###Model 1

metrics = [sm.metrics.IOUScore(threshold=0.5), sm.metrics.FScore(threshold=0.5)]

#Reused parameters in all models

n\_classes=1

activation='sigmoid'

LR = 0.0001

optim = tf.keras.optimizers.Adam(LR)

BACKBONE1 = 'resnet34'

preprocess\_input1 = sm.get\_preprocessing(BACKBONE1)

#ResNet18, preprocess\_input = Classifiers.get('resnet18')

#resnet = ResNet18((224, 224, 3), include\_top=False)

#preprocess\_input1 = resnet

# preprocess input

X\_train1 = preprocess\_input1(X1)

X\_test1 = preprocess\_input1(X\_test)

# define model

model1 = sm.Unet(BACKBONE1, encoder\_weights='imagenet', classes=n\_classes, activation=activation)

# compile keras model with defined optimozer, loss and metrics

model1.compile(optim, loss='binary\_crossentropy', metrics=metrics)

print(model1.summary())

history1=model1.fit(X1,

y1,

batch\_size=8,

epochs=50,

verbose=1,

validation\_data=(X\_test, y\_test))

MODEL SUMMARY

Downloading data from<https://github.com/qubvel/classification_models/releases/download/0.0.1/resnet34_imagenet_1000_no_top.h5>

85524480/85521592 [==============================] - 2s 0us/step

85532672/85521592 [==============================] - 2s 0us/step

Model: "model\_1"

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Layer (type) Output Shape Param # Connected to

==================================================================================================

data (InputLayer) [(None, None, None, 0 []

3)]

bn\_data (BatchNormalization) (None, None, None, 9 ['data[0][0]']

3)

zero\_padding2d (ZeroPadding2D) (None, None, None, 0 ['bn\_data[0][0]']

3)

conv0 (Conv2D) (None, None, None, 9408 ['zero\_padding2d[0][0]']

64)

bn0 (BatchNormalization) (None, None, None, 256 ['conv0[0][0]']

64)

relu0 (Activation) (None, None, None, 0 ['bn0[0][0]']

64)

zero\_padding2d\_1 (ZeroPadding2 (None, None, None, 0 ['relu0[0][0]']

D) 64)

pooling0 (MaxPooling2D) (None, None, None, 0 ['zero\_padding2d\_1[0][0]']

64)

stage1\_unit1\_bn1 (BatchNormali (None, None, None, 256 ['pooling0[0][0]']

zation) 64)

stage1\_unit1\_relu1 (Activation (None, None, None, 0 ['stage1\_unit1\_bn1[0][0]']

) 64)

zero\_padding2d\_2 (ZeroPadding2 (None, None, None, 0 ['stage1\_unit1\_relu1[0][0]']

D) 64)

stage1\_unit1\_conv1 (Conv2D) (None, None, None, 36864 ['zero\_padding2d\_2[0][0]']

64)

stage1\_unit1\_bn2 (BatchNormali (None, None, None, 256 ['stage1\_unit1\_conv1[0][0]']

zation) 64)

stage1\_unit1\_relu2 (Activation (None, None, None, 0 ['stage1\_unit1\_bn2[0][0]']

) 64)

zero\_padding2d\_3 (ZeroPadding2 (None, None, None, 0 ['stage1\_unit1\_relu2[0][0]']

D) 64)

stage1\_unit1\_conv2 (Conv2D) (None, None, None, 36864 ['zero\_padding2d\_3[0][0]']

64)

stage1\_unit1\_sc (Conv2D) (None, None, None, 4096 ['stage1\_unit1\_relu1[0][0]']

64)

add (Add) (None, None, None, 0 ['stage1\_unit1\_conv2[0][0]',

64) 'stage1\_unit1\_sc[0][0]']

stage1\_unit2\_bn1 (BatchNormali (None, None, None, 256 ['add[0][0]']

zation) 64)

stage1\_unit2\_relu1 (Activation (None, None, None, 0 ['stage1\_unit2\_bn1[0][0]']

) 64)

zero\_padding2d\_4 (ZeroPadding2 (None, None, None, 0 ['stage1\_unit2\_relu1[0][0]']

