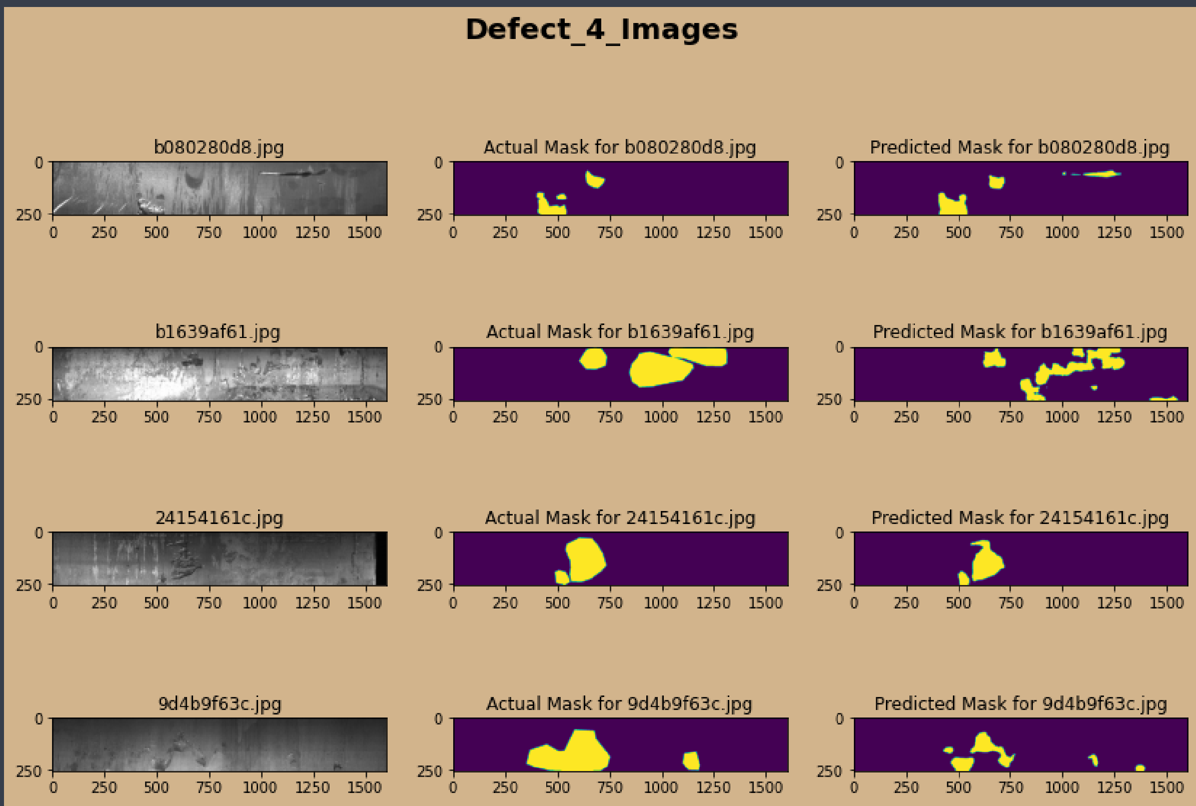
In [ ]:

```
val_preds=model.predict_generator(test_DataGenerator(val_4[14:18],preprocess=preprocess),verbose=1)
```

```
4/4 [==============================] - 6s 1s/step
```

In [ ]:

```
plot_mask(val_4[14:18].values,4,val_preds)
```



Test Dataset

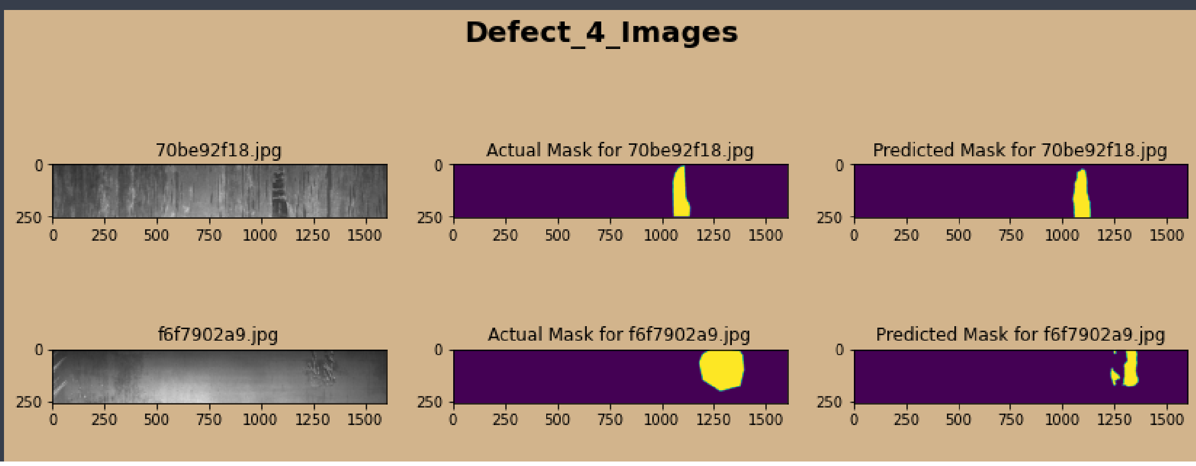
In [ ]:

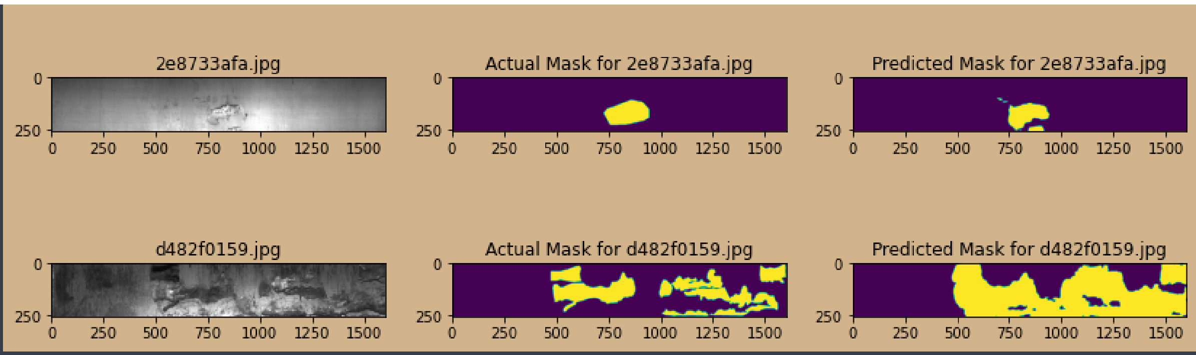
```
test_preds=model.predict_generator(test_DataGenerator(test_4[14:18],preprocess=preprocess),verbose=1)
```

```
4/4 [==============================] - 6s 1s/step
```

In [ ]:

```
plot_mask(test_4[14:18].values,4,test_preds)
```




2e8733afa.jpg
Actual Mask for 2e8733afa.jpg
Predicted Mask for 2e8733afa.jpg
d482f0159.jpg
Actual Mask for d482f0159.jpg
Predicted Mask for d482f0159.jpg
0
250
0 250 500 750 1000 1250 1500

In [ ]:

In [ ]: