

ct-heart-segmentation-using-u-net

July 4, 2025

0.1 Project Overview

CT heart segmentation plays a vital role in medical image analysis, enabling precise visualization and diagnosis of cardiac conditions. It assists clinicians in assessing and treating:

Coronary Artery Disease

Cardiomegaly (enlarged heart)

Congenital Heart Defects

In this project, we develop a deep learning solution leveraging the U-Net architecture, which is highly effective for biomedical segmentation tasks. Our goal is to achieve accurate and reliable segmentation of the heart from CT scan images, aiding in advanced clinical decision-making.

#

CT Heart Segmentation using U-Net

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Introduction

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0.1.2 What is U-Net?

U-Net is a convolutional neural network architecture specifically designed for biomedical image segmentation. It was introduced in 2015 by Olaf Ronneberger et al. and has since become a standard in medical image analysis due to its ability to produce precise segmentations even with limited training data.

The U-Net architecture is characterized by a **U-shaped structure**, consisting of:

- **Contracting Path (Encoder):** Captures context through successive convolution and max-pooling layers.
- **Expanding Path (Decoder):** Enables precise localization using upsampling and skip connections.
- **Skip Connections:** Connect corresponding layers in the encoder and decoder to retain spatial information lost during downsampling.

This architecture allows U-Net to learn both **global features** and **fine-grained local details**, making it highly effective for tasks like retinal blood vessel segmentation where accurate boundary detection is crucial.

**

Import Libraries

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```
[1]: pip install segmentation-models
```

```
Collecting segmentation-models
```

```
  Downloading segmentation_models-1.0.1-py3-none-any.whl.metadata (938 bytes)
```

```
Collecting keras-applications<=1.0.8,>=1.0.7 (from segmentation-models)
```

```
  Downloading Keras_Applications-1.0.8-py3-none-any.whl.metadata (1.7 kB)
```

```
Collecting image-classifiers==1.0.0 (from segmentation-models)
```

```
  Downloading image_classifiers-1.0.0-py3-none-any.whl.metadata (8.6 kB)
```

```
Collecting efficientnet==1.0.0 (from segmentation-models)
```

```
  Downloading efficientnet-1.0.0-py3-none-any.whl.metadata (6.1 kB)
```

```
Requirement already satisfied: scikit-image in /usr/local/lib/python3.11/dist-packages (from efficientnet==1.0.0->segmentation-models) (0.25.2)
```

```
Requirement already satisfied: numpy>=1.9.1 in /usr/local/lib/python3.11/dist-packages (from keras-applications<=1.0.8,>=1.0.7->segmentation-models) (1.26.4)
```

```
Requirement already satisfied: h5py in /usr/local/lib/python3.11/dist-packages (from keras-applications<=1.0.8,>=1.0.7->segmentation-models) (3.13.0)
```

```
Requirement already satisfied: mkl_fft in /usr/local/lib/python3.11/dist-packages (from numpy>=1.9.1->keras-applications<=1.0.8,>=1.0.7->segmentation-models) (1.3.8)
```

```
Requirement already satisfied: mkl_random in /usr/local/lib/python3.11/dist-packages (from numpy>=1.9.1->keras-applications<=1.0.8,>=1.0.7->segmentation-models) (1.2.4)
```

```
Requirement already satisfied: mkl_umath in /usr/local/lib/python3.11/dist-packages (from numpy>=1.9.1->keras-applications<=1.0.8,>=1.0.7->segmentation-
```

models) (0.1.1)

Requirement already satisfied: mkl in /usr/local/lib/python3.11/dist-packages (from numpy>=1.9.1->keras-applications<=1.0.8,>=1.0.7->segmentation-models) (2025.1.0)

Requirement already satisfied: tbb4py in /usr/local/lib/python3.11/dist-packages (from numpy>=1.9.1->keras-applications<=1.0.8,>=1.0.7->segmentation-models) (2022.1.0)

Requirement already satisfied: mkl-service in /usr/local/lib/python3.11/dist-packages (from numpy>=1.9.1->keras-applications<=1.0.8,>=1.0.7->segmentation-models) (2.4.1)

Requirement already satisfied: scipy>=1.11.4 in /usr/local/lib/python3.11/dist-packages (from scikit-image->efficientnet==1.0.0->segmentation-models) (1.15.2)

Requirement already satisfied: networkx>=3.0 in /usr/local/lib/python3.11/dist-packages (from scikit-image->efficientnet==1.0.0->segmentation-models) (3.4.2)

Requirement already satisfied: pillow>=10.1 in /usr/local/lib/python3.11/dist-packages (from scikit-image->efficientnet==1.0.0->segmentation-models) (11.1.0)

Requirement already satisfied: imageio!=2.35.0,>=2.33 in /usr/local/lib/python3.11/dist-packages (from scikit-image->efficientnet==1.0.0->segmentation-models) (2.37.0)

Requirement already satisfied: tifffile>=2022.8.12 in /usr/local/lib/python3.11/dist-packages (from scikit-image->efficientnet==1.0.0->segmentation-models) (2025.3.30)

Requirement already satisfied: packaging>=21 in /usr/local/lib/python3.11/dist-packages (from scikit-image->efficientnet==1.0.0->segmentation-models) (25.0)

Requirement already satisfied: lazy-loader>=0.4 in /usr/local/lib/python3.11/dist-packages (from scikit-image->efficientnet==1.0.0->segmentation-models) (0.4)

Requirement already satisfied: intel-openmp<2026,>=2024 in /usr/local/lib/python3.11/dist-packages (from mkl->numpy>=1.9.1->keras-applications<=1.0.8,>=1.0.7->segmentation-models) (2024.2.0)

Requirement already satisfied: tbb==2022.* in /usr/local/lib/python3.11/dist-packages (from mkl->numpy>=1.9.1->keras-applications<=1.0.8,>=1.0.7->segmentation-models) (2022.1.0)

Requirement already satisfied: tcmlib==1.* in /usr/local/lib/python3.11/dist-packages (from tbb==2022.*->mkl->numpy>=1.9.1->keras-applications<=1.0.8,>=1.0.7->segmentation-models) (1.3.0)

Requirement already satisfied: intel-cmplr-lib-rt in /usr/local/lib/python3.11/dist-packages (from mkl_umath->numpy>=1.9.1->keras-applications<=1.0.8,>=1.0.7->segmentation-models) (2024.2.0)

Requirement already satisfied: intel-cmplr-lib-ur==2024.2.0 in /usr/local/lib/python3.11/dist-packages (from intel-openmp<2026,>=2024->mkl->numpy>=1.9.1->keras-applications<=1.0.8,>=1.0.7->segmentation-models) (2024.2.0)

Downloading segmentation_models-1.0.1-py3-none-any.whl (33 kB)

Downloading efficientnet-1.0.0-py3-none-any.whl (17 kB)

Downloading image_classifiers-1.0.0-py3-none-any.whl (19 kB)

Downloading Keras_Applications-1.0.8-py3-none-any.whl (50 kB)

50.7/50.7 kB

3.4 MB/s eta 0:00:00

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

Note: you may need to restart the kernel to use updated packages.

```
[2]: # Common
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
plt.style.use('dark_background')
import os
import math
os.environ["SM_FRAMEWORK"] = "tf.keras"

# Data
from sklearn.model_selection import train_test_split
import cv2
from tqdm import tqdm

# Model
import tensorflow as tf
from tensorflow.keras import backend as K
from tensorflow.keras.utils import Sequence
import keras
from keras.models import Model
from keras.layers import Input, Conv2D, MaxPool2D, Conv2DTranspose, Resizing, Concatenate, Activation
from keras.optimizers import Adam
from keras.callbacks import EarlyStopping, ModelCheckpoint
import albumentations as A
from albumentations.core.composition import OneOf
import segmentation_models as sm

# Metrics
from tensorflow.keras.metrics import *

# Ignore
import warnings
warnings.filterwarnings("ignore")
```

2025-07-04 18:13:12.461255: E

external/local_xla/xla/stream_executor/cuda/cuda_fft.cc:477] Unable to register cuFFT factory: Attempting to register factory for plugin cuFFT when one has already been registered

WARNING: All log messages before absl::InitializeLog() is called are written to STDERR

E0000 00:00:1751652792.658839 19 cuda_dnn.cc:8310] Unable to register cuDNN factory: Attempting to register factory for plugin cuDNN when one has already been registered

E0000 00:00:1751652792.715011 19 cuda_blas.cc:1418] Unable to register cuBLAS factory: Attempting to register factory for plugin cuBLAS when one has already been registered

Segmentation Models: using `tf.keras` framework.

/usr/local/lib/python3.11/dist-packages/albumentations/__init__.py:28:

UserWarning: A new version of Albumentations is available: '2.0.8' (you have '2.0.5'). Upgrade using: pip install -U albumentations. To disable automatic update checks, set the environment variable NO_ALBUMENTATIONS_UPDATE to 1.

check_for_updates()

**

Loading Data

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```
[3]: #####
image_size = 256

# Augmentation using Albumentations
augmentation = A.Compose([
    A.HorizontalFlip(p=.5),
    A.VerticalFlip(p=.5),
    A.Rotate(limit=.45, p=1.0)
])

# Function to load image or mask from path
def load_image(path, size, mask=False):
    image = cv2.imread(path)

    if image is None:
        raise FileNotFoundError(f"Can't read image: {path}")

    image = cv2.resize(image, (size, size))

    if mask:
        # Convert mask to grayscale (1 channel)
        image = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)
    else:
        # Convert image to RGB (3 channels)
        image = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)

    # Normalize pixel values to [0, 1]
    image = image / 255.0
    return image
```

```

# Function to extract all image and mask paths from dataset folder
def get_image_mask_paths(root_path):
    image_paths = []
    mask_paths = []

    for folder in os.listdir(root_path):
        folder_path = os.path.join(root_path, folder)
        if not os.path.isdir(folder_path):
            continue
        for subfolder in os.listdir(folder_path):
            subfolder_path = os.path.join(folder_path, subfolder)
            is_mask = subfolder.lower() == "mask"
            for file in os.listdir(subfolder_path):
                file_path = os.path.join(subfolder_path, file)
                if is_mask:
                    mask_paths.append(file_path)
                else:
                    image_paths.append(file_path)

    # Sort paths to ensure image and mask alignment
    image_paths.sort()
    mask_paths.sort()
    return image_paths, mask_paths

# Data Generator for image + mask loading with optional augmentation
class SegmentationGenerator(tf.keras.utils.Sequence):
    def __init__(self, image_paths, mask_paths, batch_size=32, augment=False,
        size=512):
        self.image_paths = image_paths
        self.mask_paths = mask_paths
        self.batch_size = batch_size
        self.augment = augment
        self.size = size

    def __len__(self):
        return int(np.ceil(len(self.image_paths) / self.batch_size))

    def __getitem__(self, idx):
        # Get image/mask paths for current batch
        batch_img_paths = self.image_paths[idx * self.batch_size:(idx + 1) *
        self.batch_size]
        batch_mask_paths = self.mask_paths[idx * self.batch_size:(idx + 1) *
        self.batch_size]

        images = []
        masks = []

```

```

for img_path, mask_path in zip(batch_img_paths, batch_mask_paths):
    img = load_image(img_path, self.size, mask=False)
    mask = load_image(mask_path, self.size, mask=True)

    # Apply augmentation if enabled
    if self.augment:
        augmented = augmentation(image=img, mask=mask)
        img = augmented['image']
        mask = augmented['mask']

    # Ensure mask has shape (H, W, 1)
    if mask.ndim == 2:
        mask = np.expand_dims(mask, axis=-1)

    images.append(img.astype(np.float32))
    masks.append(mask.astype(np.float32))

return np.array(images), np.array(masks)

```

```

[4]: image_paths, mask_paths = get_image_mask_paths("/kaggle/input/
      ↪ct-heart-segmentation/data/train")
      # Step 1: Split 10% for test, 90% rest
      train_val_imgs, test_imgs, train_val_masks, test_masks = train_test_split(
          image_paths, mask_paths, test_size=0.15, random_state=42)
      # Step 2: Split 20% of total for validation
      train_imgs, val_imgs, train_masks, val_masks = train_test_split(
          train_val_imgs, train_val_masks, test_size=0.15, random_state=42)

```

```

[5]: train_gen = SegmentationGenerator(train_imgs, train_masks, batch_size=32,
      ↪augment=True, size=image_size)
      val_gen   = SegmentationGenerator(val_imgs, val_masks, batch_size=32,
      ↪augment=False, size=image_size)
      test_gen  = SegmentationGenerator(test_imgs, test_masks, batch_size=32,
      ↪augment=False, size=image_size)

```

```

[6]: images, masks = train_gen[10]

```

**

EDA

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```

[7]: def show_images_and_masks(images, masks, num_samples=8):

      num_samples = min(num_samples, len(images), len(masks))

```

```

cols = 2
pairs_per_row = 4
rows = math.ceil(num_samples / pairs_per_row)

fig, axes = plt.subplots(rows, pairs_per_row * cols, figsize=(pairs_per_row*
↪* 5, rows * 3.5))

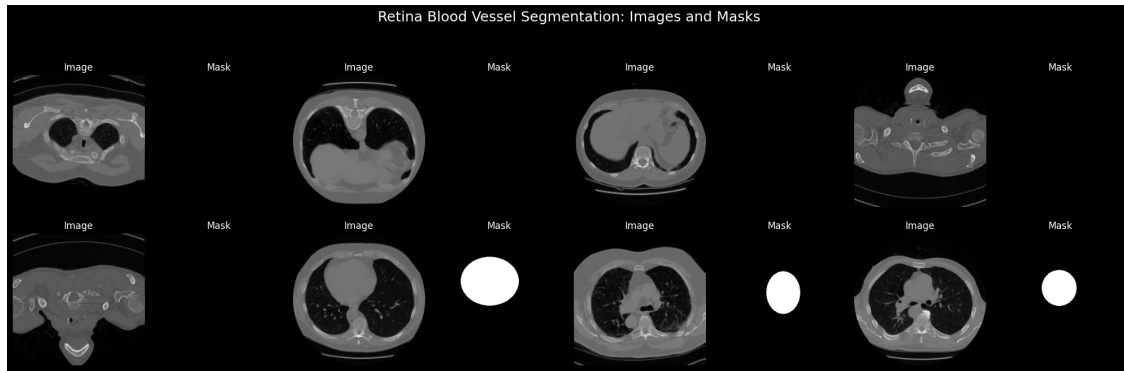
if rows == 1:
    axes = np.expand_dims(axes, 0)

fig.suptitle("Retina Blood Vessel Segmentation: Images and Masks",
↪fontsize=18, color='white')

for i in range(num_samples):
    image = images[i]
    mask = masks[i]
    row = i // pairs_per_row
    col_pair = (i % pairs_per_row) * 2
    ax_img = axes[row, col_pair]
    ax_mask = axes[row, col_pair + 1]
    ax_img.imshow(image)
    ax_img.set_title("Image", fontsize=12)
    ax_img.axis("off")
    cmap = 'gray'
    ax_mask.imshow(mask, cmap=cmap)
    ax_mask.set_title("Mask", fontsize=12)
    ax_mask.axis("off")
total_slots = rows * pairs_per_row
for i in range(num_samples, total_slots):
    row = i // pairs_per_row
    col_pair = (i % pairs_per_row) * 2
    axes[row, col_pair].axis("off")
    axes[row, col_pair + 1].axis("off")
plt.tight_layout()
plt.subplots_adjust(top=0.88)
plt.show()

```

```
[8]: show_images_and_masks(images, masks, num_samples=8)
```

**

Modeling

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0.1.3 Encoder

The encoder is responsible for extracting features from the input image. It applies two convolutional layers followed by a ReLU Activation to learn patterns and then uses max pooling to reduce the image size help the model focus on important features.

```
[9]: def encoder_block(inputs, num_filters):

    x = Conv2D(num_filters, 3, padding='same')(inputs)
    x = Activation('relu')(x)

    x = Conv2D(num_filters, 3, padding='same')(x)
    x = Activation('relu')(x)

    x = MaxPool2D(pool_size=(2, 2))(x)

    return x
```

0.1.4 Decoder

The decoder helps restore the original image size while combining the low-level and high-level features. It starts by upsampling the feature map, resizes the corresponding encoder output (skip connection), merges them and then applies two convolution layers with ReLU.

```
[10]: def decoder_block(inputs, skip_features, num_filters):

    x = Conv2DTranspose(num_filters, (2, 2), strides=2, padding='same')(inputs)
    skip_features = Resizing(x.shape[1], x.shape[2])(skip_features)
```

```

x = Concatenate()([x, skip_features])

x = Conv2D(num_filters, 3, padding='same')(x)
x = Activation('relu')(x)
x = Conv2D(num_filters, 3, padding='same')(x)
x = Activation('relu')(x)

return x

```

0.1.5 Defining the U-Net Model

This function builds the complete U-Net architecture. It connects multiple encoder and decoder blocks and includes a bottleneck in the middle. The final output layer uses a sigmoid activation for segmentation.

```

[11]: def unet_model(input_shape=(256, 256, 3), num_classes=1):
    inputs = tf.keras.layers.Input(shape=input_shape)

    # Contracting Path (Encoder)
    s1 = encoder_block(inputs, 64)
    s2 = encoder_block(s1, 128)
    s3 = encoder_block(s2, 256)
    s4 = encoder_block(s3, 512)

    # Bottleneck
    b1 = Conv2D(1024, 3, padding='same')(s4)
    b1 = Activation('relu')(b1)
    b1 = Conv2D(1024, 3, padding='same')(b1)
    b1 = Activation('relu')(b1)

    # Expansive Path (Decoder)
    d1 = decoder_block(b1, s4, 512)
    d2 = decoder_block(d1, s3, 256)
    d3 = decoder_block(d2, s2, 128)
    d4 = decoder_block(d3, s1, 64)

    outputs = Conv2D(num_classes, 1, padding='same', activation='sigmoid')(d4)

    model = Model(inputs=inputs, outputs=outputs, name='U-Net')
    return model

```

```

[12]: model = unet_model(input_shape=(image_size, image_size, 3), num_classes=1)
model.summary()













```

```

I0000 00:00:1751652811.957982      19 gpu_device.cc:2022] Created device
/job:localhost/replica:0/task:0/device:GPU:0 with 15513 MB memory: -> device:
0, name: Tesla P100-PCIE-16GB, pci bus id: 0000:00:04.0, compute capability: 6.0

```

Model: "U-Net"

Layer (type) ↳to	Output Shape	Param #	Connected
input_layer (InputLayer) ↳	(None, 256, 256, 3)	0	- 
conv2d (Conv2D) ↳input_layer[0][0]	(None, 256, 256, 64)	1,792	
activation (Activation) ↳conv2d[0][0]	(None, 256, 256, 64)	0	
conv2d_1 (Conv2D) ↳activation[0][0]	(None, 256, 256, 64)	36,928	
activation_1 (Activation) ↳conv2d_1[0][0]	(None, 256, 256, 64)	0	
max_pooling2d ↳activation_1[0][0] (MaxPooling2D) ↳	(None, 128, 128, 64)	0	
conv2d_2 (Conv2D) ↳max_pooling2d[0][0]	(None, 128, 128, 128)	73,856	
activation_2 (Activation) ↳conv2d_2[0][0]	(None, 128, 128, 128)	0	
conv2d_3 (Conv2D) ↳activation_2[0][0]	(None, 128, 128, 128)	147,584	
activation_3 (Activation) ↳conv2d_3[0][0]	(None, 128, 128, 128)	0	
max_pooling2d_1 ↳activation_3[0][0] (MaxPooling2D) ↳	(None, 64, 64, 128)	0	
conv2d_4 (Conv2D) ↳max_pooling2d_1[0][0]	(None, 64, 64, 256)	295,168	

activation_4 (Activation)	(None, 64, 64, 256)	0	⌵
↳conv2d_4[0][0]			
conv2d_5 (Conv2D)	(None, 64, 64, 256)	590,080	⌵
↳activation_4[0][0]			
activation_5 (Activation)	(None, 64, 64, 256)	0	⌵
↳conv2d_5[0][0]			
max_pooling2d_2	(None, 32, 32, 256)	0	⌵
↳activation_5[0][0]			
(MaxPooling2D)			⌵
↳			
conv2d_6 (Conv2D)	(None, 32, 32, 512)	1,180,160	⌵
↳max_pooling2d_2[0][0]			
activation_6 (Activation)	(None, 32, 32, 512)	0	⌵
↳conv2d_6[0][0]			
conv2d_7 (Conv2D)	(None, 32, 32, 512)	2,359,808	⌵
↳activation_6[0][0]			
activation_7 (Activation)	(None, 32, 32, 512)	0	⌵
↳conv2d_7[0][0]			
max_pooling2d_3	(None, 16, 16, 512)	0	⌵
↳activation_7[0][0]			
(MaxPooling2D)			⌵
↳			
conv2d_8 (Conv2D)	(None, 16, 16, 1024)	4,719,616	⌵
↳max_pooling2d_3[0][0]			
activation_8 (Activation)	(None, 16, 16, 1024)	0	⌵
↳conv2d_8[0][0]			
conv2d_9 (Conv2D)	(None, 16, 16, 1024)	9,438,208	⌵
↳activation_8[0][0]			
activation_9 (Activation)	(None, 16, 16, 1024)	0	⌵
↳conv2d_9[0][0]			
conv2d_transpose	(None, 32, 32, 512)	2,097,664	⌵
↳activation_9[0][0]			

(Conv2DTranspose)			└
↪			
resizing (Resizing)	(None, 32, 32, 512)	0	└
↪max_pooling2d_3[0][0]			
concatenate (Concatenate)	(None, 32, 32, 1024)	0	└
↪conv2d_transpose[0][0]...			
			└
↪resizing[0][0]			
conv2d_10 (Conv2D)	(None, 32, 32, 512)	4,719,104	└
↪concatenate[0][0]			
activation_10	(None, 32, 32, 512)	0	└
↪conv2d_10[0][0]			
(Activation)			└
↪			
conv2d_11 (Conv2D)	(None, 32, 32, 512)	2,359,808	└
↪activation_10[0][0]			
activation_11	(None, 32, 32, 512)	0	└
↪conv2d_11[0][0]			
(Activation)			└
↪			
conv2d_transpose_1	(None, 64, 64, 256)	524,544	└
↪activation_11[0][0]			
(Conv2DTranspose)			└
↪			
resizing_1 (Resizing)	(None, 64, 64, 256)	0	└
↪max_pooling2d_2[0][0]			
concatenate_1	(None, 64, 64, 512)	0	└
↪conv2d_transpose_1[0]...			
(Concatenate)			└
↪resizing_1[0][0]			
conv2d_12 (Conv2D)	(None, 64, 64, 256)	1,179,904	└
↪concatenate_1[0][0]			
activation_12	(None, 64, 64, 256)	0	└
↪conv2d_12[0][0]			

(Activation)			└
↳			
conv2d_13 (Conv2D)	(None, 64, 64, 256)	590,080	└
↳activation_12[0][0]			
activation_13	(None, 64, 64, 256)	0	└
↳conv2d_13[0][0]			
(Activation)			└
↳			
conv2d_transpose_2	(None, 128, 128, 128)	131,200	└
↳activation_13[0][0]			
(Conv2DTranspose)			└
↳			
resizing_2 (Resizing)	(None, 128, 128, 128)	0	└
↳max_pooling2d_1[0][0]			
concatenate_2	(None, 128, 128, 256)	0	└
↳conv2d_transpose_2[0]...			
(Concatenate)			└
↳resizing_2[0][0]			
conv2d_14 (Conv2D)	(None, 128, 128, 128)	295,040	└
↳concatenate_2[0][0]			
activation_14	(None, 128, 128, 128)	0	└
↳conv2d_14[0][0]			
(Activation)			└
↳			
conv2d_15 (Conv2D)	(None, 128, 128, 128)	147,584	└
↳activation_14[0][0]			
activation_15	(None, 128, 128, 128)	0	└
↳conv2d_15[0][0]			
(Activation)			└
↳			
conv2d_transpose_3	(None, 256, 256, 64)	32,832	└
↳activation_15[0][0]			
(Conv2DTranspose)			└
↳			

resizing_3 (Resizing)	(None, 256, 256, 64)	0	└
↳max_pooling2d[0][0]			
concatenate_3	(None, 256, 256, 128)	0	└
↳conv2d_transpose_3[0]...			
(Concatenate)			└
↳resizing_3[0][0]			
conv2d_16 (Conv2D)	(None, 256, 256, 64)	73,792	└
↳concatenate_3[0][0]			
activation_16	(None, 256, 256, 64)	0	└
↳conv2d_16[0][0]			
(Activation)			└
↳			
conv2d_17 (Conv2D)	(None, 256, 256, 64)	36,928	└
↳activation_16[0][0]			
activation_17	(None, 256, 256, 64)	0	└
↳conv2d_17[0][0]			
(Activation)			└
↳			
conv2d_18 (Conv2D)	(None, 256, 256, 1)	65	└
↳activation_17[0][0]			

Total params: 31,031,745 (118.38 MB)

Trainable params: 31,031,745 (118.38 MB)

Non-trainable params: 0 (0.00 B)

```
[13]: # Compile model
model.compile(
    optimizer='adam',
    loss= sm.losses.bce_dice_loss,
    metrics=['accuracy', sm.metrics.iou_score]
)

# Callbacks
checkpoint_cb = ModelCheckpoint(
    'best_model.keras',
```

```

        save_best_only=True,
        monitor='val_loss',
        mode='min',
        verbose=1
    )

    early_stopping_cb = EarlyStopping(
        monitor='val_loss',
        patience=5,
        mode='min',
        restore_best_weights=True,
        verbose=1
    )

    # Train model
    history = model.fit(
        train_gen,
        validation_data=val_gen,
        epochs=20,
        callbacks=[checkpoint_cb, early_stopping_cb]
    )

```

Epoch 1/20

WARNING: All log messages before absl::InitializeLog() is called are written to STDERR

I0000 00:00:1751652824.630717 69 service.cc:148] XLA service 0x7aa370009b20 initialized for platform CUDA (this does not guarantee that XLA will be used).

Devices:

I0000 00:00:1751652824.631403 69 service.cc:156] StreamExecutor device (0): Tesla P100-PCIE-16GB, Compute Capability 6.0

I0000 00:00:1751652825.709214 69 cuda_dnn.cc:529] Loaded cuDNN version 90300

2025-07-04 18:13:52.099974: E

external/local_xla/xla/service/slow_operation_alarm.cc:65] Trying algorithm eng12{k11=2} for conv (f32[32,128,128,128]{3,2,1,0}, u8[0]{0}) custom-call(f32[32,128,128,128]{3,2,1,0}, f32[128,128,3,3]{3,2,1,0}, f32[128]{0}), window={size=3x3 pad=1_1x1_1}, dim_labels=bf01_oi01->bf01, custom_call_target="__cudnn\$convBiasActivationForward", backend_config={"cudnn_conv_backend_config":{"activation_mode":"kNone","conv_result_scale":1,"leakyrelu_alpha":0,"side_input_scale":0},"force_earliest_schedule":false,"operation_queue_id":"0","wait_on_operation_queues":[]}} is taking a while...

2025-07-04 18:13:52.129728: E

external/local_xla/xla/service/slow_operation_alarm.cc:133] The operation took 1.0299225s

Trying algorithm eng12{k11=2} for conv (f32[32,128,128,128]{3,2,1,0}, u8[0]{0}) custom-call(f32[32,128,128,128]{3,2,1,0}, f32[128,128,3,3]{3,2,1,0}, f32[128]{0}), window={size=3x3 pad=1_1x1_1}, dim_labels=bf01_oi01->bf01,


```
custom_call_target="__cudnn$convBiasActivationForward", backend_config={"cudnn_c
onv_backend_config":{"activation_mode":"kNone","conv_result_scale":1,"leakyrelu_
alpha":0,"side_input_scale":0},"force_earliest_schedule":false,"operation_queue_
id":"0","wait_on_operation_queues":[]} is taking a while...
```

```
I0000 00:00:1751652887.777115      69 device_compiler.h:188] Compiled cluster
using XLA! This line is logged at most once for the lifetime of the process.
```

```
23/58          28s 825ms/step -
accuracy: 0.8358 - iou_score: 0.0197 - loss: 1.3431
```

```
E0000 00:00:1751652909.091222      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
```

```
E0000 00:00:1751652909.325235      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
```

```
E0000 00:00:1751652909.885504      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
```

```
E0000 00:00:1751652910.143755      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
```

```
58/58          0s 1s/step -
accuracy: 0.9030 - iou_score: 0.0286 - loss: 1.2157
```

```
E0000 00:00:1751652981.504334      66 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
```

```
E0000 00:00:1751652981.760571      66 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
```

```
Epoch 1: val_loss improved from inf to 0.97615, saving model to best_model.keras
```

```
58/58          171s 2s/step -
accuracy: 0.9038 - iou_score: 0.0289 - loss: 1.2136 - val_accuracy: 0.9708 -
val_iou_score: 0.0885 - val_loss: 0.9762
```

```
Epoch 2/20
```

```
58/58          0s 815ms/step -
accuracy: 0.9653 - iou_score: 0.1509 - loss: 0.8707
```

```
Epoch 2: val_loss improved from 0.97615 to 0.58043, saving model to
best_model.keras
```

```
58/58          53s 910ms/step -
accuracy: 0.9653 - iou_score: 0.1523 - loss: 0.8688 - val_accuracy: 0.9687 -
val_iou_score: 0.3725 - val_loss: 0.5804
```

```
Epoch 3/20
```

```
58/58          0s 814ms/step -
accuracy: 0.9483 - iou_score: 0.2764 - loss: 0.8521
```

```
Epoch 3: val_loss improved from 0.58043 to 0.31826, saving model to
```

```

best_model.keras
58/58          53s 906ms/step -
accuracy: 0.9485 - iou_score: 0.2780 - loss: 0.8492 - val_accuracy: 0.9853 -
val_iou_score: 0.5781 - val_loss: 0.3183
Epoch 4/20
58/58          0s 814ms/step -
accuracy: 0.9870 - iou_score: 0.6570 - loss: 0.2702
Epoch 4: val_loss improved from 0.31826 to 0.30028, saving model to
best_model.keras
58/58          53s 910ms/step -
accuracy: 0.9870 - iou_score: 0.6571 - loss: 0.2701 - val_accuracy: 0.9869 -
val_iou_score: 0.6295 - val_loss: 0.3003
Epoch 5/20
58/58          0s 827ms/step -
accuracy: 0.9816 - iou_score: 0.5234 - loss: 0.4080
Epoch 5: val_loss improved from 0.30028 to 0.24541, saving model to
best_model.keras
58/58          53s 920ms/step -
accuracy: 0.9817 - iou_score: 0.5251 - loss: 0.4062 - val_accuracy: 0.9891 -
val_iou_score: 0.6342 - val_loss: 0.2454
Epoch 6/20
58/58          0s 814ms/step -
accuracy: 0.9900 - iou_score: 0.7298 - loss: 0.1990
Epoch 6: val_loss did not improve from 0.24541
58/58          51s 876ms/step -
accuracy: 0.9900 - iou_score: 0.7297 - loss: 0.1991 - val_accuracy: 0.9895 -
val_iou_score: 0.6290 - val_loss: 0.2569
Epoch 7/20
58/58          0s 814ms/step -
accuracy: 0.9905 - iou_score: 0.7361 - loss: 0.1910
Epoch 7: val_loss improved from 0.24541 to 0.19451, saving model to
best_model.keras
58/58          53s 909ms/step -
accuracy: 0.9905 - iou_score: 0.7362 - loss: 0.1909 - val_accuracy: 0.9907 -
val_iou_score: 0.6974 - val_loss: 0.1945
Epoch 8/20
58/58          0s 815ms/step -
accuracy: 0.9910 - iou_score: 0.7407 - loss: 0.1863
Epoch 8: val_loss did not improve from 0.19451
58/58          51s 876ms/step -
accuracy: 0.9909 - iou_score: 0.7402 - loss: 0.1867 - val_accuracy: 0.9903 -
val_iou_score: 0.6607 - val_loss: 0.2273
Epoch 9/20
58/58          0s 815ms/step -
accuracy: 0.9897 - iou_score: 0.7020 - loss: 0.2203
Epoch 9: val_loss improved from 0.19451 to 0.17341, saving model to
best_model.keras
58/58          53s 908ms/step -

```

accuracy: 0.9897 - iou_score: 0.7023 - loss: 0.2201 - val_accuracy: 0.9918 -
 val_iou_score: 0.7197 - val_loss: 0.1734
 Epoch 10/20
 58/58 0s 815ms/step -
 accuracy: 0.9922 - iou_score: 0.7695 - loss: 0.1620
 Epoch 10: val_loss improved from 0.17341 to 0.16159, saving model to
 best_model.keras
 58/58 53s 911ms/step -
 accuracy: 0.9922 - iou_score: 0.7695 - loss: 0.1620 - val_accuracy: 0.9923 -
 val_iou_score: 0.7305 - val_loss: 0.1616
 Epoch 11/20
 58/58 0s 815ms/step -
 accuracy: 0.9924 - iou_score: 0.7881 - loss: 0.1483
 Epoch 11: val_loss did not improve from 0.16159
 58/58 51s 878ms/step -
 accuracy: 0.9924 - iou_score: 0.7878 - loss: 0.1485 - val_accuracy: 0.9909 -
 val_iou_score: 0.7093 - val_loss: 0.2006
 Epoch 12/20
 58/58 0s 815ms/step -
 accuracy: 0.9924 - iou_score: 0.7793 - loss: 0.1539
 Epoch 12: val_loss did not improve from 0.16159
 58/58 51s 877ms/step -
 accuracy: 0.9924 - iou_score: 0.7792 - loss: 0.1540 - val_accuracy: 0.9914 -
 val_iou_score: 0.7204 - val_loss: 0.1767
 Epoch 13/20
 58/58 0s 815ms/step -
 accuracy: 0.9928 - iou_score: 0.7993 - loss: 0.1396
 Epoch 13: val_loss improved from 0.16159 to 0.16008, saving model to
 best_model.keras
 58/58 53s 909ms/step -
 accuracy: 0.9928 - iou_score: 0.7991 - loss: 0.1397 - val_accuracy: 0.9928 -
 val_iou_score: 0.7442 - val_loss: 0.1601
 Epoch 14/20
 58/58 0s 815ms/step -
 accuracy: 0.9928 - iou_score: 0.7835 - loss: 0.1506
 Epoch 14: val_loss did not improve from 0.16008
 58/58 51s 877ms/step -
 accuracy: 0.9928 - iou_score: 0.7835 - loss: 0.1506 - val_accuracy: 0.9921 -
 val_iou_score: 0.7330 - val_loss: 0.1677
 Epoch 15/20
 58/58 0s 815ms/step -
 accuracy: 0.9935 - iou_score: 0.8155 - loss: 0.1309
 Epoch 15: val_loss improved from 0.16008 to 0.15472, saving model to
 best_model.keras
 58/58 53s 910ms/step -
 accuracy: 0.9935 - iou_score: 0.8154 - loss: 0.1309 - val_accuracy: 0.9930 -
 val_iou_score: 0.7522 - val_loss: 0.1547
 Epoch 16/20

```

58/58          0s 811ms/step -
accuracy: 0.9936 - iou_score: 0.8200 - loss: 0.1225
Epoch 16: val_loss did not improve from 0.15472
58/58          51s 874ms/step -
accuracy: 0.9936 - iou_score: 0.8198 - loss: 0.1227 - val_accuracy: 0.9905 -
val_iou_score: 0.6989 - val_loss: 0.1948
Epoch 17/20
58/58          0s 815ms/step -
accuracy: 0.9934 - iou_score: 0.8119 - loss: 0.1310
Epoch 17: val_loss did not improve from 0.15472
58/58          51s 877ms/step -
accuracy: 0.9934 - iou_score: 0.8119 - loss: 0.1310 - val_accuracy: 0.9923 -
val_iou_score: 0.7328 - val_loss: 0.1613
Epoch 18/20
58/58          0s 814ms/step -
accuracy: 0.9933 - iou_score: 0.8113 - loss: 0.1296
Epoch 18: val_loss improved from 0.15472 to 0.15085, saving model to
best_model.keras
58/58          53s 917ms/step -
accuracy: 0.9933 - iou_score: 0.8114 - loss: 0.1295 - val_accuracy: 0.9931 -
val_iou_score: 0.7563 - val_loss: 0.1508
Epoch 19/20
58/58          0s 815ms/step -
accuracy: 0.9940 - iou_score: 0.8208 - loss: 0.1210
Epoch 19: val_loss did not improve from 0.15085
58/58          51s 877ms/step -
accuracy: 0.9940 - iou_score: 0.8209 - loss: 0.1209 - val_accuracy: 0.9920 -
val_iou_score: 0.7370 - val_loss: 0.1684
Epoch 20/20
58/58          0s 814ms/step -
accuracy: 0.9928 - iou_score: 0.7923 - loss: 0.1443
Epoch 20: val_loss did not improve from 0.15085
58/58          51s 876ms/step -
accuracy: 0.9928 - iou_score: 0.7920 - loss: 0.1446 - val_accuracy: 0.9921 -
val_iou_score: 0.7144 - val_loss: 0.2037
Restoring model weights from the end of the best epoch: 18.

```

```
[14]: pd.DataFrame(history.history)
```

```

[14]:   accuracy  iou_score    loss  val_accuracy  val_iou_score  val_loss
0   0.954488  0.045640  1.088326    0.970783    0.088543  0.976154
1   0.966916  0.233579  0.760862    0.968741    0.372475  0.580428
2   0.961930  0.370492  0.680246    0.985274    0.578098  0.318260
3   0.987728  0.661855  0.262644    0.986939    0.629464  0.300277
4   0.985953  0.621342  0.302199    0.989123    0.634178  0.245408
5   0.990187  0.724344  0.203247    0.989480    0.629011  0.256853
6   0.990942  0.743354  0.186050    0.990732    0.697449  0.194506

```

7	0.989608	0.713832	0.210539	0.990295	0.660737	0.227346
8	0.990032	0.720310	0.206746	0.991808	0.719674	0.173415
9	0.992130	0.772511	0.161113	0.992278	0.730481	0.161591
10	0.991997	0.770841	0.162045	0.990947	0.709334	0.200571
11	0.992296	0.777287	0.155625	0.991429	0.720402	0.176737
12	0.992712	0.790845	0.144846	0.992764	0.744194	0.160078
13	0.992351	0.782464	0.152831	0.992123	0.732963	0.167715
14	0.993439	0.810591	0.131889	0.993008	0.752218	0.154722
15	0.993237	0.805966	0.134140	0.990469	0.698925	0.194779
16	0.993359	0.811641	0.130832	0.992285	0.732806	0.161310
17	0.993565	0.815894	0.125916	0.993113	0.756299	0.150846
18	0.993984	0.827327	0.117386	0.992025	0.736987	0.168387
19	0.992064	0.775262	0.161169	0.992070	0.714436	0.203695

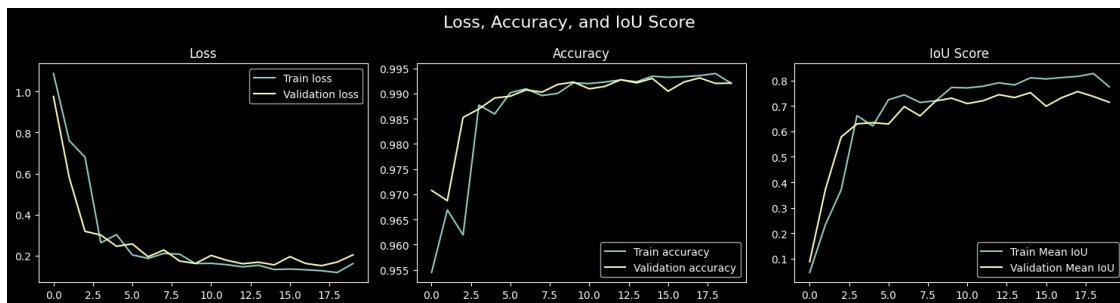
```
[15]: fig, ax = plt.subplots(1, 3, figsize=(15, 4))

# Plot Loss
ax[0].plot(history.epoch, history.history["loss"], label="Train loss")
ax[0].plot(history.epoch, history.history["val_loss"], label="Validation loss")
ax[0].set_title("Loss")
ax[0].legend()

# Plot Accuracy
ax[1].plot(history.epoch, history.history["accuracy"], label="Train accuracy")
ax[1].plot(history.epoch, history.history["val_accuracy"], label="Validation_
↪accuracy")
ax[1].set_title("Accuracy")
ax[1].legend()

# Plot Mean IoU
ax[2].plot(history.epoch, history.history["iou_score"], label="Train Mean IoU")
ax[2].plot(history.epoch, history.history["val_iou_score"], label="Validation_
↪Mean IoU")
ax[2].set_title("IoU Score")
ax[2].legend()

fig.suptitle('Loss, Accuracy, and IoU Score', fontsize=16)
plt.tight_layout()
plt.show()
```



**

Evaluation

Tabel of Contents

```
[16]: model = tf.keras.models.load_model(
        "/kaggle/working/best_model.keras",
        compile=False
    )
    model.compile(
        optimizer='adam',
        loss=sm.losses.bce_dice_loss,
        metrics=['accuracy', sm.metrics.iou_score]
    )
```

```
[17]: results = model.evaluate(test_gen, verbose=-1)
    for name, value in zip(["Test Loss", "Test Accuracy", "Test IOU Score"], results):
        print(f"{name}: {value:.4f}")
```

E0000 00:00:1751653993.891555 69 gpu_timer.cc:82] Delay kernel timed out: measured time has sub-optimal accuracy. There may be a missing warmup execution, please investigate in Nsight Systems.

E0000 00:00:1751653994.132584 69 gpu_timer.cc:82] Delay kernel timed out: measured time has sub-optimal accuracy. There may be a missing warmup execution, please investigate in Nsight Systems.

E0000 00:00:1751653995.518266 69 gpu_timer.cc:82] Delay kernel timed out: measured time has sub-optimal accuracy. There may be a missing warmup execution, please investigate in Nsight Systems.

E0000 00:00:1751653995.784315 69 gpu_timer.cc:82] Delay kernel timed out: measured time has sub-optimal accuracy. There may be a missing warmup execution, please investigate in Nsight Systems.

Test Loss: 0.1244

Test Accuracy: 0.9937

Test IOU Score: 0.8215

```
[18]: # Predict masks for the test set using the model
preds = model.predict(test_gen, verbose=1)
# Apply threshold for binary masks
preds_bin = (preds > 0.5).astype(np.float32)
```

12/12 6s 414ms/step

```
[19]: def display_predictions(test_gen, preds_bin, n_samples = 4):
    """
    Display original image, ground truth mask, and predicted mask.
    """
    images, true_masks = test_gen[0]
    pred_masks = preds_bin[:len(images)]
    fig, axes = plt.subplots(n_samples, 3, figsize=(12, 3 * n_samples))

    for i in range(n_samples):
        img = images[i]
        true_mask = true_masks[i]
        pred_mask = pred_masks[i]

        if true_mask.shape[-1] == 1:
            true_mask = np.squeeze(true_mask)
        if pred_mask.shape[-1] == 1:
            pred_mask = np.squeeze(pred_mask)

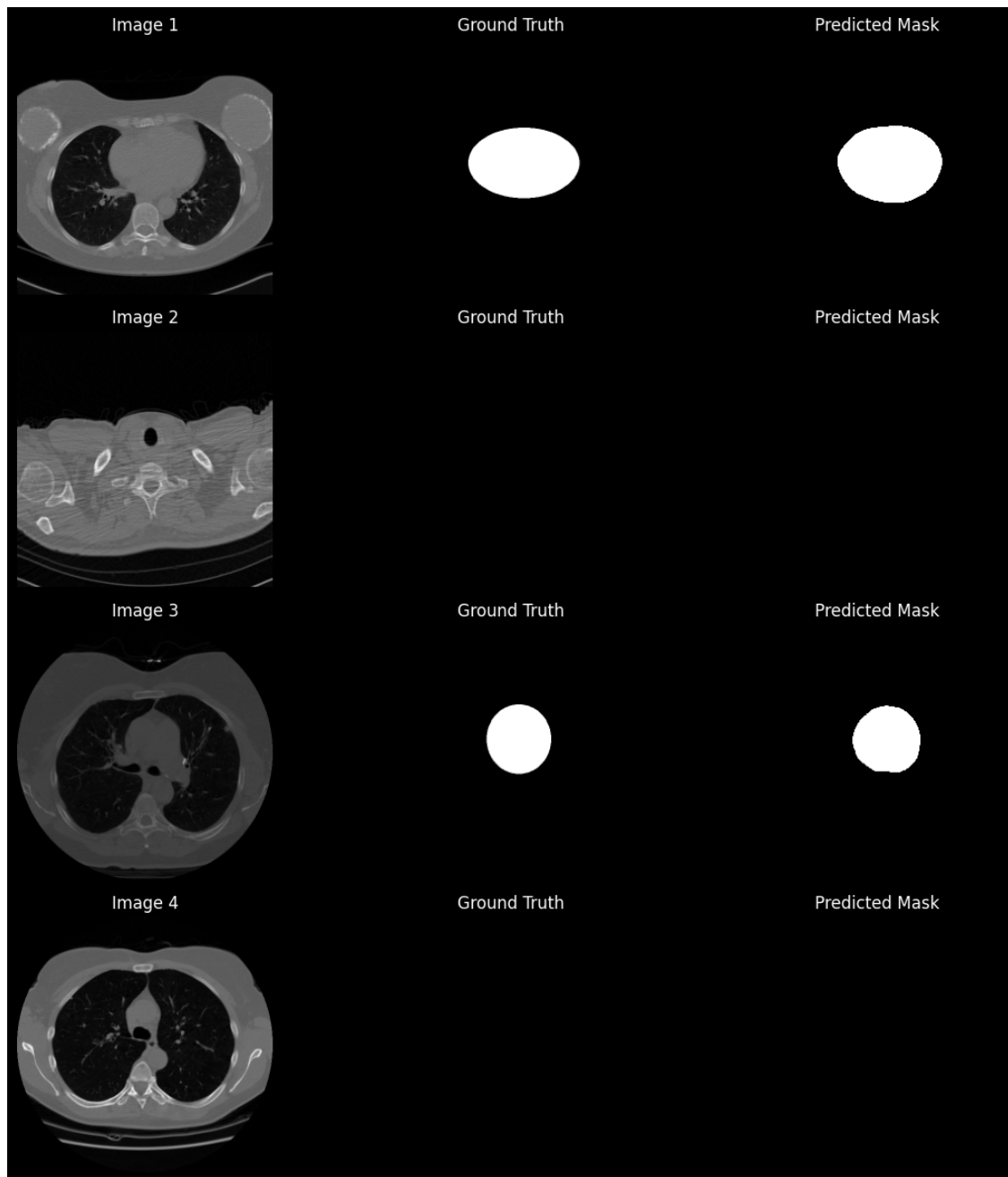
        # Image
        axes[i, 0].imshow(img)
        axes[i, 0].set_title(f"Image {i+1}")
        axes[i, 0].axis("off")

        # Ground Truth Mask
        axes[i, 1].imshow(true_mask, cmap='gray')
        axes[i, 1].set_title("Ground Truth")
        axes[i, 1].axis("off")

        # Predicted Mask
        axes[i, 2].imshow(pred_mask, cmap='gray')
        axes[i, 2].set_title("Predicted Mask")
        axes[i, 2].axis("off")

    plt.tight_layout()
    plt.show()
```

```
[20]: display_predictions(test_gen, preds_bin, n_samples = 4)
```



**

Pretrained UNet

Tabel of Contents

```
[21]: BACKBONE = "efficientnetb7"
      model = sm.Unet(
          backbone_name=BACKBONE,
```



```

        input_shape=(image_size, image_size, 3),
        encoder_weights='imagenet',
        classes=1,
        activation='sigmoid'
    )
model.summary()

```

Downloading data from https://github.com/Callidior/keras-applications/releases/download/efficientnet/efficientnet-b7_weights_tf_dim_ordering_tf_kernels_autoaugment_notop.h5
 258434480/258434480 1s
 0us/step

Model: "functional"

Layer (type)	Output Shape	Param #	Connected
↳ to			
input_layer_1 (InputLayer)	(None, 256, 256, 3)	0	-
stem_conv (Conv2D) ↳ input_layer_1[0][0]	(None, 128, 128, 64)	1,728	
stem_bn ↳ stem_conv[0][0] (BatchNormalization)	(None, 128, 128, 64)	256	
stem_activation ↳ stem_bn[0][0] (Activation)	(None, 128, 128, 64)	0	
block1a_dwconv ↳ stem_activation[0][0] (DepthwiseConv2D)	(None, 128, 128, 64)	576	
block1a_bn ↳ block1a_dwconv[0][0] (BatchNormalization)	(None, 128, 128, 64)	256	

block1a_activation	(None, 128, 128, 64)	0	┐
↳block1a_bn[0][0]			
(Activation)			┐
↳			
block1a_se_squeeze	(None, 64)	0	┐
↳block1a_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block1a_se_reshape	(None, 1, 1, 64)	0	┐
↳block1a_se_squeeze[0]...			
(Reshape)			┐
↳			
block1a_se_reduce	(None, 1, 1, 16)	1,040	┐
↳block1a_se_reshape[0]...			
(Conv2D)			┐
↳			
block1a_se_expand	(None, 1, 1, 64)	1,088	┐
↳block1a_se_reduce[0][...]			
(Conv2D)			┐
↳			
block1a_se_excite	(None, 128, 128, 64)	0	┐
↳block1a_activation[0]...			
(Multiply)			┐
↳block1a_se_expand[0][...]			
block1a_project_conv	(None, 128, 128, 32)	2,048	┐
↳block1a_se_excite[0][...]			
(Conv2D)			┐
↳			
block1a_project_bn	(None, 128, 128, 32)	128	┐
↳block1a_project_conv[...]			
(BatchNormalization)			┐
↳			
block1b_dwconv	(None, 128, 128, 32)	288	┐
↳block1a_project_bn[0]...			
(DepthwiseConv2D)			┐
↳			

block1b_bn ↳block1b_dwconv[0][0] (BatchNormalization)	(None, 128, 128, 32)	128	↳
block1b_activation ↳block1b_bn[0][0] (Activation)	(None, 128, 128, 32)	0	↳
block1b_se_squeeze ↳block1b_activation[0]... (GlobalAveragePooling2D)	(None, 32)	0	↳
block1b_se_reshape ↳block1b_se_squeeze[0]... (Reshape)	(None, 1, 1, 32)	0	↳
block1b_se_reduce ↳block1b_se_reshape[0]... (Conv2D)	(None, 1, 1, 8)	264	↳
block1b_se_expand ↳block1b_se_reduce[0][...] (Conv2D)	(None, 1, 1, 32)	288	↳
block1b_se_excite ↳block1b_activation[0]... (Multiply) ↳block1b_se_expand[0][...]	(None, 128, 128, 32)	0	↳
block1b_project_conv ↳block1b_se_excite[0][...] (Conv2D)	(None, 128, 128, 32)	1,024	↳
block1b_project_bn ↳block1b_project_conv[...] (BatchNormalization)	(None, 128, 128, 32)	128	↳

block1b_drop	(None, 128, 128, 32)	0	┐
↳block1b_project_bn[0]...			
(FixedDropout)			┐
↳			
block1b_add (Add)	(None, 128, 128, 32)	0	┐
↳block1b_drop[0][0],			
			┐
↳block1a_project_bn[0]...			
block1c_dwconv	(None, 128, 128, 32)	288	┐
↳block1b_add[0][0]			
(DepthwiseConv2D)			┐
↳			
block1c_bn	(None, 128, 128, 32)	128	┐
↳block1c_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block1c_activation	(None, 128, 128, 32)	0	┐
↳block1c_bn[0][0]			
(Activation)			┐
↳			
block1c_se_squeeze	(None, 32)	0	┐
↳block1c_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block1c_se_reshape	(None, 1, 1, 32)	0	┐
↳block1c_se_squeeze[0]...			
(Reshape)			┐
↳			
block1c_se_reduce	(None, 1, 1, 8)	264	┐
↳block1c_se_reshape[0]...			
(Conv2D)			┐
↳			
block1c_se_expand	(None, 1, 1, 32)	288	┐
↳block1c_se_reduce[0][...]			
(Conv2D)			┐
↳			

block1c_se_excite	(None, 128, 128, 32)	0	┐
↳block1c_activation[0]...			
(Multiply)			┐
↳block1c_se_expand[0][...			
block1c_project_conv	(None, 128, 128, 32)	1,024	┐
↳block1c_se_excite[0][...			
(Conv2D)			┐
↳			
block1c_project_bn	(None, 128, 128, 32)	128	┐
↳block1c_project_conv[...			
(BatchNormalization)			┐
↳			
block1c_drop	(None, 128, 128, 32)	0	┐
↳block1c_project_bn[0]...			
(FixedDropout)			┐
↳			
block1c_add (Add)	(None, 128, 128, 32)	0	┐
↳block1c_drop[0][0],			
			┐
↳block1b_add[0][0]			
block1d_dwconv	(None, 128, 128, 32)	288	┐
↳block1c_add[0][0]			
(DepthwiseConv2D)			┐
↳			
block1d_bn	(None, 128, 128, 32)	128	┐
↳block1d_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block1d_activation	(None, 128, 128, 32)	0	┐
↳block1d_bn[0][0]			
(Activation)			┐
↳			
block1d_se_squeeze	(None, 32)	0	┐
↳block1d_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			

block1d_se_reshape ↳block1d_se_squeeze[0]... (Reshape)	(None, 1, 1, 32)	0	↳
↳			
block1d_se_reduce ↳block1d_se_reshape[0]... (Conv2D)	(None, 1, 1, 8)	264	↳
↳			
block1d_se_expand ↳block1d_se_reduce[0] [...] (Conv2D)	(None, 1, 1, 32)	288	↳
↳			
block1d_se_excite ↳block1d_activation[0]... (Multiply)	(None, 128, 128, 32)	0	↳
↳block1d_se_expand[0] [...]			↳
block1d_project_conv ↳block1d_se_excite[0] [...] (Conv2D)	(None, 128, 128, 32)	1,024	↳
↳			
block1d_project_bn ↳block1d_project_conv[...] (BatchNormalization)	(None, 128, 128, 32)	128	↳
↳			
block1d_drop ↳block1d_project_bn[0]... (FixedDropout)	(None, 128, 128, 32)	0	↳
↳			
block1d_add (Add) ↳block1d_drop[0][0],	(None, 128, 128, 32)	0	↳
↳block1c_add[0][0]			↳
block2a_expand_conv ↳block1d_add[0][0] (Conv2D)	(None, 128, 128, 192)	6,144	↳
↳			

block2a_expand_bn ↳block2a_expand_conv[0... (BatchNormalization)	(None, 128, 128, 192)	768	↳
block2a_expand_activation ↳block2a_expand_bn[0] [... (Activation)	(None, 128, 128, 192)	0	↳
block2a_dwconv ↳block2a_expand_activa... (DepthwiseConv2D)	(None, 64, 64, 192)	1,728	↳
block2a_bn ↳block2a_dwconv[0][0] (BatchNormalization)	(None, 64, 64, 192)	768	↳
block2a_activation ↳block2a_bn[0][0] (Activation)	(None, 64, 64, 192)	0	↳
block2a_se_squeeze ↳block2a_activation[0]... (GlobalAveragePooling2D)	(None, 192)	0	↳
block2a_se_reshape ↳block2a_se_squeeze[0]... (Reshape)	(None, 1, 1, 192)	0	↳
block2a_se_reduce ↳block2a_se_reshape[0]... (Conv2D)	(None, 1, 1, 8)	1,544	↳
block2a_se_expand ↳block2a_se_reduce[0] [... (Conv2D)	(None, 1, 1, 192)	1,728	↳

block2a_se_excite	(None, 64, 64, 192)	0	┐
↳block2a_activation[0]...			
(Multiply)			┐
↳block2a_se_expand[0] [...			
block2a_project_conv	(None, 64, 64, 48)	9,216	┐
↳block2a_se_excite[0] [...			
(Conv2D)			┐
↳			
block2a_project_bn	(None, 64, 64, 48)	192	┐
↳block2a_project_conv[...			
(BatchNormalization)			┐
↳			
block2b_expand_conv	(None, 64, 64, 288)	13,824	┐
↳block2a_project_bn[0]...			
(Conv2D)			┐
↳			
block2b_expand_bn	(None, 64, 64, 288)	1,152	┐
↳block2b_expand_conv[0...			
(BatchNormalization)			┐
↳			
block2b_expand_activation	(None, 64, 64, 288)	0	┐
↳block2b_expand_bn[0] [...			
(Activation)			┐
↳			
block2b_dwconv	(None, 64, 64, 288)	2,592	┐
↳block2b_expand_activa...			
(DepthwiseConv2D)			┐
↳			
block2b_bn	(None, 64, 64, 288)	1,152	┐
↳block2b_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block2b_activation	(None, 64, 64, 288)	0	┐
↳block2b_bn[0][0]			
(Activation)			┐
↳			

block2b_se_squeeze	(None, 288)	0	┐
↳block2b_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block2b_se_reshape	(None, 1, 1, 288)	0	┐
↳block2b_se_squeeze[0]...			
(Reshape)			┐
↳			
block2b_se_reduce	(None, 1, 1, 12)	3,468	┐
↳block2b_se_reshape[0]...			
(Conv2D)			┐
↳			
block2b_se_expand	(None, 1, 1, 288)	3,744	┐
↳block2b_se_reduce[0] [...]			
(Conv2D)			┐
↳			
block2b_se_excite	(None, 64, 64, 288)	0	┐
↳block2b_activation[0]...			
(Multiply)			┐
↳block2b_se_expand[0] [...]			
block2b_project_conv	(None, 64, 64, 48)	13,824	┐
↳block2b_se_excite[0] [...]			
(Conv2D)			┐
↳			
block2b_project_bn	(None, 64, 64, 48)	192	┐
↳block2b_project_conv[...]			
(BatchNormalization)			┐
↳			
block2b_drop	(None, 64, 64, 48)	0	┐
↳block2b_project_bn[0]...			
(FixedDropout)			┐
↳			
block2b_add (Add)	(None, 64, 64, 48)	0	┐
↳block2b_drop[0][0],			
			┐
↳block2a_project_bn[0]...			

block2c_expand_conv ↳block2b_add[0][0] (Conv2D)	(None, 64, 64, 288)	13,824	↳
block2c_expand_bn ↳block2c_expand_conv[0... (BatchNormalization)	(None, 64, 64, 288)	1,152	↳
block2c_expand_activation ↳block2c_expand_bn[0][... (Activation)	(None, 64, 64, 288)	0	↳
block2c_dwconv ↳block2c_expand_activa... (DepthwiseConv2D)	(None, 64, 64, 288)	2,592	↳
block2c_bn ↳block2c_dwconv[0][0] (BatchNormalization)	(None, 64, 64, 288)	1,152	↳
block2c_activation ↳block2c_bn[0][0] (Activation)	(None, 64, 64, 288)	0	↳
block2c_se_squeeze ↳block2c_activation[0]... (GlobalAveragePooling2D)	(None, 288)	0	↳
block2c_se_reshape ↳block2c_se_squeeze[0]... (Reshape)	(None, 1, 1, 288)	0	↳
block2c_se_reduce ↳block2c_se_reshape[0]... (Conv2D)	(None, 1, 1, 12)	3,468	↳

block2c_se_expand	(None, 1, 1, 288)	3,744	┐
↳block2c_se_reduce[0][... (Conv2D)			┐
↳			
block2c_se_excite	(None, 64, 64, 288)	0	┐
↳block2c_activation[0]... (Multiply)			┐
↳block2c_se_expand[0][... (Conv2D)			┐
↳			
block2c_project_conv	(None, 64, 64, 48)	13,824	┐
↳block2c_se_excite[0][... (Conv2D)			┐
↳			
block2c_project_bn	(None, 64, 64, 48)	192	┐
↳block2c_project_conv[... (BatchNormalization)			┐
↳			
block2c_drop	(None, 64, 64, 48)	0	┐
↳block2c_project_bn[0]... (FixedDropout)			┐
↳			
block2c_add (Add)	(None, 64, 64, 48)	0	┐
↳block2c_drop[0][0],			┐
↳block2b_add[0][0]			
block2d_expand_conv	(None, 64, 64, 288)	13,824	┐
↳block2c_add[0][0] (Conv2D)			┐
↳			
block2d_expand_bn	(None, 64, 64, 288)	1,152	┐
↳block2d_expand_conv[0]... (BatchNormalization)			┐
↳			
block2d_expand_activation	(None, 64, 64, 288)	0	┐
↳block2d_expand_bn[0][... (Activation)			┐
↳			

block2d_dwconv ↳block2d_expand_activa... (DepthwiseConv2D) ↳	(None, 64, 64, 288)	2,592	┐
block2d_bn ↳block2d_dwconv[0][0] (BatchNormalization) ↳	(None, 64, 64, 288)	1,152	┐
block2d_activation ↳block2d_bn[0][0] (Activation) ↳	(None, 64, 64, 288)	0	┐
block2d_se_squeeze ↳block2d_activation[0]... (GlobalAveragePooling2D) ↳	(None, 288)	0	┐
block2d_se_reshape ↳block2d_se_squeeze[0]... (Reshape) ↳	(None, 1, 1, 288)	0	┐
block2d_se_reduce ↳block2d_se_reshape[0]... (Conv2D) ↳	(None, 1, 1, 12)	3,468	┐
block2d_se_expand ↳block2d_se_reduce[0][... (Conv2D) ↳	(None, 1, 1, 288)	3,744	┐
block2d_se_excite ↳block2d_activation[0]... (Multiply) ↳block2d_se_expand[0][... ↳	(None, 64, 64, 288)	0	┐
block2d_project_conv ↳block2d_se_excite[0][... (Conv2D) ↳	(None, 64, 64, 48)	13,824	┐

block2d_project_bn ↳block2d_project_conv[... (BatchNormalization)	(None, 64, 64, 48)	192	┐
↳			
block2d_drop ↳block2d_project_bn[0]... (FixedDropout)	(None, 64, 64, 48)	0	┐
↳			
block2d_add (Add) ↳block2d_drop[0][0], ↳block2c_add[0][0]	(None, 64, 64, 48)	0	┐
block2e_expand_conv ↳block2d_add[0][0] (Conv2D)	(None, 64, 64, 288)	13,824	┐
↳			
block2e_expand_bn ↳block2e_expand_conv[0... (BatchNormalization)	(None, 64, 64, 288)	1,152	┐
↳			
block2e_expand_activation ↳block2e_expand_bn[0][... (Activation)	(None, 64, 64, 288)	0	┐
↳			
block2e_dwconv ↳block2e_expand_activa... (DepthwiseConv2D)	(None, 64, 64, 288)	2,592	┐
↳			
block2e_bn ↳block2e_dwconv[0][0] (BatchNormalization)	(None, 64, 64, 288)	1,152	┐
↳			
block2e_activation ↳block2e_bn[0][0] (Activation)	(None, 64, 64, 288)	0	┐
↳			

block2e_se_squeeze	(None, 288)	0	┐
↳block2e_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block2e_se_reshape	(None, 1, 1, 288)	0	┐
↳block2e_se_squeeze[0]...			
(Reshape)			┐
↳			
block2e_se_reduce	(None, 1, 1, 12)	3,468	┐
↳block2e_se_reshape[0]...			
(Conv2D)			┐
↳			
block2e_se_expand	(None, 1, 1, 288)	3,744	┐
↳block2e_se_reduce[0] [...]			
(Conv2D)			┐
↳			
block2e_se_excite	(None, 64, 64, 288)	0	┐
↳block2e_activation[0]...			
(Multiply)			┐
↳block2e_se_expand[0] [...]			
block2e_project_conv	(None, 64, 64, 48)	13,824	┐
↳block2e_se_excite[0] [...]			
(Conv2D)			┐
↳			
block2e_project_bn	(None, 64, 64, 48)	192	┐
↳block2e_project_conv[...]			
(BatchNormalization)			┐
↳			
block2e_drop	(None, 64, 64, 48)	0	┐
↳block2e_project_bn[0]...			
(FixedDropout)			┐
↳			
block2e_add (Add)	(None, 64, 64, 48)	0	┐
↳block2e_drop[0][0],			
			┐
↳block2d_add[0][0]			

block2f_expand_conv ↳block2e_add[0][0] (Conv2D)	(None, 64, 64, 288)	13,824	↳
block2f_expand_bn ↳block2f_expand_conv[0... (BatchNormalization)	(None, 64, 64, 288)	1,152	↳
block2f_expand_activation ↳block2f_expand_bn[0][... (Activation)	(None, 64, 64, 288)	0	↳
block2f_dwconv ↳block2f_expand_activa... (DepthwiseConv2D)	(None, 64, 64, 288)	2,592	↳
block2f_bn ↳block2f_dwconv[0][0] (BatchNormalization)	(None, 64, 64, 288)	1,152	↳
block2f_activation ↳block2f_bn[0][0] (Activation)	(None, 64, 64, 288)	0	↳
block2f_se_squeeze ↳block2f_activation[0]... (GlobalAveragePooling2D)	(None, 288)	0	↳
block2f_se_reshape ↳block2f_se_squeeze[0]... (Reshape)	(None, 1, 1, 288)	0	↳
block2f_se_reduce ↳block2f_se_reshape[0]... (Conv2D)	(None, 1, 1, 12)	3,468	↳

block2f_se_expand	(None, 1, 1, 288)	3,744	┐
↳block2f_se_reduce[0][...]			
(Conv2D)			┐
↳			
block2f_se_excite	(None, 64, 64, 288)	0	┐
↳block2f_activation[0]...			
(Multiply)			┐
↳block2f_se_expand[0][...]			
block2f_project_conv	(None, 64, 64, 48)	13,824	┐
↳block2f_se_excite[0][...]			
(Conv2D)			┐
↳			
block2f_project_bn	(None, 64, 64, 48)	192	┐
↳block2f_project_conv[...]			
(BatchNormalization)			┐
↳			
block2f_drop	(None, 64, 64, 48)	0	┐
↳block2f_project_bn[0]...			
(FixedDropout)			┐
↳			
block2f_add (Add)	(None, 64, 64, 48)	0	┐
↳block2f_drop[0][0],			
			┐
↳block2e_add[0][0]			
block2g_expand_conv	(None, 64, 64, 288)	13,824	┐
↳block2f_add[0][0]			
(Conv2D)			┐
↳			
block2g_expand_bn	(None, 64, 64, 288)	1,152	┐
↳block2g_expand_conv[0]...			
(BatchNormalization)			┐
↳			
block2g_expand_activation	(None, 64, 64, 288)	0	┐
↳block2g_expand_bn[0][...]			
(Activation)			┐
↳			

block2g_dwconv ↳block2g_expand_activa... (DepthwiseConv2D) ↳	(None, 64, 64, 288)	2,592	┐
block2g_bn ↳block2g_dwconv[0][0] (BatchNormalization) ↳	(None, 64, 64, 288)	1,152	┐
block2g_activation ↳block2g_bn[0][0] (Activation) ↳	(None, 64, 64, 288)	0	┐
block2g_se_squeeze ↳block2g_activation[0]... (GlobalAveragePooling2D) ↳	(None, 288)	0	┐
block2g_se_reshape ↳block2g_se_squeeze[0]... (Reshape) ↳	(None, 1, 1, 288)	0	┐
block2g_se_reduce ↳block2g_se_reshape[0]... (Conv2D) ↳	(None, 1, 1, 12)	3,468	┐
block2g_se_expand ↳block2g_se_reduce[0][... (Conv2D) ↳	(None, 1, 1, 288)	3,744	┐
block2g_se_excite ↳block2g_activation[0]... (Multiply) ↳block2g_se_expand[0][... ↳	(None, 64, 64, 288)	0	┐
block2g_project_conv ↳block2g_se_excite[0][... (Conv2D) ↳	(None, 64, 64, 48)	13,824	┐

block2g_project_bn ↳block2g_project_conv[... (BatchNormalization)	(None, 64, 64, 48)	192	┐
↳			
block2g_drop ↳block2g_project_bn[0]... (FixedDropout)	(None, 64, 64, 48)	0	┐
↳			
block2g_add (Add) ↳block2g_drop[0][0], ↳block2f_add[0][0]	(None, 64, 64, 48)	0	┐
block3a_expand_conv ↳block2g_add[0][0] (Conv2D)	(None, 64, 64, 288)	13,824	┐
↳			
block3a_expand_bn ↳block3a_expand_conv[0... (BatchNormalization)	(None, 64, 64, 288)	1,152	┐
↳			
block3a_expand_activation ↳block3a_expand_bn[0][... (Activation)	(None, 64, 64, 288)	0	┐
↳			
block3a_dwconv ↳block3a_expand_activa... (DepthwiseConv2D)	(None, 32, 32, 288)	7,200	┐
↳			
block3a_bn ↳block3a_dwconv[0][0] (BatchNormalization)	(None, 32, 32, 288)	1,152	┐
↳			
block3a_activation ↳block3a_bn[0][0] (Activation)	(None, 32, 32, 288)	0	┐
↳			

block3a_se_squeeze ↳block3a_activation[0]... (GlobalAveragePooling2D) ↳	(None, 288)	0	↳
block3a_se_reshape ↳block3a_se_squeeze[0]... (Reshape) ↳	(None, 1, 1, 288)	0	↳
block3a_se_reduce ↳block3a_se_reshape[0]... (Conv2D) ↳	(None, 1, 1, 12)	3,468	↳
block3a_se_expand ↳block3a_se_reduce[0] [...] (Conv2D) ↳	(None, 1, 1, 288)	3,744	↳
block3a_se_excite ↳block3a_activation[0]... (Multiply) ↳block3a_se_expand[0] [...]	(None, 32, 32, 288)	0	↳
block3a_project_conv ↳block3a_se_excite[0] [...] (Conv2D) ↳	(None, 32, 32, 80)	23,040	↳
block3a_project_bn ↳block3a_project_conv[...] (BatchNormalization) ↳	(None, 32, 32, 80)	320	↳
block3b_expand_conv ↳block3a_project_bn[0]... (Conv2D) ↳	(None, 32, 32, 480)	38,400	↳
block3b_expand_bn ↳block3b_expand_conv[0...] (BatchNormalization) ↳	(None, 32, 32, 480)	1,920	↳

block3b_expand_activation	(None, 32, 32, 480)	0	┐
↳block3b_expand_bn[0][...]			
(Activation)			┐
↳			
block3b_dwconv	(None, 32, 32, 480)	12,000	┐
↳block3b_expand_activa...			
(DepthwiseConv2D)			┐
↳			
block3b_bn	(None, 32, 32, 480)	1,920	┐
↳block3b_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block3b_activation	(None, 32, 32, 480)	0	┐
↳block3b_bn[0][0]			
(Activation)			┐
↳			
block3b_se_squeeze	(None, 480)	0	┐
↳block3b_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block3b_se_reshape	(None, 1, 1, 480)	0	┐
↳block3b_se_squeeze[0]...			
(Reshape)			┐
↳			
block3b_se_reduce	(None, 1, 1, 20)	9,620	┐
↳block3b_se_reshape[0]...			
(Conv2D)			┐
↳			
block3b_se_expand	(None, 1, 1, 480)	10,080	┐
↳block3b_se_reduce[0][...]			
(Conv2D)			┐
↳			
block3b_se_excite	(None, 32, 32, 480)	0	┐
↳block3b_activation[0]...			
(Multiply)			┐
↳block3b_se_expand[0][...]			

block3b_project_conv ↳block3b_se_excite[0][... (Conv2D)	(None, 32, 32, 80)	38,400	┐
↳			
block3b_project_bn ↳block3b_project_conv[... (BatchNormalization)	(None, 32, 32, 80)	320	┐
↳			
block3b_drop ↳block3b_project_bn[0]... (FixedDropout)	(None, 32, 32, 80)	0	┐
↳			
block3b_add (Add) ↳block3b_drop[0][0], ↳block3a_project_bn[0]...	(None, 32, 32, 80)	0	┐
block3c_expand_conv ↳block3b_add[0][0] (Conv2D)	(None, 32, 32, 480)	38,400	┐
↳			
block3c_expand_bn ↳block3c_expand_conv[0... (BatchNormalization)	(None, 32, 32, 480)	1,920	┐
↳			
block3c_expand_activation ↳block3c_expand_bn[0][... (Activation)	(None, 32, 32, 480)	0	┐
↳			
block3c_dwconv ↳block3c_expand_activa... (DepthwiseConv2D)	(None, 32, 32, 480)	12,000	┐
↳			
block3c_bn ↳block3c_dwconv[0][0] (BatchNormalization)	(None, 32, 32, 480)	1,920	┐
↳			

block3c_activation ↳block3c_bn[0][0] (Activation)	(None, 32, 32, 480)	0	↳
↳			
block3c_se_squeeze ↳block3c_activation[0]... (GlobalAveragePooling2D)	(None, 480)	0	↳
↳			
block3c_se_reshape ↳block3c_se_squeeze[0]... (Reshape)	(None, 1, 1, 480)	0	↳
↳			
block3c_se_reduce ↳block3c_se_reshape[0]... (Conv2D)	(None, 1, 1, 20)	9,620	↳
↳			
block3c_se_expand ↳block3c_se_reduce[0][...]... (Conv2D)	(None, 1, 1, 480)	10,080	↳
↳			
block3c_se_excite ↳block3c_activation[0]... (Multiply)	(None, 32, 32, 480)	0	↳
↳block3c_se_expand[0][...]...			↳
block3c_project_conv ↳block3c_se_excite[0][...]... (Conv2D)	(None, 32, 32, 80)	38,400	↳
↳			
block3c_project_bn ↳block3c_project_conv[...]... (BatchNormalization)	(None, 32, 32, 80)	320	↳
↳			
block3c_drop ↳block3c_project_bn[0]... (FixedDropout)	(None, 32, 32, 80)	0	↳
↳			

block3c_add (Add)	(None, 32, 32, 80)	0	┐
↳block3c_drop[0][0],			
			┐
↳block3b_add[0][0]			
block3d_expand_conv	(None, 32, 32, 480)	38,400	┐
↳block3c_add[0][0]			
(Conv2D)			┐
↳			
block3d_expand_bn	(None, 32, 32, 480)	1,920	┐
↳block3d_expand_conv[0...			
(BatchNormalization)			┐
↳			
block3d_expand_activation	(None, 32, 32, 480)	0	┐
↳block3d_expand_bn[0][...			
(Activation)			┐
↳			
block3d_dwconv	(None, 32, 32, 480)	12,000	┐
↳block3d_expand_activa...			
(DepthwiseConv2D)			┐
↳			
block3d_bn	(None, 32, 32, 480)	1,920	┐
↳block3d_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block3d_activation	(None, 32, 32, 480)	0	┐
↳block3d_bn[0][0]			
(Activation)			┐
↳			
block3d_se_squeeze	(None, 480)	0	┐
↳block3d_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block3d_se_reshape	(None, 1, 1, 480)	0	┐
↳block3d_se_squeeze[0]...			
(Reshape)			┐
↳			

block3d_se_reduce ↳block3d_se_reshape[0]... (Conv2D) ↳	(None, 1, 1, 20)	9,620	↳
block3d_se_expand ↳block3d_se_reduce[0] [...] (Conv2D) ↳	(None, 1, 1, 480)	10,080	↳
block3d_se_excite ↳block3d_activation[0]... (Multiply) ↳block3d_se_expand[0] [...]	(None, 32, 32, 480)	0	↳
block3d_project_conv ↳block3d_se_excite[0] [...] (Conv2D) ↳	(None, 32, 32, 80)	38,400	↳
block3d_project_bn ↳block3d_project_conv[...] (BatchNormalization) ↳	(None, 32, 32, 80)	320	↳
block3d_drop ↳block3d_project_bn[0]... (FixedDropout) ↳	(None, 32, 32, 80)	0	↳
block3d_add (Add) ↳block3d_drop[0][0], ↳block3c_add[0][0]	(None, 32, 32, 80)	0	↳
block3e_expand_conv ↳block3d_add[0][0] (Conv2D) ↳	(None, 32, 32, 480)	38,400	↳
block3e_expand_bn ↳block3e_expand_conv[0...] (BatchNormalization) ↳	(None, 32, 32, 480)	1,920	↳

block3e_expand_activation ↳block3e_expand_bn[0][... (Activation)	(None, 32, 32, 480)	0	↳
block3e_dwconv ↳block3e_expand_activa... (DepthwiseConv2D)	(None, 32, 32, 480)	12,000	↳
block3e_bn ↳block3e_dwconv[0][0] (BatchNormalization)	(None, 32, 32, 480)	1,920	↳
block3e_activation ↳block3e_bn[0][0] (Activation)	(None, 32, 32, 480)	0	↳
block3e_se_squeeze ↳block3e_activation[0]... (GlobalAveragePooling2D)	(None, 480)	0	↳
block3e_se_reshape ↳block3e_se_squeeze[0]... (Reshape)	(None, 1, 1, 480)	0	↳
block3e_se_reduce ↳block3e_se_reshape[0]... (Conv2D)	(None, 1, 1, 20)	9,620	↳
block3e_se_expand ↳block3e_se_reduce[0][... (Conv2D)	(None, 1, 1, 480)	10,080	↳
block3e_se_excite ↳block3e_activation[0]... (Multiply) ↳block3e_se_expand[0][...	(None, 32, 32, 480)	0	↳

block3e_project_conv ↳block3e_se_excite[0][... (Conv2D)	(None, 32, 32, 80)	38,400	┐
↳			
block3e_project_bn ↳block3e_project_conv[... (BatchNormalization)	(None, 32, 32, 80)	320	┐
↳			
block3e_drop ↳block3e_project_bn[0]... (FixedDropout)	(None, 32, 32, 80)	0	┐
↳			
block3e_add (Add) ↳block3e_drop[0][0], ↳block3d_add[0][0]	(None, 32, 32, 80)	0	┐
block3f_expand_conv ↳block3e_add[0][0] (Conv2D)	(None, 32, 32, 480)	38,400	┐
↳			
block3f_expand_bn ↳block3f_expand_conv[0... (BatchNormalization)	(None, 32, 32, 480)	1,920	┐
↳			
block3f_expand_activation ↳block3f_expand_bn[0][... (Activation)	(None, 32, 32, 480)	0	┐
↳			
block3f_dwconv ↳block3f_expand_activa... (DepthwiseConv2D)	(None, 32, 32, 480)	12,000	┐
↳			
block3f_bn ↳block3f_dwconv[0][0] (BatchNormalization)	(None, 32, 32, 480)	1,920	┐
↳			

block3f_activation ↳ block3f_bn[0][0] (Activation)	(None, 32, 32, 480)	0	↳
↳			
block3f_se_squeeze ↳ block3f_activation[0]... (GlobalAveragePooling2D)	(None, 480)	0	↳
↳			
block3f_se_reshape ↳ block3f_se_squeeze[0]... (Reshape)	(None, 1, 1, 480)	0	↳
↳			
block3f_se_reduce ↳ block3f_se_reshape[0]... (Conv2D)	(None, 1, 1, 20)	9,620	↳
↳			
block3f_se_expand ↳ block3f_se_reduce[0][...]... (Conv2D)	(None, 1, 1, 480)	10,080	↳
↳			
block3f_se_excite ↳ block3f_activation[0]... (Multiply)	(None, 32, 32, 480)	0	↳
↳ block3f_se_expand[0][...]...			↳
block3f_project_conv ↳ block3f_se_excite[0][...]... (Conv2D)	(None, 32, 32, 80)	38,400	↳
↳			
block3f_project_bn ↳ block3f_project_conv[...]... (BatchNormalization)	(None, 32, 32, 80)	320	↳
↳			
block3f_drop ↳ block3f_project_bn[0]... (FixedDropout)	(None, 32, 32, 80)	0	↳
↳			

block3f_add (Add)	(None, 32, 32, 80)	0	┐
↳block3f_drop[0][0],			
			┐
↳block3e_add[0][0]			
block3g_expand_conv	(None, 32, 32, 480)	38,400	┐
↳block3f_add[0][0]			
(Conv2D)			┐
↳			
block3g_expand_bn	(None, 32, 32, 480)	1,920	┐
↳block3g_expand_conv[0...			
(BatchNormalization)			┐
↳			
block3g_expand_activation	(None, 32, 32, 480)	0	┐
↳block3g_expand_bn[0][...			
(Activation)			┐
↳			
block3g_dwconv	(None, 32, 32, 480)	12,000	┐
↳block3g_expand_activa...			
(DepthwiseConv2D)			┐
↳			
block3g_bn	(None, 32, 32, 480)	1,920	┐
↳block3g_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block3g_activation	(None, 32, 32, 480)	0	┐
↳block3g_bn[0][0]			
(Activation)			┐
↳			
block3g_se_squeeze	(None, 480)	0	┐
↳block3g_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block3g_se_reshape	(None, 1, 1, 480)	0	┐
↳block3g_se_squeeze[0]...			
(Reshape)			┐
↳			

block3g_se_reduce ↳block3g_se_reshape[0]... (Conv2D) ↳	(None, 1, 1, 20)	9,620	↳
block3g_se_expand ↳block3g_se_reduce[0] [...] (Conv2D) ↳	(None, 1, 1, 480)	10,080	↳
block3g_se_excite ↳block3g_activation[0]... (Multiply) ↳block3g_se_expand[0] [...]	(None, 32, 32, 480)	0	↳
block3g_project_conv ↳block3g_se_excite[0] [...] (Conv2D) ↳	(None, 32, 32, 80)	38,400	↳
block3g_project_bn ↳block3g_project_conv[...] (BatchNormalization) ↳	(None, 32, 32, 80)	320	↳
block3g_drop ↳block3g_project_bn[0]... (FixedDropout) ↳	(None, 32, 32, 80)	0	↳
block3g_add (Add) ↳block3g_drop[0][0], ↳block3f_add[0][0]	(None, 32, 32, 80)	0	↳
block4a_expand_conv ↳block3g_add[0][0] (Conv2D) ↳	(None, 32, 32, 480)	38,400	↳
block4a_expand_bn ↳block4a_expand_conv[0...] (BatchNormalization) ↳	(None, 32, 32, 480)	1,920	↳

block4a_expand_activation	(None, 32, 32, 480)	0	┐
↳block4a_expand_bn[0][...]			
(Activation)			┐
↳			
block4a_dwconv	(None, 16, 16, 480)	4,320	┐
↳block4a_expand_activa...			
(DepthwiseConv2D)			┐
↳			
block4a_bn	(None, 16, 16, 480)	1,920	┐
↳block4a_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block4a_activation	(None, 16, 16, 480)	0	┐
↳block4a_bn[0][0]			
(Activation)			┐
↳			
block4a_se_squeeze	(None, 480)	0	┐
↳block4a_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block4a_se_reshape	(None, 1, 1, 480)	0	┐
↳block4a_se_squeeze[0]...			
(Reshape)			┐
↳			
block4a_se_reduce	(None, 1, 1, 20)	9,620	┐
↳block4a_se_reshape[0]...			
(Conv2D)			┐
↳			
block4a_se_expand	(None, 1, 1, 480)	10,080	┐
↳block4a_se_reduce[0][...]			
(Conv2D)			┐
↳			
block4a_se_excite	(None, 16, 16, 480)	0	┐
↳block4a_activation[0]...			
(Multiply)			┐
↳block4a_se_expand[0][...]			

block4a_project_conv ↳block4a_se_excite[0][... (Conv2D)	(None, 16, 16, 160)	76,800	↳
block4a_project_bn ↳block4a_project_conv[... (BatchNormalization)	(None, 16, 16, 160)	640	↳
block4b_expand_conv ↳block4a_project_bn[0]... (Conv2D)	(None, 16, 16, 960)	153,600	↳
block4b_expand_bn ↳block4b_expand_conv[0... (BatchNormalization)	(None, 16, 16, 960)	3,840	↳
block4b_expand_activation ↳block4b_expand_bn[0][... (Activation)	(None, 16, 16, 960)	0	↳
block4b_dwconv ↳block4b_expand_activa... (DepthwiseConv2D)	(None, 16, 16, 960)	8,640	↳
block4b_bn ↳block4b_dwconv[0][0] (BatchNormalization)	(None, 16, 16, 960)	3,840	↳
block4b_activation ↳block4b_bn[0][0] (Activation)	(None, 16, 16, 960)	0	↳
block4b_se_squeeze ↳block4b_activation[0]... (GlobalAveragePooling2D)	(None, 960)	0	↳

block4b_se_reshape	(None, 1, 1, 960)	0	┐
↳block4b_se_squeeze[0]...			
(Reshape)			┐
↳			
block4b_se_reduce	(None, 1, 1, 40)	38,440	┐
↳block4b_se_reshape[0]...			
(Conv2D)			┐
↳			
block4b_se_expand	(None, 1, 1, 960)	39,360	┐
↳block4b_se_reduce[0] [...]			
(Conv2D)			┐
↳			
block4b_se_excite	(None, 16, 16, 960)	0	┐
↳block4b_activation[0]...			
(Multiply)			┐
↳block4b_se_expand[0] [...]			
block4b_project_conv	(None, 16, 16, 160)	153,600	┐
↳block4b_se_excite[0] [...]			
(Conv2D)			┐
↳			
block4b_project_bn	(None, 16, 16, 160)	640	┐
↳block4b_project_conv[...]			
(BatchNormalization)			┐
↳			
block4b_drop	(None, 16, 16, 160)	0	┐
↳block4b_project_bn[0]...			
(FixedDropout)			┐
↳			
block4b_add (Add)	(None, 16, 16, 160)	0	┐
↳block4b_drop[0][0],			
			┐
↳block4a_project_bn[0]...			
block4c_expand_conv	(None, 16, 16, 960)	153,600	┐
↳block4b_add[0][0]			
(Conv2D)			┐
↳			

block4c_expand_bn ↳block4c_expand_conv[0... (BatchNormalization)	(None, 16, 16, 960)	3,840	┐	┐
block4c_expand_activation ↳block4c_expand_bn[0] [... (Activation)	(None, 16, 16, 960)	0	┐	┐
block4c_dwconv ↳block4c_expand_activa... (DepthwiseConv2D)	(None, 16, 16, 960)	8,640	┐	┐
block4c_bn ↳block4c_dwconv[0][0] (BatchNormalization)	(None, 16, 16, 960)	3,840	┐	┐
block4c_activation ↳block4c_bn[0][0] (Activation)	(None, 16, 16, 960)	0	┐	┐
block4c_se_squeeze ↳block4c_activation[0]... (GlobalAveragePooling2D)	(None, 960)	0	┐	┐
block4c_se_reshape ↳block4c_se_squeeze[0]... (Reshape)	(None, 1, 1, 960)	0	┐	┐
block4c_se_reduce ↳block4c_se_reshape[0]... (Conv2D)	(None, 1, 1, 40)	38,440	┐	┐
block4c_se_expand ↳block4c_se_reduce[0] [... (Conv2D)	(None, 1, 1, 960)	39,360	┐	┐

block4c_se_excite	(None, 16, 16, 960)	0	┐
↳block4c_activation[0]...			
(Multiply)			┐
↳block4c_se_expand[0] [...			
block4c_project_conv	(None, 16, 16, 160)	153,600	┐
↳block4c_se_excite[0] [...			
(Conv2D)			┐
↳			
block4c_project_bn	(None, 16, 16, 160)	640	┐
↳block4c_project_conv[...			
(BatchNormalization)			┐
↳			
block4c_drop	(None, 16, 16, 160)	0	┐
↳block4c_project_bn[0]...			
(FixedDropout)			┐
↳			
block4c_add (Add)	(None, 16, 16, 160)	0	┐
↳block4c_drop[0][0],			
			┐
↳block4b_add[0][0]			
block4d_expand_conv	(None, 16, 16, 960)	153,600	┐
↳block4c_add[0][0]			
(Conv2D)			┐
↳			
block4d_expand_bn	(None, 16, 16, 960)	3,840	┐
↳block4d_expand_conv[0...			
(BatchNormalization)			┐
↳			
block4d_expand_activation	(None, 16, 16, 960)	0	┐
↳block4d_expand_bn[0] [...			
(Activation)			┐
↳			
block4d_dwconv	(None, 16, 16, 960)	8,640	┐
↳block4d_expand_activa...			
(DepthwiseConv2D)			┐
↳			

block4d_bn ↳block4d_dwconv[0][0] (BatchNormalization)	(None, 16, 16, 960)	3,840	↳
block4d_activation ↳block4d_bn[0][0] (Activation)	(None, 16, 16, 960)	0	↳
block4d_se_squeeze ↳block4d_activation[0]... (GlobalAveragePooling2D)	(None, 960)	0	↳
block4d_se_reshape ↳block4d_se_squeeze[0]... (Reshape)	(None, 1, 1, 960)	0	↳
block4d_se_reduce ↳block4d_se_reshape[0]... (Conv2D)	(None, 1, 1, 40)	38,440	↳
block4d_se_expand ↳block4d_se_reduce[0][...] (Conv2D)	(None, 1, 1, 960)	39,360	↳
block4d_se_excite ↳block4d_activation[0]... (Multiply) ↳block4d_se_expand[0][...]	(None, 16, 16, 960)	0	↳
block4d_project_conv ↳block4d_se_excite[0][...] (Conv2D)	(None, 16, 16, 160)	153,600	↳
block4d_project_bn ↳block4d_project_conv[...] (BatchNormalization)	(None, 16, 16, 160)	640	↳

block4d_drop	(None, 16, 16, 160)	0	┐
↳block4d_project_bn[0]...			
(FixedDropout)			┐
↳			
block4d_add (Add)	(None, 16, 16, 160)	0	┐
↳block4d_drop[0][0],			
			┐
↳block4c_add[0][0]			
block4e_expand_conv	(None, 16, 16, 960)	153,600	┐
↳block4d_add[0][0]			
(Conv2D)			┐
↳			
block4e_expand_bn	(None, 16, 16, 960)	3,840	┐
↳block4e_expand_conv[0...			
(BatchNormalization)			┐
↳			
block4e_expand_activation	(None, 16, 16, 960)	0	┐
↳block4e_expand_bn[0][...			
(Activation)			┐
↳			
block4e_dwconv	(None, 16, 16, 960)	8,640	┐
↳block4e_expand_activa...			
(DepthwiseConv2D)			┐
↳			
block4e_bn	(None, 16, 16, 960)	3,840	┐
↳block4e_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block4e_activation	(None, 16, 16, 960)	0	┐
↳block4e_bn[0][0]			
(Activation)			┐
↳			
block4e_se_squeeze	(None, 960)	0	┐
↳block4e_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			

block4e_se_reshape ↳block4e_se_squeeze[0]... (Reshape) ↳	(None, 1, 1, 960)	0	↳
block4e_se_reduce ↳block4e_se_reshape[0]... (Conv2D) ↳	(None, 1, 1, 40)	38,440	↳
block4e_se_expand ↳block4e_se_reduce[0] [...] (Conv2D) ↳	(None, 1, 1, 960)	39,360	↳
block4e_se_excite ↳block4e_activation[0]... (Multiply) ↳block4e_se_expand[0] [...]	(None, 16, 16, 960)	0	↳
block4e_project_conv ↳block4e_se_excite[0] [...] (Conv2D) ↳	(None, 16, 16, 160)	153,600	↳
block4e_project_bn ↳block4e_project_conv[...] (BatchNormalization) ↳	(None, 16, 16, 160)	640	↳
block4e_drop ↳block4e_project_bn[0]... (FixedDropout) ↳	(None, 16, 16, 160)	0	↳
block4e_add (Add) ↳block4e_drop[0][0], ↳block4d_add[0][0]	(None, 16, 16, 160)	0	↳
block4f_expand_conv ↳block4e_add[0][0] (Conv2D) ↳	(None, 16, 16, 960)	153,600	↳

block4f_expand_bn ↳block4f_expand_conv[0... (BatchNormalization)	(None, 16, 16, 960)	3,840	↳
block4f_expand_activation ↳block4f_expand_bn[0][... (Activation)	(None, 16, 16, 960)	0	↳
block4f_dwconv ↳block4f_expand_activa... (DepthwiseConv2D)	(None, 16, 16, 960)	8,640	↳
block4f_bn ↳block4f_dwconv[0][0] (BatchNormalization)	(None, 16, 16, 960)	3,840	↳
block4f_activation ↳block4f_bn[0][0] (Activation)	(None, 16, 16, 960)	0	↳
block4f_se_squeeze ↳block4f_activation[0]... (GlobalAveragePooling2D)	(None, 960)	0	↳
block4f_se_reshape ↳block4f_se_squeeze[0]... (Reshape)	(None, 1, 1, 960)	0	↳
block4f_se_reduce ↳block4f_se_reshape[0]... (Conv2D)	(None, 1, 1, 40)	38,440	↳
block4f_se_expand ↳block4f_se_reduce[0][... (Conv2D)	(None, 1, 1, 960)	39,360	↳

block4f_se_excite	(None, 16, 16, 960)	0	┐
↳block4f_activation[0]...			
(Multiply)			┐
↳block4f_se_expand[0] [...			
block4f_project_conv	(None, 16, 16, 160)	153,600	┐
↳block4f_se_excite[0] [...			
(Conv2D)			┐
↳			
block4f_project_bn	(None, 16, 16, 160)	640	┐
↳block4f_project_conv[...			
(BatchNormalization)			┐
↳			
block4f_drop	(None, 16, 16, 160)	0	┐
↳block4f_project_bn[0]...			
(FixedDropout)			┐
↳			
block4f_add (Add)	(None, 16, 16, 160)	0	┐
↳block4f_drop[0][0],			
			┐
↳block4e_add[0][0]			
block4g_expand_conv	(None, 16, 16, 960)	153,600	┐
↳block4f_add[0][0]			
(Conv2D)			┐
↳			
block4g_expand_bn	(None, 16, 16, 960)	3,840	┐
↳block4g_expand_conv[0...			
(BatchNormalization)			┐
↳			
block4g_expand_activation	(None, 16, 16, 960)	0	┐
↳block4g_expand_bn[0] [...			
(Activation)			┐
↳			
block4g_dwconv	(None, 16, 16, 960)	8,640	┐
↳block4g_expand_activa...			
(DepthwiseConv2D)			┐
↳			

block4g_bn ↳block4g_dwconv[0][0] (BatchNormalization)	(None, 16, 16, 960)	3,840	↳
block4g_activation ↳block4g_bn[0][0] (Activation)	(None, 16, 16, 960)	0	↳
block4g_se_squeeze ↳block4g_activation[0]... (GlobalAveragePooling2D)	(None, 960)	0	↳
block4g_se_reshape ↳block4g_se_squeeze[0]... (Reshape)	(None, 1, 1, 960)	0	↳
block4g_se_reduce ↳block4g_se_reshape[0]... (Conv2D)	(None, 1, 1, 40)	38,440	↳
block4g_se_expand ↳block4g_se_reduce[0][...] (Conv2D)	(None, 1, 1, 960)	39,360	↳
block4g_se_excite ↳block4g_activation[0]... (Multiply) ↳block4g_se_expand[0][...]	(None, 16, 16, 960)	0	↳
block4g_project_conv ↳block4g_se_excite[0][...] (Conv2D)	(None, 16, 16, 160)	153,600	↳
block4g_project_bn ↳block4g_project_conv[...] (BatchNormalization)	(None, 16, 16, 160)	640	↳

block4g_drop	(None, 16, 16, 160)	0	┐
↳block4g_project_bn[0]...			
(FixedDropout)			┐
↳			
block4g_add (Add)	(None, 16, 16, 160)	0	┐
↳block4g_drop[0][0],			
			┐
↳block4f_add[0][0]			
block4h_expand_conv	(None, 16, 16, 960)	153,600	┐
↳block4g_add[0][0]			
(Conv2D)			┐
↳			
block4h_expand_bn	(None, 16, 16, 960)	3,840	┐
↳block4h_expand_conv[0...			
(BatchNormalization)			┐
↳			
block4h_expand_activation	(None, 16, 16, 960)	0	┐
↳block4h_expand_bn[0][...			
(Activation)			┐
↳			
block4h_dwconv	(None, 16, 16, 960)	8,640	┐
↳block4h_expand_activa...			
(DepthwiseConv2D)			┐
↳			
block4h_bn	(None, 16, 16, 960)	3,840	┐
↳block4h_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block4h_activation	(None, 16, 16, 960)	0	┐
↳block4h_bn[0][0]			
(Activation)			┐
↳			
block4h_se_squeeze	(None, 960)	0	┐
↳block4h_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			

block4h_se_reshape ↳block4h_se_squeeze[0]... (Reshape)	(None, 1, 1, 960)	0	↳
↳			
block4h_se_reduce ↳block4h_se_reshape[0]... (Conv2D)	(None, 1, 1, 40)	38,440	↳
↳			
block4h_se_expand ↳block4h_se_reduce[0] [...] (Conv2D)	(None, 1, 1, 960)	39,360	↳
↳			
block4h_se_excite ↳block4h_activation[0]... (Multiply)	(None, 16, 16, 960)	0	↳
↳block4h_se_expand[0] [...]			↳
block4h_project_conv ↳block4h_se_excite[0] [...] (Conv2D)	(None, 16, 16, 160)	153,600	↳
↳			
block4h_project_bn ↳block4h_project_conv[...] (BatchNormalization)	(None, 16, 16, 160)	640	↳
↳			
block4h_drop ↳block4h_project_bn[0]... (FixedDropout)	(None, 16, 16, 160)	0	↳
↳			
block4h_add (Add) ↳block4h_drop[0][0],	(None, 16, 16, 160)	0	↳
↳block4g_add[0][0]			↳
block4i_expand_conv ↳block4h_add[0][0] (Conv2D)	(None, 16, 16, 960)	153,600	↳
↳			

block4i_expand_bn ↳block4i_expand_conv[0... (BatchNormalization)	(None, 16, 16, 960)	3,840	┐	┐
block4i_expand_activation ↳block4i_expand_bn[0][... (Activation)	(None, 16, 16, 960)	0	┐	┐
block4i_dwconv ↳block4i_expand_activa... (DepthwiseConv2D)	(None, 16, 16, 960)	8,640	┐	┐
block4i_bn ↳block4i_dwconv[0][0] (BatchNormalization)	(None, 16, 16, 960)	3,840	┐	┐
block4i_activation ↳block4i_bn[0][0] (Activation)	(None, 16, 16, 960)	0	┐	┐
block4i_se_squeeze ↳block4i_activation[0]... (GlobalAveragePooling2D)	(None, 960)	0	┐	┐
block4i_se_reshape ↳block4i_se_squeeze[0]... (Reshape)	(None, 1, 1, 960)	0	┐	┐
block4i_se_reduce ↳block4i_se_reshape[0]... (Conv2D)	(None, 1, 1, 40)	38,440	┐	┐
block4i_se_expand ↳block4i_se_reduce[0][... (Conv2D)	(None, 1, 1, 960)	39,360	┐	┐

block4i_se_excite	(None, 16, 16, 960)	0	┐
↳block4i_activation[0]...			
(Multiply)			┐
↳block4i_se_expand[0] [...			
block4i_project_conv	(None, 16, 16, 160)	153,600	┐
↳block4i_se_excite[0] [...			
(Conv2D)			┐
↳			
block4i_project_bn	(None, 16, 16, 160)	640	┐
↳block4i_project_conv[...			
(BatchNormalization)			┐
↳			
block4i_drop	(None, 16, 16, 160)	0	┐
↳block4i_project_bn[0]...			
(FixedDropout)			┐
↳			
block4i_add (Add)	(None, 16, 16, 160)	0	┐
↳block4i_drop[0][0],			
			┐
↳block4h_add[0][0]			
block4j_expand_conv	(None, 16, 16, 960)	153,600	┐
↳block4i_add[0][0]			
(Conv2D)			┐
↳			
block4j_expand_bn	(None, 16, 16, 960)	3,840	┐
↳block4j_expand_conv[0...			
(BatchNormalization)			┐
↳			
block4j_expand_activation	(None, 16, 16, 960)	0	┐
↳block4j_expand_bn[0] [...			
(Activation)			┐
↳			
block4j_dwconv	(None, 16, 16, 960)	8,640	┐
↳block4j_expand_activa...			
(DepthwiseConv2D)			┐
↳			

block4j_bn ↳block4j_dwconv[0][0] (BatchNormalization)	(None, 16, 16, 960)	3,840	↳
block4j_activation ↳block4j_bn[0][0] (Activation)	(None, 16, 16, 960)	0	↳
block4j_se_squeeze ↳block4j_activation[0]... (GlobalAveragePooling2D)	(None, 960)	0	↳
block4j_se_reshape ↳block4j_se_squeeze[0]... (Reshape)	(None, 1, 1, 960)	0	↳
block4j_se_reduce ↳block4j_se_reshape[0]... (Conv2D)	(None, 1, 1, 40)	38,440	↳
block4j_se_expand ↳block4j_se_reduce[0][...] (Conv2D)	(None, 1, 1, 960)	39,360	↳
block4j_se_excite ↳block4j_activation[0]... (Multiply) ↳block4j_se_expand[0][...]	(None, 16, 16, 960)	0	↳
block4j_project_conv ↳block4j_se_excite[0][...] (Conv2D)	(None, 16, 16, 160)	153,600	↳
block4j_project_bn ↳block4j_project_conv[...] (BatchNormalization)	(None, 16, 16, 160)	640	↳

block4j_drop	(None, 16, 16, 160)	0	┐
↳block4j_project_bn[0]...			
(FixedDropout)			┐
↳			
block4j_add (Add)	(None, 16, 16, 160)	0	┐
↳block4j_drop[0][0],			
			┐
↳block4i_add[0][0]			
block5a_expand_conv	(None, 16, 16, 960)	153,600	┐
↳block4j_add[0][0]			
(Conv2D)			┐
↳			
block5a_expand_bn	(None, 16, 16, 960)	3,840	┐
↳block5a_expand_conv[0...			
(BatchNormalization)			┐
↳			
block5a_expand_activation	(None, 16, 16, 960)	0	┐
↳block5a_expand_bn[0][...			
(Activation)			┐
↳			
block5a_dwconv	(None, 16, 16, 960)	24,000	┐
↳block5a_expand_activa...			
(DepthwiseConv2D)			┐
↳			
block5a_bn	(None, 16, 16, 960)	3,840	┐
↳block5a_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block5a_activation	(None, 16, 16, 960)	0	┐
↳block5a_bn[0][0]			
(Activation)			┐
↳			
block5a_se_squeeze	(None, 960)	0	┐
↳block5a_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			

block5a_se_reshape ↳block5a_se_squeeze[0]... (Reshape) ↳	(None, 1, 1, 960)	0	↳
block5a_se_reduce ↳block5a_se_reshape[0]... (Conv2D) ↳	(None, 1, 1, 40)	38,440	↳
block5a_se_expand ↳block5a_se_reduce[0] [...] (Conv2D) ↳	(None, 1, 1, 960)	39,360	↳
block5a_se_excite ↳block5a_activation[0]... (Multiply) ↳block5a_se_expand[0] [...]	(None, 16, 16, 960)	0	↳
block5a_project_conv ↳block5a_se_excite[0] [...] (Conv2D) ↳	(None, 16, 16, 224)	215,040	↳
block5a_project_bn ↳block5a_project_conv[...] (BatchNormalization) ↳	(None, 16, 16, 224)	896	↳
block5b_expand_conv ↳block5a_project_bn[0]... (Conv2D) ↳	(None, 16, 16, 1344)	301,056	↳
block5b_expand_bn ↳block5b_expand_conv[0...] (BatchNormalization) ↳	(None, 16, 16, 1344)	5,376	↳
block5b_expand_activation ↳block5b_expand_bn[0] [...] (Activation) ↳	(None, 16, 16, 1344)	0	↳

block5b_dwconv ↳block5b_expand_activa... (DepthwiseConv2D) ↳	(None, 16, 16, 1344)	33,600	↳
block5b_bn ↳block5b_dwconv[0][0] (BatchNormalization) ↳	(None, 16, 16, 1344)	5,376	↳
block5b_activation ↳block5b_bn[0][0] (Activation) ↳	(None, 16, 16, 1344)	0	↳
block5b_se_squeeze ↳block5b_activation[0]... (GlobalAveragePooling2D) ↳	(None, 1344)	0	↳
block5b_se_reshape ↳block5b_se_squeeze[0]... (Reshape) ↳	(None, 1, 1, 1344)	0	↳
block5b_se_reduce ↳block5b_se_reshape[0]... (Conv2D) ↳	(None, 1, 1, 56)	75,320	↳
block5b_se_expand ↳block5b_se_reduce[0][... (Conv2D) ↳	(None, 1, 1, 1344)	76,608	↳
block5b_se_excite ↳block5b_activation[0]... (Multiply) ↳block5b_se_expand[0][... ↳	(None, 16, 16, 1344)	0	↳
block5b_project_conv ↳block5b_se_excite[0][... (Conv2D) ↳	(None, 16, 16, 224)	301,056	↳

block5b_project_bn ↳block5b_project_conv[... (BatchNormalization)	(None, 16, 16, 224)	896	┐	
↳				
block5b_drop ↳block5b_project_bn[0]... (FixedDropout)	(None, 16, 16, 224)	0	┐	
↳				
block5b_add (Add) ↳block5b_drop[0][0], ↳block5a_project_bn[0]...	(None, 16, 16, 224)	0	┐	
block5c_expand_conv ↳block5b_add[0][0] (Conv2D)	(None, 16, 16, 1344)	301,056	┐	
↳				
block5c_expand_bn ↳block5c_expand_conv[0... (BatchNormalization)	(None, 16, 16, 1344)	5,376	┐	
↳				
block5c_expand_activation ↳block5c_expand_bn[0][... (Activation)	(None, 16, 16, 1344)	0	┐	
↳				
block5c_dwconv ↳block5c_expand_activa... (DepthwiseConv2D)	(None, 16, 16, 1344)	33,600	┐	
↳				
block5c_bn ↳block5c_dwconv[0][0] (BatchNormalization)	(None, 16, 16, 1344)	5,376	┐	
↳				
block5c_activation ↳block5c_bn[0][0] (Activation)	(None, 16, 16, 1344)	0	┐	
↳				

block5c_se_squeeze ↳block5c_activation[0]... (GlobalAveragePooling2D) ↳	(None, 1344)	0	↳
block5c_se_reshape ↳block5c_se_squeeze[0]... (Reshape) ↳	(None, 1, 1, 1344)	0	↳
block5c_se_reduce ↳block5c_se_reshape[0]... (Conv2D) ↳	(None, 1, 1, 56)	75,320	↳
block5c_se_expand ↳block5c_se_reduce[0] [...] (Conv2D) ↳	(None, 1, 1, 1344)	76,608	↳
block5c_se_excite ↳block5c_activation[0]... (Multiply) ↳block5c_se_expand[0] [...]	(None, 16, 16, 1344)	0	↳
block5c_project_conv ↳block5c_se_excite[0] [...] (Conv2D) ↳	(None, 16, 16, 224)	301,056	↳
block5c_project_bn ↳block5c_project_conv[...] (BatchNormalization) ↳	(None, 16, 16, 224)	896	↳
block5c_drop ↳block5c_project_bn[0]... (FixedDropout) ↳	(None, 16, 16, 224)	0	↳
block5c_add (Add) ↳block5c_drop[0][0], ↳block5b_add[0][0]	(None, 16, 16, 224)	0	↳

block5d_expand_conv ↳block5c_add[0][0] (Conv2D)	(None, 16, 16, 1344)	301,056	↳
block5d_expand_bn ↳block5d_expand_conv[0... (BatchNormalization)	(None, 16, 16, 1344)	5,376	↳
block5d_expand_activation ↳block5d_expand_bn[0][... (Activation)	(None, 16, 16, 1344)	0	↳
block5d_dwconv ↳block5d_expand_activa... (DepthwiseConv2D)	(None, 16, 16, 1344)	33,600	↳
block5d_bn ↳block5d_dwconv[0][0] (BatchNormalization)	(None, 16, 16, 1344)	5,376	↳
block5d_activation ↳block5d_bn[0][0] (Activation)	(None, 16, 16, 1344)	0	↳
block5d_se_squeeze ↳block5d_activation[0]... (GlobalAveragePooling2D)	(None, 1344)	0	↳
block5d_se_reshape ↳block5d_se_squeeze[0]... (Reshape)	(None, 1, 1, 1344)	0	↳
block5d_se_reduce ↳block5d_se_reshape[0]... (Conv2D)	(None, 1, 1, 56)	75,320	↳

block5d_se_expand ↳block5d_se_reduce[0][... (Conv2D)	(None, 1, 1, 1344)	76,608	┐
↳			
block5d_se_excite ↳block5d_activation[0]... (Multiply)	(None, 16, 16, 1344)	0	┐
↳block5d_se_expand[0][... (Conv2D)			┐
↳			
block5d_project_conv ↳block5d_se_excite[0][... (Conv2D)	(None, 16, 16, 224)	301,056	┐
↳			
block5d_project_bn ↳block5d_project_conv[... (BatchNormalization)	(None, 16, 16, 224)	896	┐
↳			
block5d_drop ↳block5d_project_bn[0]... (FixedDropout)	(None, 16, 16, 224)	0	┐
↳			
block5d_add (Add) ↳block5d_drop[0][0], ↳block5c_add[0][0]	(None, 16, 16, 224)	0	┐
			┐
block5e_expand_conv ↳block5d_add[0][0] (Conv2D)	(None, 16, 16, 1344)	301,056	┐
↳			
block5e_expand_bn ↳block5e_expand_conv[0]... (BatchNormalization)	(None, 16, 16, 1344)	5,376	┐
↳			
block5e_expand_activation ↳block5e_expand_bn[0][... (Activation)	(None, 16, 16, 1344)	0	┐
↳			

block5e_dwconv ↳block5e_expand_activa... (DepthwiseConv2D)	(None, 16, 16, 1344)	33,600	↳
block5e_bn ↳block5e_dwconv[0][0] (BatchNormalization)	(None, 16, 16, 1344)	5,376	↳
block5e_activation ↳block5e_bn[0][0] (Activation)	(None, 16, 16, 1344)	0	↳
block5e_se_squeeze ↳block5e_activation[0]... (GlobalAveragePooling2D)	(None, 1344)	0	↳
block5e_se_reshape ↳block5e_se_squeeze[0]... (Reshape)	(None, 1, 1, 1344)	0	↳
block5e_se_reduce ↳block5e_se_reshape[0]... (Conv2D)	(None, 1, 1, 56)	75,320	↳
block5e_se_expand ↳block5e_se_reduce[0][... (Conv2D)	(None, 1, 1, 1344)	76,608	↳
block5e_se_excite ↳block5e_activation[0]... (Multiply) ↳block5e_se_expand[0][...	(None, 16, 16, 1344)	0	↳
block5e_project_conv ↳block5e_se_excite[0][... (Conv2D)	(None, 16, 16, 224)	301,056	↳

block5e_project_bn ↳block5e_project_conv[... (BatchNormalization)	(None, 16, 16, 224)	896	┐	┐
↳				
block5e_drop ↳block5e_project_bn[0]... (FixedDropout)	(None, 16, 16, 224)	0	┐	┐
↳				
block5e_add (Add) ↳block5e_drop[0][0], ↳block5d_add[0][0]	(None, 16, 16, 224)	0	┐	┐
block5f_expand_conv ↳block5e_add[0][0] (Conv2D)	(None, 16, 16, 1344)	301,056	┐	┐
↳				
block5f_expand_bn ↳block5f_expand_conv[0... (BatchNormalization)	(None, 16, 16, 1344)	5,376	┐	┐
↳				
block5f_expand_activation ↳block5f_expand_bn[0][... (Activation)	(None, 16, 16, 1344)	0	┐	┐
↳				
block5f_dwconv ↳block5f_expand_activa... (DepthwiseConv2D)	(None, 16, 16, 1344)	33,600	┐	┐
↳				
block5f_bn ↳block5f_dwconv[0][0] (BatchNormalization)	(None, 16, 16, 1344)	5,376	┐	┐
↳				
block5f_activation ↳block5f_bn[0][0] (Activation)	(None, 16, 16, 1344)	0	┐	┐
↳				

block5f_se_squeeze	(None, 1344)	0	┐
↳block5f_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block5f_se_reshape	(None, 1, 1, 1344)	0	┐
↳block5f_se_squeeze[0]...			
(Reshape)			┐
↳			
block5f_se_reduce	(None, 1, 1, 56)	75,320	┐
↳block5f_se_reshape[0]...			
(Conv2D)			┐
↳			
block5f_se_expand	(None, 1, 1, 1344)	76,608	┐
↳block5f_se_reduce[0] [...]			
(Conv2D)			┐
↳			
block5f_se_excite	(None, 16, 16, 1344)	0	┐
↳block5f_activation[0]...			
(Multiply)			┐
↳block5f_se_expand[0] [...]			
block5f_project_conv	(None, 16, 16, 224)	301,056	┐
↳block5f_se_excite[0] [...]			
(Conv2D)			┐
↳			
block5f_project_bn	(None, 16, 16, 224)	896	┐
↳block5f_project_conv[...]			
(BatchNormalization)			┐
↳			
block5f_drop	(None, 16, 16, 224)	0	┐
↳block5f_project_bn[0]...			
(FixedDropout)			┐
↳			
block5f_add (Add)	(None, 16, 16, 224)	0	┐
↳block5f_drop[0][0],			
			┐
↳block5e_add[0][0]			

block5g_expand_conv ↳block5f_add[0][0] (Conv2D)	(None, 16, 16, 1344)	301,056	┐
↳			
block5g_expand_bn ↳block5g_expand_conv[0... (BatchNormalization)	(None, 16, 16, 1344)	5,376	┐
↳			
block5g_expand_activation ↳block5g_expand_bn[0][... (Activation)	(None, 16, 16, 1344)	0	┐
↳			
block5g_dwconv ↳block5g_expand_activa... (DepthwiseConv2D)	(None, 16, 16, 1344)	33,600	┐
↳			
block5g_bn ↳block5g_dwconv[0][0] (BatchNormalization)	(None, 16, 16, 1344)	5,376	┐
↳			
block5g_activation ↳block5g_bn[0][0] (Activation)	(None, 16, 16, 1344)	0	┐
↳			
block5g_se_squeeze ↳block5g_activation[0]... (GlobalAveragePooling2D)	(None, 1344)	0	┐
↳			
block5g_se_reshape ↳block5g_se_squeeze[0]... (Reshape)	(None, 1, 1, 1344)	0	┐
↳			
block5g_se_reduce ↳block5g_se_reshape[0]... (Conv2D)	(None, 1, 1, 56)	75,320	┐
↳			

block5g_se_expand ↳block5g_se_reduce[0][... (Conv2D)	(None, 1, 1, 1344)	76,608	↳
block5g_se_excite ↳block5g_activation[0]... (Multiply)	(None, 16, 16, 1344)	0	↳
↳block5g_se_expand[0][... block5g_project_conv ↳block5g_se_excite[0][... (Conv2D)	(None, 16, 16, 224)	301,056	↳
↳ block5g_project_bn ↳block5g_project_conv[... (BatchNormalization)	(None, 16, 16, 224)	896	↳
↳ block5g_drop ↳block5g_project_bn[0]... (FixedDropout)	(None, 16, 16, 224)	0	↳
↳ block5g_add (Add) ↳block5g_drop[0][0], ↳block5f_add[0][0]	(None, 16, 16, 224)	0	↳
block5h_expand_conv ↳block5g_add[0][0] (Conv2D)	(None, 16, 16, 1344)	301,056	↳
↳ block5h_expand_bn ↳block5h_expand_conv[0... (BatchNormalization)	(None, 16, 16, 1344)	5,376	↳
↳ block5h_expand_activation ↳block5h_expand_bn[0][... (Activation)	(None, 16, 16, 1344)	0	↳
↳			

block5h_dwconv ↳block5h_expand_activa... (DepthwiseConv2D)	(None, 16, 16, 1344)	33,600	↳
block5h_bn ↳block5h_dwconv[0][0] (BatchNormalization)	(None, 16, 16, 1344)	5,376	↳
block5h_activation ↳block5h_bn[0][0] (Activation)	(None, 16, 16, 1344)	0	↳
block5h_se_squeeze ↳block5h_activation[0]... (GlobalAveragePooling2D)	(None, 1344)	0	↳
block5h_se_reshape ↳block5h_se_squeeze[0]... (Reshape)	(None, 1, 1, 1344)	0	↳
block5h_se_reduce ↳block5h_se_reshape[0]... (Conv2D)	(None, 1, 1, 56)	75,320	↳
block5h_se_expand ↳block5h_se_reduce[0][... (Conv2D)	(None, 1, 1, 1344)	76,608	↳
block5h_se_excite ↳block5h_activation[0]... (Multiply) ↳block5h_se_expand[0][...	(None, 16, 16, 1344)	0	↳
block5h_project_conv ↳block5h_se_excite[0][... (Conv2D)	(None, 16, 16, 224)	301,056	↳

block5h_project_bn ↳block5h_project_conv[... (BatchNormalization)	(None, 16, 16, 224)	896	┐	
↳				
block5h_drop ↳block5h_project_bn[0]... (FixedDropout)	(None, 16, 16, 224)	0	┐	
↳				
block5h_add (Add) ↳block5h_drop[0][0], ↳block5g_add[0][0]	(None, 16, 16, 224)	0	┐	
block5i_expand_conv ↳block5h_add[0][0] (Conv2D)	(None, 16, 16, 1344)	301,056	┐	
↳				
block5i_expand_bn ↳block5i_expand_conv[0... (BatchNormalization)	(None, 16, 16, 1344)	5,376	┐	
↳				
block5i_expand_activation ↳block5i_expand_bn[0][... (Activation)	(None, 16, 16, 1344)	0	┐	
↳				
block5i_dwconv ↳block5i_expand_activa... (DepthwiseConv2D)	(None, 16, 16, 1344)	33,600	┐	
↳				
block5i_bn ↳block5i_dwconv[0][0] (BatchNormalization)	(None, 16, 16, 1344)	5,376	┐	
↳				
block5i_activation ↳block5i_bn[0][0] (Activation)	(None, 16, 16, 1344)	0	┐	
↳				

block5i_se_squeeze	(None, 1344)	0	┐
↳block5i_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block5i_se_reshape	(None, 1, 1, 1344)	0	┐
↳block5i_se_squeeze[0]...			
(Reshape)			┐
↳			
block5i_se_reduce	(None, 1, 1, 56)	75,320	┐
↳block5i_se_reshape[0]...			
(Conv2D)			┐
↳			
block5i_se_expand	(None, 1, 1, 1344)	76,608	┐
↳block5i_se_reduce[0] [...]			
(Conv2D)			┐
↳			
block5i_se_excite	(None, 16, 16, 1344)	0	┐
↳block5i_activation[0]...			
(Multiply)			┐
↳block5i_se_expand[0] [...]			
block5i_project_conv	(None, 16, 16, 224)	301,056	┐
↳block5i_se_excite[0] [...]			
(Conv2D)			┐
↳			
block5i_project_bn	(None, 16, 16, 224)	896	┐
↳block5i_project_conv[...]			
(BatchNormalization)			┐
↳			
block5i_drop	(None, 16, 16, 224)	0	┐
↳block5i_project_bn[0]...			
(FixedDropout)			┐
↳			
block5i_add (Add)	(None, 16, 16, 224)	0	┐
↳block5i_drop[0][0],			
			┐
↳block5h_add[0][0]			

block5j_expand_conv ↳block5i_add[0][0] (Conv2D)	(None, 16, 16, 1344)	301,056	⌵	⌵
block5j_expand_bn ↳block5j_expand_conv[0... (BatchNormalization)	(None, 16, 16, 1344)	5,376	⌵	⌵
block5j_expand_activation ↳block5j_expand_bn[0][... (Activation)	(None, 16, 16, 1344)	0	⌵	⌵
block5j_dwconv ↳block5j_expand_activa... (DepthwiseConv2D)	(None, 16, 16, 1344)	33,600	⌵	⌵
block5j_bn ↳block5j_dwconv[0][0] (BatchNormalization)	(None, 16, 16, 1344)	5,376	⌵	⌵
block5j_activation ↳block5j_bn[0][0] (Activation)	(None, 16, 16, 1344)	0	⌵	⌵
block5j_se_squeeze ↳block5j_activation[0]... (GlobalAveragePooling2D)	(None, 1344)	0	⌵	⌵
block5j_se_reshape ↳block5j_se_squeeze[0]... (Reshape)	(None, 1, 1, 1344)	0	⌵	⌵
block5j_se_reduce ↳block5j_se_reshape[0]... (Conv2D)	(None, 1, 1, 56)	75,320	⌵	⌵

block5j_se_expand	(None, 1, 1, 1344)	76,608	┐
↳block5j_se_reduce[0][... (Conv2D)			┐
↳			
block5j_se_excite	(None, 16, 16, 1344)	0	┐
↳block5j_activation[0]... (Multiply)			┐
↳block5j_se_expand[0][... (Conv2D)			┐
↳			
block5j_project_conv	(None, 16, 16, 224)	301,056	┐
↳block5j_se_excite[0][... (Conv2D)			┐
↳			
block5j_project_bn	(None, 16, 16, 224)	896	┐
↳block5j_project_conv[... (BatchNormalization)			┐
↳			
block5j_drop	(None, 16, 16, 224)	0	┐
↳block5j_project_bn[0]... (FixedDropout)			┐
↳			
block5j_add (Add)	(None, 16, 16, 224)	0	┐
↳block5j_drop[0][0],			┐
↳block5i_add[0][0]			
block6a_expand_conv	(None, 16, 16, 1344)	301,056	┐
↳block5j_add[0][0] (Conv2D)			┐
↳			
block6a_expand_bn	(None, 16, 16, 1344)	5,376	┐
↳block6a_expand_conv[0]... (BatchNormalization)			┐
↳			
block6a_expand_activation	(None, 16, 16, 1344)	0	┐
↳block6a_expand_bn[0][... (Activation)			┐
↳			

block6a_dwconv	(None, 8, 8, 1344)	33,600	┐
↳block6a_expand_activa...	(DepthwiseConv2D)		┐
↳			
block6a_bn	(None, 8, 8, 1344)	5,376	┐
↳block6a_dwconv[0][0]	(BatchNormalization)		┐
↳			
block6a_activation	(None, 8, 8, 1344)	0	┐
↳block6a_bn[0][0]	(Activation)		┐
↳			
block6a_se_squeeze	(None, 1344)	0	┐
↳block6a_activation[0]...	(GlobalAveragePooling2D)		┐
↳			
block6a_se_reshape	(None, 1, 1, 1344)	0	┐
↳block6a_se_squeeze[0]...	(Reshape)		┐
↳			
block6a_se_reduce	(None, 1, 1, 56)	75,320	┐
↳block6a_se_reshape[0]...	(Conv2D)		┐
↳			
block6a_se_expand	(None, 1, 1, 1344)	76,608	┐
↳block6a_se_reduce[0][...]	(Conv2D)		┐
↳			
block6a_se_excite	(None, 8, 8, 1344)	0	┐
↳block6a_activation[0]...	(Multiply)		┐
↳block6a_se_expand[0][...]			
block6a_project_conv	(None, 8, 8, 384)	516,096	┐
↳block6a_se_excite[0][...]	(Conv2D)		┐
↳			

block6a_project_bn ↳block6a_project_conv[... (BatchNormalization)	(None, 8, 8, 384)	1,536	┐	┐
↳				
block6b_expand_conv ↳block6a_project_bn[0]... (Conv2D)	(None, 8, 8, 2304)	884,736	┐	┐
↳				
block6b_expand_bn ↳block6b_expand_conv[0... (BatchNormalization)	(None, 8, 8, 2304)	9,216	┐	┐
↳				
block6b_expand_activation ↳block6b_expand_bn[0][... (Activation)	(None, 8, 8, 2304)	0	┐	┐
↳				
block6b_dwconv ↳block6b_expand_activa... (DepthwiseConv2D)	(None, 8, 8, 2304)	57,600	┐	┐
↳				
block6b_bn ↳block6b_dwconv[0][0] (BatchNormalization)	(None, 8, 8, 2304)	9,216	┐	┐
↳				
block6b_activation ↳block6b_bn[0][0] (Activation)	(None, 8, 8, 2304)	0	┐	┐
↳				
block6b_se_squeeze ↳block6b_activation[0]... (GlobalAveragePooling2D)	(None, 2304)	0	┐	┐
↳				
block6b_se_reshape ↳block6b_se_squeeze[0]... (Reshape)	(None, 1, 1, 2304)	0	┐	┐
↳				

block6b_se_reduce ↳block6b_se_reshape[0]... (Conv2D) ↳	(None, 1, 1, 96)	221,280	↳
block6b_se_expand ↳block6b_se_reduce[0] [...] (Conv2D) ↳	(None, 1, 1, 2304)	223,488	↳
block6b_se_excite ↳block6b_activation[0]... (Multiply) ↳block6b_se_expand[0] [...]	(None, 8, 8, 2304)	0	↳
block6b_project_conv ↳block6b_se_excite[0] [...] (Conv2D) ↳	(None, 8, 8, 384)	884,736	↳
block6b_project_bn ↳block6b_project_conv[...] (BatchNormalization) ↳	(None, 8, 8, 384)	1,536	↳
block6b_drop ↳block6b_project_bn[0]... (FixedDropout) ↳	(None, 8, 8, 384)	0	↳
block6b_add (Add) ↳block6b_drop[0][0], ↳block6a_project_bn[0]...	(None, 8, 8, 384)	0	↳
block6c_expand_conv ↳block6b_add[0][0] (Conv2D) ↳	(None, 8, 8, 2304)	884,736	↳
block6c_expand_bn ↳block6c_expand_conv[0...] (BatchNormalization) ↳	(None, 8, 8, 2304)	9,216	↳

block6c_expand_activation	(None, 8, 8, 2304)	0	┐
↳block6c_expand_bn[0][...]			
(Activation)			┐
↳			
block6c_dwconv	(None, 8, 8, 2304)	57,600	┐
↳block6c_expand_activa...			
(DepthwiseConv2D)			┐
↳			
block6c_bn	(None, 8, 8, 2304)	9,216	┐
↳block6c_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block6c_activation	(None, 8, 8, 2304)	0	┐
↳block6c_bn[0][0]			
(Activation)			┐
↳			
block6c_se_squeeze	(None, 2304)	0	┐
↳block6c_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block6c_se_reshape	(None, 1, 1, 2304)	0	┐
↳block6c_se_squeeze[0]...			
(Reshape)			┐
↳			
block6c_se_reduce	(None, 1, 1, 96)	221,280	┐
↳block6c_se_reshape[0]...			
(Conv2D)			┐
↳			
block6c_se_expand	(None, 1, 1, 2304)	223,488	┐
↳block6c_se_reduce[0][...]			
(Conv2D)			┐
↳			
block6c_se_excite	(None, 8, 8, 2304)	0	┐
↳block6c_activation[0]...			
(Multiply)			┐
↳block6c_se_expand[0][...]			

block6c_project_conv ↳block6c_se_excite[0][... (Conv2D)	(None, 8, 8, 384)	884,736	┐
↳			
block6c_project_bn ↳block6c_project_conv[... (BatchNormalization)	(None, 8, 8, 384)	1,536	┐
↳			
block6c_drop ↳block6c_project_bn[0]... (FixedDropout)	(None, 8, 8, 384)	0	┐
↳			
block6c_add (Add) ↳block6c_drop[0][0], ↳block6b_add[0][0]	(None, 8, 8, 384)	0	┐
block6d_expand_conv ↳block6c_add[0][0] (Conv2D)	(None, 8, 8, 2304)	884,736	┐
↳			
block6d_expand_bn ↳block6d_expand_conv[0... (BatchNormalization)	(None, 8, 8, 2304)	9,216	┐
↳			
block6d_expand_activation ↳block6d_expand_bn[0][... (Activation)	(None, 8, 8, 2304)	0	┐
↳			
block6d_dwconv ↳block6d_expand_activa... (DepthwiseConv2D)	(None, 8, 8, 2304)	57,600	┐
↳			
block6d_bn ↳block6d_dwconv[0][0] (BatchNormalization)	(None, 8, 8, 2304)	9,216	┐
↳			

block6d_activation	(None, 8, 8, 2304)	0	┐
↳block6d_bn[0][0]			
(Activation)			┐
↳			
block6d_se_squeeze	(None, 2304)	0	┐
↳block6d_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block6d_se_reshape	(None, 1, 1, 2304)	0	┐
↳block6d_se_squeeze[0]...			
(Reshape)			┐
↳			
block6d_se_reduce	(None, 1, 1, 96)	221,280	┐
↳block6d_se_reshape[0]...			
(Conv2D)			┐
↳			
block6d_se_expand	(None, 1, 1, 2304)	223,488	┐
↳block6d_se_reduce[0][...]			
(Conv2D)			┐
↳			
block6d_se_excite	(None, 8, 8, 2304)	0	┐
↳block6d_activation[0]...			
(Multiply)			┐
↳block6d_se_expand[0][...]			
block6d_project_conv	(None, 8, 8, 384)	884,736	┐
↳block6d_se_excite[0][...]			
(Conv2D)			┐
↳			
block6d_project_bn	(None, 8, 8, 384)	1,536	┐
↳block6d_project_conv[...]			
(BatchNormalization)			┐
↳			
block6d_drop	(None, 8, 8, 384)	0	┐
↳block6d_project_bn[0]...			
(FixedDropout)			┐
↳			

block6d_add (Add)	(None, 8, 8, 384)	0	┐
↳block6d_drop[0][0],			
			┐
↳block6c_add[0][0]			
block6e_expand_conv	(None, 8, 8, 2304)	884,736	┐
↳block6d_add[0][0]			
(Conv2D)			┐
↳			
block6e_expand_bn	(None, 8, 8, 2304)	9,216	┐
↳block6e_expand_conv[0...			
(BatchNormalization)			┐
↳			
block6e_expand_activation	(None, 8, 8, 2304)	0	┐
↳block6e_expand_bn[0][...			
(Activation)			┐
↳			
block6e_dwconv	(None, 8, 8, 2304)	57,600	┐
↳block6e_expand_activa...			
(DepthwiseConv2D)			┐
↳			
block6e_bn	(None, 8, 8, 2304)	9,216	┐
↳block6e_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block6e_activation	(None, 8, 8, 2304)	0	┐
↳block6e_bn[0][0]			
(Activation)			┐
↳			
block6e_se_squeeze	(None, 2304)	0	┐
↳block6e_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block6e_se_reshape	(None, 1, 1, 2304)	0	┐
↳block6e_se_squeeze[0]...			
(Reshape)			┐
↳			

block6e_se_reduce ↳block6e_se_reshape[0]... (Conv2D) ↳	(None, 1, 1, 96)	221,280	↳
block6e_se_expand ↳block6e_se_reduce[0] [...] (Conv2D) ↳	(None, 1, 1, 2304)	223,488	↳
block6e_se_excite ↳block6e_activation[0]... (Multiply) ↳block6e_se_expand[0] [...]	(None, 8, 8, 2304)	0	↳
block6e_project_conv ↳block6e_se_excite[0] [...] (Conv2D) ↳	(None, 8, 8, 384)	884,736	↳
block6e_project_bn ↳block6e_project_conv[...] (BatchNormalization) ↳	(None, 8, 8, 384)	1,536	↳
block6e_drop ↳block6e_project_bn[0]... (FixedDropout) ↳	(None, 8, 8, 384)	0	↳
block6e_add (Add) ↳block6e_drop[0][0], ↳block6d_add[0][0]	(None, 8, 8, 384)	0	↳
block6f_expand_conv ↳block6e_add[0][0] (Conv2D) ↳	(None, 8, 8, 2304)	884,736	↳
block6f_expand_bn ↳block6f_expand_conv[0...] (BatchNormalization) ↳	(None, 8, 8, 2304)	9,216	↳

block6f_expand_activation	(None, 8, 8, 2304)	0	┐
↳block6f_expand_bn[0][...]			
(Activation)			┐
↳			
block6f_dwconv	(None, 8, 8, 2304)	57,600	┐
↳block6f_expand_activa...			
(DepthwiseConv2D)			┐
↳			
block6f_bn	(None, 8, 8, 2304)	9,216	┐
↳block6f_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block6f_activation	(None, 8, 8, 2304)	0	┐
↳block6f_bn[0][0]			
(Activation)			┐
↳			
block6f_se_squeeze	(None, 2304)	0	┐
↳block6f_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block6f_se_reshape	(None, 1, 1, 2304)	0	┐
↳block6f_se_squeeze[0]...			
(Reshape)			┐
↳			
block6f_se_reduce	(None, 1, 1, 96)	221,280	┐
↳block6f_se_reshape[0]...			
(Conv2D)			┐
↳			
block6f_se_expand	(None, 1, 1, 2304)	223,488	┐
↳block6f_se_reduce[0][...]			
(Conv2D)			┐
↳			
block6f_se_excite	(None, 8, 8, 2304)	0	┐
↳block6f_activation[0]...			
(Multiply)			┐
↳block6f_se_expand[0][...]			

block6f_project_conv ↳block6f_se_excite[0][... (Conv2D)	(None, 8, 8, 384)	884,736	┐
↳			
block6f_project_bn ↳block6f_project_conv[... (BatchNormalization)	(None, 8, 8, 384)	1,536	┐
↳			
block6f_drop ↳block6f_project_bn[0]... (FixedDropout)	(None, 8, 8, 384)	0	┐
↳			
block6f_add (Add) ↳block6f_drop[0][0], ↳block6e_add[0][0]	(None, 8, 8, 384)	0	┐
block6g_expand_conv ↳block6f_add[0][0] (Conv2D)	(None, 8, 8, 2304)	884,736	┐
↳			
block6g_expand_bn ↳block6g_expand_conv[0... (BatchNormalization)	(None, 8, 8, 2304)	9,216	┐
↳			
block6g_expand_activation ↳block6g_expand_bn[0][... (Activation)	(None, 8, 8, 2304)	0	┐
↳			
block6g_dwconv ↳block6g_expand_activa... (DepthwiseConv2D)	(None, 8, 8, 2304)	57,600	┐
↳			
block6g_bn ↳block6g_dwconv[0][0] (BatchNormalization)	(None, 8, 8, 2304)	9,216	┐
↳			

block6g_activation	(None, 8, 8, 2304)	0	┐
↳block6g_bn[0][0]			
(Activation)			┐
↳			
block6g_se_squeeze	(None, 2304)	0	┐
↳block6g_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block6g_se_reshape	(None, 1, 1, 2304)	0	┐
↳block6g_se_squeeze[0]...			
(Reshape)			┐
↳			
block6g_se_reduce	(None, 1, 1, 96)	221,280	┐
↳block6g_se_reshape[0]...			
(Conv2D)			┐
↳			
block6g_se_expand	(None, 1, 1, 2304)	223,488	┐
↳block6g_se_reduce[0][...]			
(Conv2D)			┐
↳			
block6g_se_excite	(None, 8, 8, 2304)	0	┐
↳block6g_activation[0]...			
(Multiply)			┐
↳block6g_se_expand[0][...]			
block6g_project_conv	(None, 8, 8, 384)	884,736	┐
↳block6g_se_excite[0][...]			
(Conv2D)			┐
↳			
block6g_project_bn	(None, 8, 8, 384)	1,536	┐
↳block6g_project_conv[...]			
(BatchNormalization)			┐
↳			
block6g_drop	(None, 8, 8, 384)	0	┐
↳block6g_project_bn[0]...			
(FixedDropout)			┐
↳			

block6g_add (Add)	(None, 8, 8, 384)	0	┐
↳block6g_drop[0][0],			
			┐
↳block6f_add[0][0]			
block6h_expand_conv	(None, 8, 8, 2304)	884,736	┐
↳block6g_add[0][0]			
(Conv2D)			┐
↳			
block6h_expand_bn	(None, 8, 8, 2304)	9,216	┐
↳block6h_expand_conv[0...			
(BatchNormalization)			┐
↳			
block6h_expand_activation	(None, 8, 8, 2304)	0	┐
↳block6h_expand_bn[0][...			
(Activation)			┐
↳			
block6h_dwconv	(None, 8, 8, 2304)	57,600	┐
↳block6h_expand_activa...			
(DepthwiseConv2D)			┐
↳			
block6h_bn	(None, 8, 8, 2304)	9,216	┐
↳block6h_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block6h_activation	(None, 8, 8, 2304)	0	┐
↳block6h_bn[0][0]			
(Activation)			┐
↳			
block6h_se_squeeze	(None, 2304)	0	┐
↳block6h_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block6h_se_reshape	(None, 1, 1, 2304)	0	┐
↳block6h_se_squeeze[0]...			
(Reshape)			┐
↳			

block6h_se_reduce	(None, 1, 1, 96)	221,280	␣
↳block6h_se_reshape[0]...			
(Conv2D)			␣
↳			
block6h_se_expand	(None, 1, 1, 2304)	223,488	␣
↳block6h_se_reduce[0] [...]			
(Conv2D)			␣
↳			
block6h_se_excite	(None, 8, 8, 2304)	0	␣
↳block6h_activation[0]...			
(Multiply)			␣
↳block6h_se_expand[0] [...]			
block6h_project_conv	(None, 8, 8, 384)	884,736	␣
↳block6h_se_excite[0] [...]			
(Conv2D)			␣
↳			
block6h_project_bn	(None, 8, 8, 384)	1,536	␣
↳block6h_project_conv[...]			
(BatchNormalization)			␣
↳			
block6h_drop	(None, 8, 8, 384)	0	␣
↳block6h_project_bn[0]...			
(FixedDropout)			␣
↳			
block6h_add (Add)	(None, 8, 8, 384)	0	␣
↳block6h_drop[0][0],			
			␣
↳block6g_add[0][0]			
block6i_expand_conv	(None, 8, 8, 2304)	884,736	␣
↳block6h_add[0][0]			
(Conv2D)			␣
↳			
block6i_expand_bn	(None, 8, 8, 2304)	9,216	␣
↳block6i_expand_conv[0...]			
(BatchNormalization)			␣
↳			

block6i_expand_activation	(None, 8, 8, 2304)	0	┐
↳block6i_expand_bn[0][...]			
(Activation)			┐
↳			
block6i_dwconv	(None, 8, 8, 2304)	57,600	┐
↳block6i_expand_activa...			
(DepthwiseConv2D)			┐
↳			
block6i_bn	(None, 8, 8, 2304)	9,216	┐
↳block6i_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block6i_activation	(None, 8, 8, 2304)	0	┐
↳block6i_bn[0][0]			
(Activation)			┐
↳			
block6i_se_squeeze	(None, 2304)	0	┐
↳block6i_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block6i_se_reshape	(None, 1, 1, 2304)	0	┐
↳block6i_se_squeeze[0]...			
(Reshape)			┐
↳			
block6i_se_reduce	(None, 1, 1, 96)	221,280	┐
↳block6i_se_reshape[0]...			
(Conv2D)			┐
↳			
block6i_se_expand	(None, 1, 1, 2304)	223,488	┐
↳block6i_se_reduce[0][...]			
(Conv2D)			┐
↳			
block6i_se_excite	(None, 8, 8, 2304)	0	┐
↳block6i_activation[0]...			
(Multiply)			┐
↳block6i_se_expand[0][...]			

block6i_project_conv ↳block6i_se_excite[0][... (Conv2D)	(None, 8, 8, 384)	884,736	┐
↳			
block6i_project_bn ↳block6i_project_conv[... (BatchNormalization)	(None, 8, 8, 384)	1,536	┐
↳			
block6i_drop ↳block6i_project_bn[0]... (FixedDropout)	(None, 8, 8, 384)	0	┐
↳			
block6i_add (Add) ↳block6i_drop[0][0], ↳block6h_add[0][0]	(None, 8, 8, 384)	0	┐
block6j_expand_conv ↳block6i_add[0][0] (Conv2D)	(None, 8, 8, 2304)	884,736	┐
↳			
block6j_expand_bn ↳block6j_expand_conv[0... (BatchNormalization)	(None, 8, 8, 2304)	9,216	┐
↳			
block6j_expand_activation ↳block6j_expand_bn[0][... (Activation)	(None, 8, 8, 2304)	0	┐
↳			
block6j_dwconv ↳block6j_expand_activa... (DepthwiseConv2D)	(None, 8, 8, 2304)	57,600	┐
↳			
block6j_bn ↳block6j_dwconv[0][0] (BatchNormalization)	(None, 8, 8, 2304)	9,216	┐
↳			

block6j_activation	(None, 8, 8, 2304)	0	┐
↳block6j_bn[0][0]			
(Activation)			┐
↳			
block6j_se_squeeze	(None, 2304)	0	┐
↳block6j_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block6j_se_reshape	(None, 1, 1, 2304)	0	┐
↳block6j_se_squeeze[0]...			
(Reshape)			┐
↳			
block6j_se_reduce	(None, 1, 1, 96)	221,280	┐
↳block6j_se_reshape[0]...			
(Conv2D)			┐
↳			
block6j_se_expand	(None, 1, 1, 2304)	223,488	┐
↳block6j_se_reduce[0][...]			
(Conv2D)			┐
↳			
block6j_se_excite	(None, 8, 8, 2304)	0	┐
↳block6j_activation[0]...			
(Multiply)			┐
↳block6j_se_expand[0][...]			
block6j_project_conv	(None, 8, 8, 384)	884,736	┐
↳block6j_se_excite[0][...]			
(Conv2D)			┐
↳			
block6j_project_bn	(None, 8, 8, 384)	1,536	┐
↳block6j_project_conv[...]			
(BatchNormalization)			┐
↳			
block6j_drop	(None, 8, 8, 384)	0	┐
↳block6j_project_bn[0]...			
(FixedDropout)			┐
↳			

block6j_add (Add)	(None, 8, 8, 384)	0	┐
↳block6j_drop[0][0],			
↳block6i_add[0][0]			┐
block6k_expand_conv	(None, 8, 8, 2304)	884,736	┐
↳block6j_add[0][0]			
(Conv2D)			┐
↳			
block6k_expand_bn	(None, 8, 8, 2304)	9,216	┐
↳block6k_expand_conv[0...			
(BatchNormalization)			┐
↳			
block6k_expand_activation	(None, 8, 8, 2304)	0	┐
↳block6k_expand_bn[0][...			
(Activation)			┐
↳			
block6k_dwconv	(None, 8, 8, 2304)	57,600	┐
↳block6k_expand_activa...			
(DepthwiseConv2D)			┐
↳			
block6k_bn	(None, 8, 8, 2304)	9,216	┐
↳block6k_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block6k_activation	(None, 8, 8, 2304)	0	┐
↳block6k_bn[0][0]			
(Activation)			┐
↳			
block6k_se_squeeze	(None, 2304)	0	┐
↳block6k_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block6k_se_reshape	(None, 1, 1, 2304)	0	┐
↳block6k_se_squeeze[0]...			
(Reshape)			┐
↳			

block6k_se_reduce ↳block6k_se_reshape[0]... (Conv2D) ↳	(None, 1, 1, 96)	221,280	↳
block6k_se_expand ↳block6k_se_reduce[0] [...] (Conv2D) ↳	(None, 1, 1, 2304)	223,488	↳
block6k_se_excite ↳block6k_activation[0]... (Multiply) ↳block6k_se_expand[0] [...]	(None, 8, 8, 2304)	0	↳
block6k_project_conv ↳block6k_se_excite[0] [...] (Conv2D) ↳	(None, 8, 8, 384)	884,736	↳
block6k_project_bn ↳block6k_project_conv[...] (BatchNormalization) ↳	(None, 8, 8, 384)	1,536	↳
block6k_drop ↳block6k_project_bn[0]... (FixedDropout) ↳	(None, 8, 8, 384)	0	↳
block6k_add (Add) ↳block6k_drop[0][0], ↳block6j_add[0][0]	(None, 8, 8, 384)	0	↳
block6l_expand_conv ↳block6k_add[0][0] (Conv2D) ↳	(None, 8, 8, 2304)	884,736	↳
block6l_expand_bn ↳block6l_expand_conv[0...] (BatchNormalization) ↳	(None, 8, 8, 2304)	9,216	↳

block6l_expand_activation	(None, 8, 8, 2304)	0	┐
↳block6l_expand_bn[0][...]			
(Activation)			┐
↳			
block6l_dwconv	(None, 8, 8, 2304)	57,600	┐
↳block6l_expand_activa...			
(DepthwiseConv2D)			┐
↳			
block6l_bn	(None, 8, 8, 2304)	9,216	┐
↳block6l_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block6l_activation	(None, 8, 8, 2304)	0	┐
↳block6l_bn[0][0]			
(Activation)			┐
↳			
block6l_se_squeeze	(None, 2304)	0	┐
↳block6l_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block6l_se_reshape	(None, 1, 1, 2304)	0	┐
↳block6l_se_squeeze[0]...			
(Reshape)			┐
↳			
block6l_se_reduce	(None, 1, 1, 96)	221,280	┐
↳block6l_se_reshape[0]...			
(Conv2D)			┐
↳			
block6l_se_expand	(None, 1, 1, 2304)	223,488	┐
↳block6l_se_reduce[0][...]			
(Conv2D)			┐
↳			
block6l_se_excite	(None, 8, 8, 2304)	0	┐
↳block6l_activation[0]...			
(Multiply)			┐
↳block6l_se_expand[0][...]			

block6l_project_conv ↳block6l_se_excite[0][... (Conv2D)	(None, 8, 8, 384)	884,736	┐
↳			
block6l_project_bn ↳block6l_project_conv[... (BatchNormalization)	(None, 8, 8, 384)	1,536	┐
↳			
block6l_drop ↳block6l_project_bn[0]... (FixedDropout)	(None, 8, 8, 384)	0	┐
↳			
block6l_add (Add) ↳block6l_drop[0][0], ↳block6k_add[0][0]	(None, 8, 8, 384)	0	┐
block6m_expand_conv ↳block6l_add[0][0] (Conv2D)	(None, 8, 8, 2304)	884,736	┐
↳			
block6m_expand_bn ↳block6m_expand_conv[0... (BatchNormalization)	(None, 8, 8, 2304)	9,216	┐
↳			
block6m_expand_activation ↳block6m_expand_bn[0][... (Activation)	(None, 8, 8, 2304)	0	┐
↳			
block6m_dwconv ↳block6m_expand_activa... (DepthwiseConv2D)	(None, 8, 8, 2304)	57,600	┐
↳			
block6m_bn ↳block6m_dwconv[0][0] (BatchNormalization)	(None, 8, 8, 2304)	9,216	┐
↳			

block6m_activation	(None, 8, 8, 2304)	0	┐
↳block6m_bn[0][0]			
(Activation)			┐
↳			
block6m_se_squeeze	(None, 2304)	0	┐
↳block6m_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block6m_se_reshape	(None, 1, 1, 2304)	0	┐
↳block6m_se_squeeze[0]...			
(Reshape)			┐
↳			
block6m_se_reduce	(None, 1, 1, 96)	221,280	┐
↳block6m_se_reshape[0]...			
(Conv2D)			┐
↳			
block6m_se_expand	(None, 1, 1, 2304)	223,488	┐
↳block6m_se_reduce[0][...]			
(Conv2D)			┐
↳			
block6m_se_excite	(None, 8, 8, 2304)	0	┐
↳block6m_activation[0]...			
(Multiply)			┐
↳block6m_se_expand[0][...]			
block6m_project_conv	(None, 8, 8, 384)	884,736	┐
↳block6m_se_excite[0][...]			
(Conv2D)			┐
↳			
block6m_project_bn	(None, 8, 8, 384)	1,536	┐
↳block6m_project_conv[...]			
(BatchNormalization)			┐
↳			
block6m_drop	(None, 8, 8, 384)	0	┐
↳block6m_project_bn[0]...			
(FixedDropout)			┐
↳			

block6m_add (Add)	(None, 8, 8, 384)	0	┐
↳block6m_drop[0][0],			
			┐
↳block6l_add[0][0]			
block7a_expand_conv	(None, 8, 8, 2304)	884,736	┐
↳block6m_add[0][0]			
(Conv2D)			┐
↳			
block7a_expand_bn	(None, 8, 8, 2304)	9,216	┐
↳block7a_expand_conv[0...			
(BatchNormalization)			┐
↳			
block7a_expand_activation	(None, 8, 8, 2304)	0	┐
↳block7a_expand_bn[0][...			
(Activation)			┐
↳			
block7a_dwconv	(None, 8, 8, 2304)	20,736	┐
↳block7a_expand_activa...			
(DepthwiseConv2D)			┐
↳			
block7a_bn	(None, 8, 8, 2304)	9,216	┐
↳block7a_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block7a_activation	(None, 8, 8, 2304)	0	┐
↳block7a_bn[0][0]			
(Activation)			┐
↳			
block7a_se_squeeze	(None, 2304)	0	┐
↳block7a_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			
block7a_se_reshape	(None, 1, 1, 2304)	0	┐
↳block7a_se_squeeze[0]...			
(Reshape)			┐
↳			

block7a_se_reduce	(None, 1, 1, 96)	221,280	␣
↳block7a_se_reshape[0]...			
(Conv2D)			␣
↳			
block7a_se_expand	(None, 1, 1, 2304)	223,488	␣
↳block7a_se_reduce[0] [...]			
(Conv2D)			␣
↳			
block7a_se_excite	(None, 8, 8, 2304)	0	␣
↳block7a_activation[0]...			
(Multiply)			␣
↳block7a_se_expand[0] [...]			
block7a_project_conv	(None, 8, 8, 640)	1,474,560	␣
↳block7a_se_excite[0] [...]			
(Conv2D)			␣
↳			
block7a_project_bn	(None, 8, 8, 640)	2,560	␣
↳block7a_project_conv[...]			
(BatchNormalization)			␣
↳			
block7b_expand_conv	(None, 8, 8, 3840)	2,457,600	␣
↳block7a_project_bn[0]...			
(Conv2D)			␣
↳			
block7b_expand_bn	(None, 8, 8, 3840)	15,360	␣
↳block7b_expand_conv[0...]			
(BatchNormalization)			␣
↳			
block7b_expand_activation	(None, 8, 8, 3840)	0	␣
↳block7b_expand_bn[0] [...]			
(Activation)			␣
↳			
block7b_dwconv	(None, 8, 8, 3840)	34,560	␣
↳block7b_expand_activa...			
(DepthwiseConv2D)			␣
↳			

block7b_bn ↳block7b_dwconv[0][0] (BatchNormalization)	(None, 8, 8, 3840)	15,360	↳
block7b_activation ↳block7b_bn[0][0] (Activation)	(None, 8, 8, 3840)	0	↳
block7b_se_squeeze ↳block7b_activation[0]... (GlobalAveragePooling2D)	(None, 3840)	0	↳
block7b_se_reshape ↳block7b_se_squeeze[0]... (Reshape)	(None, 1, 1, 3840)	0	↳
block7b_se_reduce ↳block7b_se_reshape[0]... (Conv2D)	(None, 1, 1, 160)	614,560	↳
block7b_se_expand ↳block7b_se_reduce[0][...] (Conv2D)	(None, 1, 1, 3840)	618,240	↳
block7b_se_excite ↳block7b_activation[0]... (Multiply) ↳block7b_se_expand[0][...]	(None, 8, 8, 3840)	0	↳
block7b_project_conv ↳block7b_se_excite[0][...] (Conv2D)	(None, 8, 8, 640)	2,457,600	↳
block7b_project_bn ↳block7b_project_conv[...] (BatchNormalization)	(None, 8, 8, 640)	2,560	↳

block7b_drop	(None, 8, 8, 640)	0	┐
↳block7b_project_bn[0]...			
(FixedDropout)			┐
↳			
block7b_add (Add)	(None, 8, 8, 640)	0	┐
↳block7b_drop[0][0],			
			┐
↳block7a_project_bn[0]...			
block7c_expand_conv	(None, 8, 8, 3840)	2,457,600	┐
↳block7b_add[0][0]			
(Conv2D)			┐
↳			
block7c_expand_bn	(None, 8, 8, 3840)	15,360	┐
↳block7c_expand_conv[0]...			
(BatchNormalization)			┐
↳			
block7c_expand_activation	(None, 8, 8, 3840)	0	┐
↳block7c_expand_bn[0][...]...			
(Activation)			┐
↳			
block7c_dwconv	(None, 8, 8, 3840)	34,560	┐
↳block7c_expand_activa...			
(DepthwiseConv2D)			┐
↳			
block7c_bn	(None, 8, 8, 3840)	15,360	┐
↳block7c_dwconv[0][0]			
(BatchNormalization)			┐
↳			
block7c_activation	(None, 8, 8, 3840)	0	┐
↳block7c_bn[0][0]			
(Activation)			┐
↳			
block7c_se_squeeze	(None, 3840)	0	┐
↳block7c_activation[0]...			
(GlobalAveragePooling2D)			┐
↳			

block7c_se_reshape	(None, 1, 1, 3840)	0	┐
↳block7c_se_squeeze[0]...			
(Reshape)			┐
↳			
block7c_se_reduce	(None, 1, 1, 160)	614,560	┐
↳block7c_se_reshape[0]...			
(Conv2D)			┐
↳			
block7c_se_expand	(None, 1, 1, 3840)	618,240	┐
↳block7c_se_reduce[0] [...]			
(Conv2D)			┐
↳			
block7c_se_excite	(None, 8, 8, 3840)	0	┐
↳block7c_activation[0]...			
(Multiply)			┐
↳block7c_se_expand[0] [...]			
block7c_project_conv	(None, 8, 8, 640)	2,457,600	┐
↳block7c_se_excite[0] [...]			
(Conv2D)			┐
↳			
block7c_project_bn	(None, 8, 8, 640)	2,560	┐
↳block7c_project_conv[...]			
(BatchNormalization)			┐
↳			
block7c_drop	(None, 8, 8, 640)	0	┐
↳block7c_project_bn[0]...			
(FixedDropout)			┐
↳			
block7c_add (Add)	(None, 8, 8, 640)	0	┐
↳block7c_drop[0][0],			
			┐
↳block7b_add[0][0]			
block7d_expand_conv	(None, 8, 8, 3840)	2,457,600	┐
↳block7c_add[0][0]			
(Conv2D)			┐
↳			

block7d_expand_bn ↳block7d_expand_conv[0... (BatchNormalization)	(None, 8, 8, 3840)	15,360	↳
block7d_expand_activation ↳block7d_expand_bn[0][... (Activation)	(None, 8, 8, 3840)	0	↳
block7d_dwconv ↳block7d_expand_activa... (DepthwiseConv2D)	(None, 8, 8, 3840)	34,560	↳
block7d_bn ↳block7d_dwconv[0][0] (BatchNormalization)	(None, 8, 8, 3840)	15,360	↳
block7d_activation ↳block7d_bn[0][0] (Activation)	(None, 8, 8, 3840)	0	↳
block7d_se_squeeze ↳block7d_activation[0]... (GlobalAveragePooling2D)	(None, 3840)	0	↳
block7d_se_reshape ↳block7d_se_squeeze[0]... (Reshape)	(None, 1, 1, 3840)	0	↳
block7d_se_reduce ↳block7d_se_reshape[0]... (Conv2D)	(None, 1, 1, 160)	614,560	↳
block7d_se_expand ↳block7d_se_reduce[0][... (Conv2D)	(None, 1, 1, 3840)	618,240	↳

block7d_se_excite	(None, 8, 8, 3840)	0	┐
↳block7d_activation[0]...			
(Multiply)			┐
↳block7d_se_expand[0] [...			
block7d_project_conv	(None, 8, 8, 640)	2,457,600	┐
↳block7d_se_excite[0] [...			
(Conv2D)			┐
↳			
block7d_project_bn	(None, 8, 8, 640)	2,560	┐
↳block7d_project_conv[...			
(BatchNormalization)			┐
↳			
block7d_drop	(None, 8, 8, 640)	0	┐
↳block7d_project_bn[0]...			
(FixedDropout)			┐
↳			
block7d_add (Add)	(None, 8, 8, 640)	0	┐
↳block7d_drop[0][0],			
			┐
↳block7c_add[0][0]			
top_conv (Conv2D)	(None, 8, 8, 2560)	1,638,400	┐
↳block7d_add[0][0]			
top_bn	(None, 8, 8, 2560)	10,240	┐
↳top_conv[0][0]			
(BatchNormalization)			┐
↳			
top_activation	(None, 8, 8, 2560)	0	┐
↳top_bn[0][0]			
(Activation)			┐
↳			
decoder_stage0_upsampling	(None, 16, 16, 2560)	0	┐
↳top_activation[0][0]			
(UpSampling2D)			┐
↳			
decoder_stage0_concat	(None, 16, 16, 3904)	0	┐
↳decoder_stage0_upsamp...			

(Concatenate)			└
↳block6a_expand_activa...			
decoder_stage0a_conv	(None, 16, 16, 256)	8,994,816	└
↳decoder_stage0_concat...			
(Conv2D)			└
↳			
decoder_stage0a_bn	(None, 16, 16, 256)	1,024	└
↳decoder_stage0a_conv[...			
(BatchNormalization)			└
↳			
decoder_stage0a_relu	(None, 16, 16, 256)	0	└
↳decoder_stage0a_bn[0]...			
(Activation)			└
↳			
decoder_stage0b_conv	(None, 16, 16, 256)	589,824	└
↳decoder_stage0a_relu[...			
(Conv2D)			└
↳			
decoder_stage0b_bn	(None, 16, 16, 256)	1,024	└
↳decoder_stage0b_conv[...			
(BatchNormalization)			└
↳			
decoder_stage0b_relu	(None, 16, 16, 256)	0	└
↳decoder_stage0b_bn[0]...			
(Activation)			└
↳			
decoder_stage1_upsampling	(None, 32, 32, 256)	0	└
↳decoder_stage0b_relu[...			
(UpSampling2D)			└
↳			
decoder_stage1_concat	(None, 32, 32, 736)	0	└
↳decoder_stage1_upsamp...			
(Concatenate)			└
↳block4a_expand_activa...			
decoder_stage1a_conv	(None, 32, 32, 128)	847,872	└
↳decoder_stage1_concat...			

(Conv2D)			└
↪			
decoder_stage1a_bn	(None, 32, 32, 128)	512	└
↪decoder_stage1a_conv[...]			
(BatchNormalization)			└
↪			
decoder_stage1a_relu	(None, 32, 32, 128)	0	└
↪decoder_stage1a_bn[0]...			
(Activation)			└
↪			
decoder_stage1b_conv	(None, 32, 32, 128)	147,456	└
↪decoder_stage1a_relu[...]			
(Conv2D)			└
↪			
decoder_stage1b_bn	(None, 32, 32, 128)	512	└
↪decoder_stage1b_conv[...]			
(BatchNormalization)			└
↪			
decoder_stage1b_relu	(None, 32, 32, 128)	0	└
↪decoder_stage1b_bn[0]...			
(Activation)			└
↪			
decoder_stage2_upsampling	(None, 64, 64, 128)	0	└
↪decoder_stage1b_relu[...]			
(UpSampling2D)			└
↪			
decoder_stage2_concat	(None, 64, 64, 416)	0	└
↪decoder_stage2_upsamp...			
(Concatenate)			└
↪block3a_expand_activa...			
decoder_stage2a_conv	(None, 64, 64, 64)	239,616	└
↪decoder_stage2_concat...			
(Conv2D)			└
↪			
decoder_stage2a_bn	(None, 64, 64, 64)	256	└
↪decoder_stage2a_conv[...]			

(BatchNormalization)			┐
↪			
decoder_stage2a_relu	(None, 64, 64, 64)	0	┐
↪decoder_stage2a_bn[0]...			
(Activation)			┐
↪			
decoder_stage2b_conv	(None, 64, 64, 64)	36,864	┐
↪decoder_stage2a_relu[...			
(Conv2D)			┐
↪			
decoder_stage2b_bn	(None, 64, 64, 64)	256	┐
↪decoder_stage2b_conv[...			
(BatchNormalization)			┐
↪			
decoder_stage2b_relu	(None, 64, 64, 64)	0	┐
↪decoder_stage2b_bn[0]...			
(Activation)			┐
↪			
decoder_stage3_upsampling	(None, 128, 128, 64)	0	┐
↪decoder_stage2b_relu[...			
(UpSampling2D)			┐
↪			
decoder_stage3_concat	(None, 128, 128, 256)	0	┐
↪decoder_stage3_upsamp...			
(Concatenate)			┐
↪block2a_expand_activa...			
decoder_stage3a_conv	(None, 128, 128, 32)	73,728	┐
↪decoder_stage3_concat...			
(Conv2D)			┐
↪			
decoder_stage3a_bn	(None, 128, 128, 32)	128	┐
↪decoder_stage3a_conv[...			
(BatchNormalization)			┐
↪			
decoder_stage3a_relu	(None, 128, 128, 32)	0	┐
↪decoder_stage3a_bn[0]...			

(Activation)			└
↪			
decoder_stage3b_conv	(None, 128, 128, 32)	9,216	└
↪decoder_stage3a_relu[...]			
(Conv2D)			└
↪			
decoder_stage3b_bn	(None, 128, 128, 32)	128	└
↪decoder_stage3b_conv[...]			
(BatchNormalization)			└
↪			
decoder_stage3b_relu	(None, 128, 128, 32)	0	└
↪decoder_stage3b_bn[0]...			
(Activation)			└
↪			
decoder_stage4_upsampling	(None, 256, 256, 32)	0	└
↪decoder_stage3b_relu[...]			
(UpSampling2D)			└
↪			
decoder_stage4a_conv	(None, 256, 256, 16)	4,608	└
↪decoder_stage4_upsamp...			
(Conv2D)			└
↪			
decoder_stage4a_bn	(None, 256, 256, 16)	64	└
↪decoder_stage4a_conv[...]			
(BatchNormalization)			└
↪			
decoder_stage4a_relu	(None, 256, 256, 16)	0	└
↪decoder_stage4a_bn[0]...			
(Activation)			└
↪			
decoder_stage4b_conv	(None, 256, 256, 16)	2,304	└
↪decoder_stage4a_relu[...]			
(Conv2D)			└
↪			
decoder_stage4b_bn	(None, 256, 256, 16)	64	└
↪decoder_stage4b_conv[...]			