D) 64)

stage1\_unit2\_conv1 (Conv2D) (None, None, None, 36864 ['zero\_padding2d\_4[0][0]']

64)

stage1\_unit2\_bn2 (BatchNormali (None, None, None, 256 ['stage1\_unit2\_conv1[0][0]']

zation) 64)

stage1\_unit2\_relu2 (Activation (None, None, None, 0 ['stage1\_unit2\_bn2[0][0]']

) 64)

zero\_padding2d\_5 (ZeroPadding2 (None, None, None, 0 ['stage1\_unit2\_relu2[0][0]']

D) 64)

stage1\_unit2\_conv2 (Conv2D) (None, None, None, 36864 ['zero\_padding2d\_5[0][0]']

64)

add\_1 (Add) (None, None, None, 0 ['stage1\_unit2\_conv2[0][0]',

64) 'add[0][0]']

stage1\_unit3\_bn1 (BatchNormali (None, None, None, 256 ['add\_1[0][0]']

zation) 64)

stage1\_unit3\_relu1 (Activation (None, None, None, 0 ['stage1\_unit3\_bn1[0][0]']

) 64)

zero\_padding2d\_6 (ZeroPadding2 (None, None, None, 0 ['stage1\_unit3\_relu1[0][0]']

D) 64)

stage1\_unit3\_conv1 (Conv2D) (None, None, None, 36864 ['zero\_padding2d\_6[0][0]']

64)

stage1\_unit3\_bn2 (BatchNormali (None, None, None, 256 ['stage1\_unit3\_conv1[0][0]']

zation) 64)

stage1\_unit3\_relu2 (Activation (None, None, None, 0 ['stage1\_unit3\_bn2[0][0]']

) 64)

zero\_padding2d\_7 (ZeroPadding2 (None, None, None, 0 ['stage1\_unit3\_relu2[0][0]']

D) 64)

stage1\_unit3\_conv2 (Conv2D) (None, None, None, 36864 ['zero\_padding2d\_7[0][0]']

64)

add\_2 (Add) (None, None, None, 0 ['stage1\_unit3\_conv2[0][0]',

64) 'add\_1[0][0]']

stage2\_unit1\_bn1 (BatchNormali (None, None, None, 256 ['add\_2[0][0]']

zation) 64)

stage2\_unit1\_relu1 (Activation (None, None, None, 0 ['stage2\_unit1\_bn1[0][0]']

) 64)

zero\_padding2d\_8 (ZeroPadding2 (None, None, None, 0 ['stage2\_unit1\_relu1[0][0]']

D) 64)

stage2\_unit1\_conv1 (Conv2D) (None, None, None, 73728 ['zero\_padding2d\_8[0][0]']

128)

stage2\_unit1\_bn2 (BatchNormali (None, None, None, 512 ['stage2\_unit1\_conv1[0][0]']

zation) 128)

stage2\_unit1\_relu2 (Activation (None, None, None, 0 ['stage2\_unit1\_bn2[0][0]']

) 128)

zero\_padding2d\_9 (ZeroPadding2 (None, None, None, 0 ['stage2\_unit1\_relu2[0][0]']

D) 128)

stage2\_unit1\_conv2 (Conv2D) (None, None, None, 147456 ['zero\_padding2d\_9[0][0]']

128)

stage2\_unit1\_sc (Conv2D) (None, None, None, 8192 ['stage2\_unit1\_relu1[0][0]']

128)

add\_3 (Add) (None, None, None, 0 ['stage2\_unit1\_conv2[0][0]',

128) 'stage2\_unit1\_sc[0][0]']

stage2\_unit2\_bn1 (BatchNormali (None, None, None, 512 ['add\_3[0][0]']

zation) 128)

stage2\_unit2\_relu1 (Activation (None, None, None, 0 ['stage2\_unit2\_bn1[0][0]']

) 128)

zero\_padding2d\_10 (ZeroPadding (None, None, None, 0 ['stage2\_unit2\_relu1[0][0]']

2D) 128)

stage2\_unit2\_conv1 (Conv2D) (None, None, None, 147456 ['zero\_padding2d\_10[0][0]']

128)

stage2\_unit2\_bn2 (BatchNormali (None, None, None, 512 ['stage2\_unit2\_conv1[0][0]']

zation) 128)

stage2\_unit2\_relu2 (Activation (None, None, None, 0 ['stage2\_unit2\_bn2[0][0]']

) 128)

zero\_padding2d\_11 (ZeroPadding (None, None, None, 0 ['stage2\_unit2\_relu2[0][0]']

2D) 128)

stage2\_unit2\_conv2 (Conv2D) (None, None, None, 147456 ['zero\_padding2d\_11[0][0]']

128)

add\_4 (Add) (None, None, None, 0 ['stage2\_unit2\_conv2[0][0]',

128) 'add\_3[0][0]']

stage2\_unit3\_bn1 (BatchNormali (None, None, None, 512 ['add\_4[0][0]']

zation) 128)

stage2\_unit3\_relu1 (Activation (None, None, None, 0 ['stage2\_unit3\_bn1[0][0]']

) 128)

zero\_padding2d\_12 (ZeroPadding (None, None, None, 0 ['stage2\_unit3\_relu1[0][0]']

2D) 128)

stage2\_unit3\_conv1 (Conv2D) (None, None, None, 147456 ['zero\_padding2d\_12[0][0]']

128)

stage2\_unit3\_bn2 (BatchNormali (None, None, None, 512 ['stage2\_unit3\_conv1[0][0]']

zation) 128)

stage2\_unit3\_relu2 (Activation (None, None, None, 0 ['stage2\_unit3\_bn2[0][0]']

) 128)

zero\_padding2d\_13 (ZeroPadding (None, None, None, 0 ['stage2\_unit3\_relu2[0][0]']

2D) 128)

stage2\_unit3\_conv2 (Conv2D) (None, None, None, 147456 ['zero\_padding2d\_13[0][0]']

128)

add\_5 (Add) (None, None, None, 0 ['stage2\_unit3\_conv2[0][0]',

128) 'add\_4[0][0]']

stage2\_unit4\_bn1 (BatchNormali (None, None, None, 512 ['add\_5[0][0]']

zation) 128)

stage2\_unit4\_relu1 (Activation (None, None, None, 0 ['stage2\_unit4\_bn1[0][0]']

) 128)

zero\_padding2d\_14 (ZeroPadding (None, None, None, 0 ['stage2\_unit4\_relu1[0][0]']

2D) 128)

stage2\_unit4\_conv1 (Conv2D) (None, None, None, 147456 ['zero\_padding2d\_14[0][0]']

128)

stage2\_unit4\_bn2 (BatchNormali (None, None, None, 512 ['stage2\_unit4\_conv1[0][0]']

zation) 128)

stage2\_unit4\_relu2 (Activation (None, None, None, 0 ['stage2\_unit4\_bn2[0][0]']

) 128)

zero\_padding2d\_15 (ZeroPadding (None, None, None, 0 ['stage2\_unit4\_relu2[0][0]']

2D) 128)

stage2\_unit4\_conv2 (Conv2D) (None, None, None, 147456 ['zero\_padding2d\_15[0][0]']

128)

add\_6 (Add) (None, None, None, 0 ['stage2\_unit4\_conv2[0][0]',

128) 'add\_5[0][0]']

stage3\_unit1\_bn1 (BatchNormali (None, None, None, 512 ['add\_6[0][0]']

zation) 128)

stage3\_unit1\_relu1 (Activation (None, None, None, 0 ['stage3\_unit1\_bn1[0][0]']

) 128)

zero\_padding2d\_16 (ZeroPadding (None, None, None, 0 ['stage3\_unit1\_relu1[0][0]']

2D) 128)

stage3\_unit1\_conv1 (Conv2D) (None, None, None, 294912 ['zero\_padding2d\_16[0][0]']

256)

stage3\_unit1\_bn2 (BatchNormali (None, None, None, 1024 ['stage3\_unit1\_conv1[0][0]']

zation) 256)

stage3\_unit1\_relu2 (Activation (None, None, None, 0 ['stage3\_unit1\_bn2[0][0]']

) 256)

zero\_padding2d\_17 (ZeroPadding (None, None, None, 0 ['stage3\_unit1\_relu2[0][0]']

2D) 256)

stage3\_unit1\_conv2 (Conv2D) (None, None, None, 589824 ['zero\_padding2d\_17[0][0]']