```

(BatchNormalization)
↳

decoder_stage4b_relu      (None, 256, 256, 16)      0
↳decoder_stage4b_bn[0]...
(Activation)
↳

final_conv (Conv2D)      (None, 256, 256, 1)      145
↳decoder_stage4b_relu[...]

sigmoid (Activation)      (None, 256, 256, 1)      0
↳final_conv[0][0]

```

Total params: 75,048,097 (286.29 MB)

Trainable params: 74,735,393 (285.09 MB)

Non-trainable params: 312,704 (1.19 MB)

```

[22]: # Compile
model.compile(
    optimizer='adam',
    loss=sm.losses.bce_dice_loss,
    metrics=['accuracy', sm.metrics.iou_score]
)

# Callbacks
checkpoint_cb = ModelCheckpoint(
    'best_model_pred.keras',
    save_best_only=True,
    monitor='val_loss',
    mode='min',
    verbose=1
)

early_stopping_cb = EarlyStopping(
    monitor='val_loss',
    patience=5,
    mode='min',
    restore_best_weights=True,
    verbose=1
)

```

```

history = model.fit(
    train_gen,
    validation_data=val_gen,
    epochs=20,
    callbacks=[checkpoint_cb, early_stopping_cb]
)

```

Epoch 1/20

```

E0000 00:00:1751654260.808718      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
E0000 00:00:1751654261.045324      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
E0000 00:00:1751654261.843612      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
E0000 00:00:1751654262.049524      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
E0000 00:00:1751654262.692961      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
E0000 00:00:1751654262.899131      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
E0000 00:00:1751654263.301770      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
E0000 00:00:1751654263.507871      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
E0000 00:00:1751654264.089993      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
E0000 00:00:1751654264.318934      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
E0000 00:00:1751654265.064953      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
E0000 00:00:1751654265.330364      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
E0000 00:00:1751654265.863753      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.

```



```

E0000 00:00:1751654266.129041      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
E0000 00:00:1751654266.962289      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
E0000 00:00:1751654267.303378      67 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
2025-07-04 18:37:50.256142: E
external/local_xla/xla/service/slow_operation_alarm.cc:65] Trying algorithm
eng0{} for conv (f32[128,736,3,3]{3,2,1,0}, u8[0]{0}) custom-
call(f32[32,736,32,32]{3,2,1,0}, f32[32,128,32,32]{3,2,1,0}), window={size=3x3
pad=1_1x1_1}, dim_labels=bf01_oi01->bf01,
custom_call_target="__cudnn$convBackwardFilter", backend_config={"cudnn_conv_bac
kend_config":{"activation_mode":"kNone","conv_result_scale":1,"leakyrelu_alpha":
0,"side_input_scale":0},"force_earliest_schedule":false,"operation_queue_id":"0"
,"wait_on_operation_queues":[]}} is taking a while...
2025-07-04 18:37:50.312475: E
external/local_xla/xla/service/slow_operation_alarm.cc:133] The operation took
1.056463163s
Trying algorithm eng0{} for conv (f32[128,736,3,3]{3,2,1,0}, u8[0]{0}) custom-
call(f32[32,736,32,32]{3,2,1,0}, f32[32,128,32,32]{3,2,1,0}), window={size=3x3
pad=1_1x1_1}, dim_labels=bf01_oi01->bf01,
custom_call_target="__cudnn$convBackwardFilter", backend_config={"cudnn_conv_bac
kend_config":{"activation_mode":"kNone","conv_result_scale":1,"leakyrelu_alpha":
0,"side_input_scale":0},"force_earliest_schedule":false,"operation_queue_id":"0"
,"wait_on_operation_queues":[]}} is taking a while...
2025-07-04 18:37:52.161416: E
external/local_xla/xla/service/slow_operation_alarm.cc:65] Trying algorithm
eng0{} for conv (f32[64,416,3,3]{3,2,1,0}, u8[0]{0}) custom-
call(f32[32,416,64,64]{3,2,1,0}, f32[32,64,64,64]{3,2,1,0}), window={size=3x3
pad=1_1x1_1}, dim_labels=bf01_oi01->bf01,
custom_call_target="__cudnn$convBackwardFilter", backend_config={"cudnn_conv_bac
kend_config":{"activation_mode":"kNone","conv_result_scale":1,"leakyrelu_alpha":
0,"side_input_scale":0},"force_earliest_schedule":false,"operation_queue_id":"0"
,"wait_on_operation_queues":[]}} is taking a while...
2025-07-04 18:37:52.361458: E
external/local_xla/xla/service/slow_operation_alarm.cc:133] The operation took
1.200161829s
Trying algorithm eng0{} for conv (f32[64,416,3,3]{3,2,1,0}, u8[0]{0}) custom-
call(f32[32,416,64,64]{3,2,1,0}, f32[32,64,64,64]{3,2,1,0}), window={size=3x3
pad=1_1x1_1}, dim_labels=bf01_oi01->bf01,
custom_call_target="__cudnn$convBackwardFilter", backend_config={"cudnn_conv_bac
kend_config":{"activation_mode":"kNone","conv_result_scale":1,"leakyrelu_alpha":
0,"side_input_scale":0},"force_earliest_schedule":false,"operation_queue_id":"0"
,"wait_on_operation_queues":[]}} is taking a while...

```

42/58 15s 983ms/step -
accuracy: 0.9360 - iou_score: 0.1414 - loss: 1.0296

E0000 00:00:1751654422.798131 68 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.

E0000 00:00:1751654422.992488 68 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.

E0000 00:00:1751654423.526049 68 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.

E0000 00:00:1751654423.726637 68 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.

E0000 00:00:1751654424.104287 68 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.

E0000 00:00:1751654424.325885 68 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.

E0000 00:00:1751654424.939342 68 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.

E0000 00:00:1751654425.199524 68 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.

58/58 0s 3s/step -
accuracy: 0.9466 - iou_score: 0.1842 - loss: 0.9392
Epoch 1: val_loss improved from inf to 6.51061, saving model to
best_model_pred.keras

58/58 525s 4s/step -
accuracy: 0.9471 - iou_score: 0.1867 - loss: 0.9343 - val_accuracy: 0.2343 -
val_iou_score: 0.0370 - val_loss: 6.5106
Epoch 2/20

58/58 0s 972ms/step -
accuracy: 0.9916 - iou_score: 0.6746 - loss: 0.2290
Epoch 2: val_loss improved from 6.51061 to 6.15699, saving model to
best_model_pred.keras

58/58 66s 1s/step -
accuracy: 0.9916 - iou_score: 0.6749 - loss: 0.2287 - val_accuracy: 0.3877 -
val_iou_score: 0.0461 - val_loss: 6.1570
Epoch 3/20

58/58 0s 973ms/step -
accuracy: 0.9929 - iou_score: 0.7615 - loss: 0.1621
Epoch 3: val_loss improved from 6.15699 to 1.21632, saving model to
best_model_pred.keras

58/58 66s 1s/step -

accuracy: 0.9929 - iou_score: 0.7616 - loss: 0.1621 - val_accuracy: 0.8456 -
 val_iou_score: 0.1585 - val_loss: 1.2163
 Epoch 4/20
 58/58 0s 970ms/step -
 accuracy: 0.9937 - iou_score: 0.8039 - loss: 0.1335
 Epoch 4: val_loss improved from 1.21632 to 0.24060, saving model to
 best_model_pred.keras
 58/58 66s 1s/step -
 accuracy: 0.9937 - iou_score: 0.8039 - loss: 0.1335 - val_accuracy: 0.9890 -
 val_iou_score: 0.6798 - val_loss: 0.2406
 Epoch 5/20
 58/58 0s 972ms/step -
 accuracy: 0.9927 - iou_score: 0.7690 - loss: 0.1601
 Epoch 5: val_loss did not improve from 0.24060
 58/58 60s 1s/step -
 accuracy: 0.9927 - iou_score: 0.7690 - loss: 0.1601 - val_accuracy: 0.9387 -
 val_iou_score: 0.3108 - val_loss: 0.7869
 Epoch 6/20
 58/58 0s 972ms/step -
 accuracy: 0.9936 - iou_score: 0.8087 - loss: 0.1295
 Epoch 6: val_loss did not improve from 0.24060
 58/58 60s 1s/step -
 accuracy: 0.9936 - iou_score: 0.8088 - loss: 0.1295 - val_accuracy: 0.9820 -
 val_iou_score: 0.5779 - val_loss: 0.3614
 Epoch 7/20
 58/58 0s 970ms/step -
 accuracy: 0.9936 - iou_score: 0.8073 - loss: 0.1273
 Epoch 7: val_loss did not improve from 0.24060
 58/58 60s 1s/step -
 accuracy: 0.9936 - iou_score: 0.8073 - loss: 0.1274 - val_accuracy: 0.9825 -
 val_iou_score: 0.5639 - val_loss: 0.3485
 Epoch 8/20
 58/58 0s 972ms/step -
 accuracy: 0.9946 - iou_score: 0.8265 - loss: 0.1169
 Epoch 8: val_loss improved from 0.24060 to 0.17754, saving model to
 best_model_pred.keras
 58/58 66s 1s/step -
 accuracy: 0.9946 - iou_score: 0.8267 - loss: 0.1168 - val_accuracy: 0.9918 -
 val_iou_score: 0.7733 - val_loss: 0.1775
 Epoch 9/20
 58/58 0s 971ms/step -
 accuracy: 0.9946 - iou_score: 0.8444 - loss: 0.1048
 Epoch 9: val_loss improved from 0.17754 to 0.15589, saving model to
 best_model_pred.keras
 58/58 66s 1s/step -
 accuracy: 0.9946 - iou_score: 0.8444 - loss: 0.1048 - val_accuracy: 0.9929 -
 val_iou_score: 0.7919 - val_loss: 0.1559
 Epoch 10/20

```

58/58          0s 971ms/step -
accuracy: 0.9949 - iou_score: 0.8543 - loss: 0.0966
Epoch 10: val_loss improved from 0.15589 to 0.12645, saving model to
best_model_pred.keras
58/58          66s 1s/step -
accuracy: 0.9949 - iou_score: 0.8543 - loss: 0.0966 - val_accuracy: 0.9942 -
val_iou_score: 0.8219 - val_loss: 0.1264
Epoch 11/20
58/58          0s 970ms/step -
accuracy: 0.9950 - iou_score: 0.8573 - loss: 0.0941
Epoch 11: val_loss did not improve from 0.12645
58/58          60s 1s/step -
accuracy: 0.9950 - iou_score: 0.8573 - loss: 0.0941 - val_accuracy: 0.9926 -
val_iou_score: 0.7943 - val_loss: 0.1516
Epoch 12/20
58/58          0s 972ms/step -
accuracy: 0.9953 - iou_score: 0.8586 - loss: 0.0931
Epoch 12: val_loss improved from 0.12645 to 0.11634, saving model to
best_model_pred.keras
58/58          66s 1s/step -
accuracy: 0.9953 - iou_score: 0.8585 - loss: 0.0932 - val_accuracy: 0.9944 -
val_iou_score: 0.8302 - val_loss: 0.1163
Epoch 13/20
58/58          0s 971ms/step -
accuracy: 0.9952 - iou_score: 0.8593 - loss: 0.0924
Epoch 13: val_loss did not improve from 0.11634
58/58          60s 1s/step -
accuracy: 0.9952 - iou_score: 0.8591 - loss: 0.0926 - val_accuracy: 0.9870 -
val_iou_score: 0.6481 - val_loss: 0.2698
Epoch 14/20
58/58          0s 971ms/step -
accuracy: 0.9951 - iou_score: 0.8554 - loss: 0.0953
Epoch 14: val_loss did not improve from 0.11634
58/58          60s 1s/step -
accuracy: 0.9951 - iou_score: 0.8554 - loss: 0.0953 - val_accuracy: 0.9935 -
val_iou_score: 0.8099 - val_loss: 0.1410
Epoch 15/20
58/58          0s 972ms/step -
accuracy: 0.9950 - iou_score: 0.8614 - loss: 0.0923
Epoch 15: val_loss did not improve from 0.11634
58/58          60s 1s/step -
accuracy: 0.9950 - iou_score: 0.8613 - loss: 0.0924 - val_accuracy: 0.9941 -
val_iou_score: 0.8173 - val_loss: 0.1325
Epoch 16/20
58/58          0s 970ms/step -
accuracy: 0.9953 - iou_score: 0.8673 - loss: 0.0871
Epoch 16: val_loss did not improve from 0.11634
58/58          60s 1s/step -

```

```

accuracy: 0.9953 - iou_score: 0.8673 - loss: 0.0871 - val_accuracy: 0.9937 -
val_iou_score: 0.7955 - val_loss: 0.1460
Epoch 17/20
58/58          0s 970ms/step -
accuracy: 0.9953 - iou_score: 0.8688 - loss: 0.0865
Epoch 17: val_loss did not improve from 0.11634
58/58          60s 1s/step -
accuracy: 0.9953 - iou_score: 0.8687 - loss: 0.0865 - val_accuracy: 0.9916 -
val_iou_score: 0.7266 - val_loss: 0.2225
Epoch 17: early stopping
Restoring model weights from the end of the best epoch: 12.

```

```
[23]: pd.DataFrame(history.history)
```

```
[23]:
```

	accuracy	iou_score	loss	val_accuracy	val_iou_score	val_loss
0	0.976286	0.333117	0.649955	0.234272	0.037025	6.510610
1	0.991509	0.696750	0.212298	0.387707	0.046097	6.156987
2	0.992848	0.767692	0.157154	0.845646	0.158456	1.216320
3	0.993758	0.804220	0.130933	0.989004	0.679768	0.240598
4	0.992446	0.773231	0.159281	0.938655	0.310782	0.786904
5	0.993668	0.810152	0.130025	0.981972	0.577916	0.361366
6	0.993545	0.807237	0.129812	0.982520	0.563938	0.348526
7	0.994483	0.835116	0.110995	0.991821	0.773291	0.177537
8	0.994556	0.840724	0.106807	0.992930	0.791892	0.155892
9	0.995059	0.854348	0.096336	0.994176	0.821913	0.126449
10	0.995053	0.855617	0.095257	0.992642	0.794256	0.151603
11	0.995083	0.856058	0.095795	0.994444	0.830246	0.116336
12	0.994827	0.849274	0.100201	0.987034	0.648133	0.269842
13	0.995061	0.854069	0.096112	0.993474	0.809863	0.141015
14	0.995080	0.857144	0.094991	0.994056	0.817271	0.132495
15	0.995415	0.867870	0.087207	0.993748	0.795499	0.146045
16	0.995253	0.862819	0.090621	0.991556	0.726599	0.222465

```
[24]: fig, ax = plt.subplots(1, 3, figsize=(15, 4))

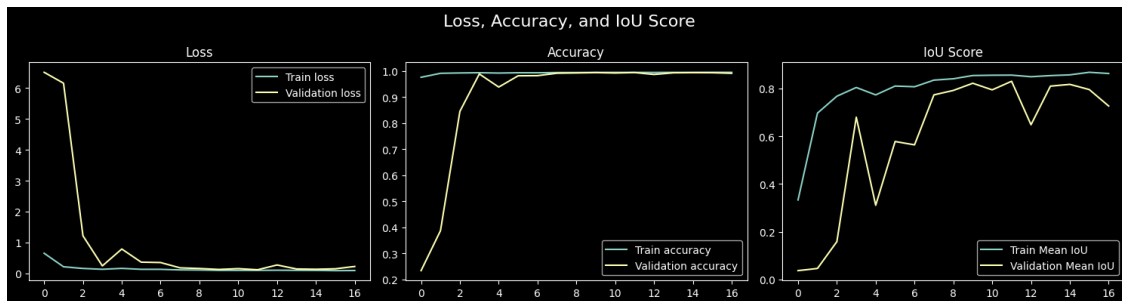
# Plot Loss
ax[0].plot(history.epoch, history.history["loss"], label="Train loss")
ax[0].plot(history.epoch, history.history["val_loss"], label="Validation loss")
ax[0].set_title("Loss")
ax[0].legend()

# Plot Accuracy
ax[1].plot(history.epoch, history.history["accuracy"], label="Train accuracy")
ax[1].plot(history.epoch, history.history["val_accuracy"], label="Validation_
↪accuracy")
ax[1].set_title("Accuracy")
ax[1].legend()

```

```
# Plot Mean IoU
ax[2].plot(history.epoch, history.history["iou_score"], label="Train Mean IoU")
ax[2].plot(history.epoch, history.history["val_iou_score"], label="Validation_
↪Mean IoU")
ax[2].set_title("IoU Score")
ax[2].legend()

fig.suptitle('Loss, Accuracy, and IoU Score', fontsize=16)
plt.tight_layout()
plt.show()
```



**

Evaluation

Tabel of Contents

```
[25]: model = tf.keras.models.load_model(
        "/kaggle/working/best_model_pred.keras",
        compile=False
    )
    model.compile(
        optimizer='adam',
        loss=sm.losses.bce_dice_loss,
        metrics=['accuracy', sm.metrics.iou_score]
    )
```

```
[26]: results = model.evaluate(test_gen, verbose=-1)
    for name, value in zip(["Test Loss", "Test Accuracy", "Test IOU Score"], results):
        print(f"{name}: {value:.4f}")
```

```
E0000 00:00:1751655602.711357      68 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
E0000 00:00:1751655602.950368      68 gpu_timer.cc:82] Delay kernel timed out:
measured time has sub-optimal accuracy. There may be a missing warmup execution,
please investigate in Nsight Systems.
```

Test Loss: 0.1049
Test Accuracy: 0.9945
Test IOU Score: 0.8457

```
[27]: # Predict masks for the test set using the model  
      preds = model.predict(test_gen, verbose=1)  
      # Apply threshold for binary masks  
      preds_bin = (preds > 0.5).astype(np.float32)
```

12/12 38s 2s/step

```
[28]: display_predictions(test_gen, preds_bin, n_samples = 4)
```