256)

stage3\_unit1\_sc (Conv2D) (None, None, None, 32768 ['stage3\_unit1\_relu1[0][0]']

256)

add\_7 (Add) (None, None, None, 0 ['stage3\_unit1\_conv2[0][0]',

256) 'stage3\_unit1\_sc[0][0]']

stage3\_unit2\_bn1 (BatchNormali (None, None, None, 1024 ['add\_7[0][0]']

zation) 256)

stage3\_unit2\_relu1 (Activation (None, None, None, 0 ['stage3\_unit2\_bn1[0][0]']

) 256)

zero\_padding2d\_18 (ZeroPadding (None, None, None, 0 ['stage3\_unit2\_relu1[0][0]']

2D) 256)

stage3\_unit2\_conv1 (Conv2D) (None, None, None, 589824 ['zero\_padding2d\_18[0][0]']

256)

stage3\_unit2\_bn2 (BatchNormali (None, None, None, 1024 ['stage3\_unit2\_conv1[0][0]']

zation) 256)

stage3\_unit2\_relu2 (Activation (None, None, None, 0 ['stage3\_unit2\_bn2[0][0]']

) 256)

zero\_padding2d\_19 (ZeroPadding (None, None, None, 0 ['stage3\_unit2\_relu2[0][0]']

2D) 256)

stage3\_unit2\_conv2 (Conv2D) (None, None, None, 589824 ['zero\_padding2d\_19[0][0]']

256)

add\_8 (Add) (None, None, None, 0 ['stage3\_unit2\_conv2[0][0]',

256) 'add\_7[0][0]']

stage3\_unit3\_bn1 (BatchNormali (None, None, None, 1024 ['add\_8[0][0]']

zation) 256)

stage3\_unit3\_relu1 (Activation (None, None, None, 0 ['stage3\_unit3\_bn1[0][0]']

) 256)

zero\_padding2d\_20 (ZeroPadding (None, None, None, 0 ['stage3\_unit3\_relu1[0][0]']

2D) 256)

stage3\_unit3\_conv1 (Conv2D) (None, None, None, 589824 ['zero\_padding2d\_20[0][0]']

256)

stage3\_unit3\_bn2 (BatchNormali (None, None, None, 1024 ['stage3\_unit3\_conv1[0][0]']

zation) 256)

stage3\_unit3\_relu2 (Activation (None, None, None, 0 ['stage3\_unit3\_bn2[0][0]']

) 256)

zero\_padding2d\_21 (ZeroPadding (None, None, None, 0 ['stage3\_unit3\_relu2[0][0]']

2D) 256)

stage3\_unit3\_conv2 (Conv2D) (None, None, None, 589824 ['zero\_padding2d\_21[0][0]']

256)

add\_9 (Add) (None, None, None, 0 ['stage3\_unit3\_conv2[0][0]',

256) 'add\_8[0][0]']

stage3\_unit4\_bn1 (BatchNormali (None, None, None, 1024 ['add\_9[0][0]']

zation) 256)

stage3\_unit4\_relu1 (Activation (None, None, None, 0 ['stage3\_unit4\_bn1[0][0]']

) 256)

zero\_padding2d\_22 (ZeroPadding (None, None, None, 0 ['stage3\_unit4\_relu1[0][0]']

2D) 256)

stage3\_unit4\_conv1 (Conv2D) (None, None, None, 589824 ['zero\_padding2d\_22[0][0]']

256)

stage3\_unit4\_bn2 (BatchNormali (None, None, None, 1024 ['stage3\_unit4\_conv1[0][0]']

zation) 256)

stage3\_unit4\_relu2 (Activation (None, None, None, 0 ['stage3\_unit4\_bn2[0][0]']

) 256)

zero\_padding2d\_23 (ZeroPadding (None, None, None, 0 ['stage3\_unit4\_relu2[0][0]']

2D) 256)

stage3\_unit4\_conv2 (Conv2D) (None, None, None, 589824 ['zero\_padding2d\_23[0][0]']

256)

add\_10 (Add) (None, None, None, 0 ['stage3\_unit4\_conv2[0][0]',

256) 'add\_9[0][0]']

stage3\_unit5\_bn1 (BatchNormali (None, None, None, 1024 ['add\_10[0][0]']

zation) 256)

stage3\_unit5\_relu1 (Activation (None, None, None, 0 ['stage3\_unit5\_bn1[0][0]']

) 256)

zero\_padding2d\_24 (ZeroPadding (None, None, None, 0 ['stage3\_unit5\_relu1[0][0]']

2D) 256)

stage3\_unit5\_conv1 (Conv2D) (None, None, None, 589824 ['zero\_padding2d\_24[0][0]']

256)

stage3\_unit5\_bn2 (BatchNormali (None, None, None, 1024 ['stage3\_unit5\_conv1[0][0]']

zation) 256)

stage3\_unit5\_relu2 (Activation (None, None, None, 0 ['stage3\_unit5\_bn2[0][0]']

) 256)

zero\_padding2d\_25 (ZeroPadding (None, None, None, 0 ['stage3\_unit5\_relu2[0][0]']

2D) 256)

stage3\_unit5\_conv2 (Conv2D) (None, None, None, 589824 ['zero\_padding2d\_25[0][0]']

256)

add\_11 (Add) (None, None, None, 0 ['stage3\_unit5\_conv2[0][0]',

256) 'add\_10[0][0]']

stage3\_unit6\_bn1 (BatchNormali (None, None, None, 1024 ['add\_11[0][0]']

zation) 256)

stage3\_unit6\_relu1 (Activation (None, None, None, 0 ['stage3\_unit6\_bn1[0][0]']

) 256)

zero\_padding2d\_26 (ZeroPadding (None, None, None, 0 ['stage3\_unit6\_relu1[0][0]']

2D) 256)

stage3\_unit6\_conv1 (Conv2D) (None, None, None, 589824 ['zero\_padding2d\_26[0][0]']

256)

stage3\_unit6\_bn2 (BatchNormali (None, None, None, 1024 ['stage3\_unit6\_conv1[0][0]']

zation) 256)

stage3\_unit6\_relu2 (Activation (None, None, None, 0 ['stage3\_unit6\_bn2[0][0]']

) 256)

zero\_padding2d\_27 (ZeroPadding (None, None, None, 0 ['stage3\_unit6\_relu2[0][0]']

2D) 256)

stage3\_unit6\_conv2 (Conv2D) (None, None, None, 589824 ['zero\_padding2d\_27[0][0]']

256)

add\_12 (Add) (None, None, None, 0 ['stage3\_unit6\_conv2[0][0]',

256) 'add\_11[0][0]']

stage4\_unit1\_bn1 (BatchNormali (None, None, None, 1024 ['add\_12[0][0]']

zation) 256)

stage4\_unit1\_relu1 (Activation (None, None, None, 0 ['stage4\_unit1\_bn1[0][0]']

) 256)

zero\_padding2d\_28 (ZeroPadding (None, None, None, 0 ['stage4\_unit1\_relu1[0][0]']

2D) 256)

stage4\_unit1\_conv1 (Conv2D) (None, None, None, 1179648 ['zero\_padding2d\_28[0][0]']

512)

stage4\_unit1\_bn2 (BatchNormali (None, None, None, 2048 ['stage4\_unit1\_conv1[0][0]']

zation) 512)

stage4\_unit1\_relu2 (Activation (None, None, None, 0 ['stage4\_unit1\_bn2[0][0]']

) 512)

zero\_padding2d\_29 (ZeroPadding (None, None, None, 0 ['stage4\_unit1\_relu2[0][0]']

2D) 512)

stage4\_unit1\_conv2 (Conv2D) (None, None, None, 2359296 ['zero\_padding2d\_29[0][0]']

512)

stage4\_unit1\_sc (Conv2D) (None, None, None, 131072 ['stage4\_unit1\_relu1[0][0]']

512)

add\_13 (Add) (None, None, None, 0 ['stage4\_unit1\_conv2[0][0]',

512) 'stage4\_unit1\_sc[0][0]']

stage4\_unit2\_bn1 (BatchNormali (None, None, None, 2048 ['add\_13[0][0]']

zation) 512)

stage4\_unit2\_relu1 (Activation (None, None, None, 0 ['stage4\_unit2\_bn1[0][0]']

) 512)

zero\_padding2d\_30 (ZeroPadding (None, None, None, 0 ['stage4\_unit2\_relu1[0][0]']

2D) 512)

stage4\_unit2\_conv1 (Conv2D) (None, None, None, 2359296 ['zero\_padding2d\_30[0][0]']

512)

stage4\_unit2\_bn2 (BatchNormali (None, None, None, 2048 ['stage4\_unit2\_conv1[0][0]']

zation) 512)

stage4\_unit2\_relu2 (Activation (None, None, None, 0 ['stage4\_unit2\_bn2[0][0]']

) 512)

zero\_padding2d\_31 (ZeroPadding (None, None, None, 0 ['stage4\_unit2\_relu2[0][0]']

2D) 512)

stage4\_unit2\_conv2 (Conv2D) (None, None, None, 2359296 ['zero\_padding2d\_31[0][0]']

512)

add\_14 (Add) (None, None, None, 0 ['stage4\_unit2\_conv2[0][0]',

512) 'add\_13[0][0]']

stage4\_unit3\_bn1 (BatchNormali (None, None, None, 2048 ['add\_14[0][0]']

zation) 512)

stage4\_unit3\_relu1 (Activation (None, None, None, 0 ['stage4\_unit3\_bn1[0][0]']

) 512)

zero\_padding2d\_32 (ZeroPadding (None, None, None, 0 ['stage4\_unit3\_relu1[0][0]']

2D) 512)

stage4\_unit3\_conv1 (Conv2D) (None, None, None, 2359296 ['zero\_padding2d\_32[0][0]']

512)

stage4\_unit3\_bn2 (BatchNormali (None, None, None, 2048 ['stage4\_unit3\_conv1[0][0]']

zation) 512)

stage4\_unit3\_relu2 (Activation (None, None, None, 0 ['stage4\_unit3\_bn2[0][0]']

) 512)

zero\_padding2d\_33 (ZeroPadding (None, None, None, 0 ['stage4\_unit3\_relu2[0][0]']

2D) 512)

stage4\_unit3\_conv2 (Conv2D) (None, None, None, 2359296 ['zero\_padding2d\_33[0][0]']

512)

add\_15 (Add) (None, None, None, 0 ['stage4\_unit3\_conv2[0][0]',

512) 'add\_14[0][0]']

bn1 (BatchNormalization) (None, None, None, 2048 ['add\_15[0][0]']

512)

relu1 (Activation) (None, None, None, 0 ['bn1[0][0]']

512)

decoder\_stage0\_upsampling (UpS (None, None, None, 0 ['relu1[0][0]']

ampling2D) 512)

decoder\_stage0\_concat (Concate (None, None, None, 0 ['decoder\_stage0\_upsampling[0][0]

nate) 768) ',

'stage4\_unit1\_relu1[0][0]']

decoder\_stage0a\_conv (Conv2D) (None, None, None, 1769472 ['decoder\_stage0\_concat[0][0]']

256)

decoder\_stage0a\_bn (BatchNorma (None, None, None, 1024 ['decoder\_stage0a\_conv[0][0]']

lization) 256)

decoder\_stage0a\_relu (Activati (None, None, None, 0 ['decoder\_stage0a\_bn[0][0]']

on) 256)

decoder\_stage0b\_conv (Conv2D) (None, None, None, 589824 ['decoder\_stage0a\_relu[0][0]']

256)

decoder\_stage0b\_bn (BatchNorma (None, None, None, 1024 ['decoder\_stage0b\_conv[0][0]']

lization) 256)

decoder\_stage0b\_relu (Activati (None, None, None, 0 ['decoder\_stage0b\_bn[0][0]']

on) 256)

decoder\_stage1\_upsampling (UpS (None, None, None, 0 ['decoder\_stage0b\_relu[0][0]']

ampling2D) 256)

decoder\_stage1\_concat (Concate (None, None, None, 0 ['decoder\_stage1\_upsampling[0][0]

nate) 384) ',

'stage3\_unit1\_relu1[0][0]']

decoder\_stage1a\_conv (Conv2D) (None, None, None, 442368 ['decoder\_stage1\_concat[0][0]']

128)

decoder\_stage1a\_bn (BatchNorma (None, None, None, 512 ['decoder\_stage1a\_conv[0][0]']

lization) 128)

decoder\_stage1a\_relu (Activati (None, None, None, 0 ['decoder\_stage1a\_bn[0][0]']

on) 128)

decoder\_stage1b\_conv (Conv2D) (None, None, None, 147456 ['decoder\_stage1a\_relu[0][0]']

128)

decoder\_stage1b\_bn (BatchNorma (None, None, None, 512 ['decoder\_stage1b\_conv[0][0]']

lization) 128)

decoder\_stage1b\_relu (Activati (None, None, None, 0 ['decoder\_stage1b\_bn[0][0]']

on) 128)

decoder\_stage2\_upsampling (UpS (None, None, None, 0 ['decoder\_stage1b\_relu[0][0]']

ampling2D) 128)

decoder\_stage2\_concat (Concate (None, None, None, 0 ['decoder\_stage2\_upsampling[0][0]

nate) 192) ',

'stage2\_unit1\_relu1[0][0]']

decoder\_stage2a\_conv (Conv2D) (None, None, None, 110592 ['decoder\_stage2\_concat[0][0]']

64)

decoder\_stage2a\_bn (BatchNorma (None, None, None, 256 ['decoder\_stage2a\_conv[0][0]']

lization) 64)

decoder\_stage2a\_relu (Activati (None, None, None, 0 ['decoder\_stage2a\_bn[0][0]']

on) 64)

decoder\_stage2b\_conv (Conv2D) (None, None, None, 36864 ['decoder\_stage2a\_relu[0][0]']

64)

decoder\_stage2b\_bn (BatchNorma (None, None, None, 256 ['decoder\_stage2b\_conv[0][0]']

lization) 64)

decoder\_stage2b\_relu (Activati (None, None, None, 0 ['decoder\_stage2b\_bn[0][0]']

on) 64)

decoder\_stage3\_upsampling (UpS (None, None, None, 0 ['decoder\_stage2b\_relu[0][0]']

ampling2D) 64)

decoder\_stage3\_concat (Concate (None, None, None, 0 ['decoder\_stage3\_upsampling[0][0]

nate) 128) ',

'relu0[0][0]']

decoder\_stage3a\_conv (Conv2D) (None, None, None, 36864 ['decoder\_stage3\_concat[0][0]']

32)

decoder\_stage3a\_bn (BatchNorma (None, None, None, 128 ['decoder\_stage3a\_conv[0][0]']

lization) 32)

decoder\_stage3a\_relu (Activati (None, None, None, 0 ['decoder\_stage3a\_bn[0][0]']

on) 32)

decoder\_stage3b\_conv (Conv2D) (None, None, None, 9216 ['decoder\_stage3a\_relu[0][0]']

32)

decoder\_stage3b\_bn (BatchNorma (None, None, None, 128 ['decoder\_stage3b\_conv[0][0]']

lization) 32)

decoder\_stage3b\_relu (Activati (None, None, None, 0 ['decoder\_stage3b\_bn[0][0]']

on) 32)

decoder\_stage4\_upsampling (UpS (None, None, None, 0 ['decoder\_stage3b\_relu[0][0]']

ampling2D) 32)

decoder\_stage4a\_conv (Conv2D) (None, None, None, 4608 ['decoder\_stage4\_upsampling[0][0]

16) ']

decoder\_stage4a\_bn (BatchNorma (None, None, None, 64 ['decoder\_stage4a\_conv[0][0]']

lization) 16)

decoder\_stage4a\_relu (Activati (None, None, None, 0 ['decoder\_stage4a\_bn[0][0]']

on) 16)

decoder\_stage4b\_conv (Conv2D) (None, None, None, 2304 ['decoder\_stage4a\_relu[0][0]']

16)

decoder\_stage4b\_bn (BatchNorma (None, None, None, 64 ['decoder\_stage4b\_conv[0][0]']

lization) 16)

decoder\_stage4b\_relu (Activati (None, None, None, 0 ['decoder\_stage4b\_bn[0][0]']

on) 16)

final\_conv (Conv2D) (None, None, None, 145 ['decoder\_stage4b\_relu[0][0]']

1)

sigmoid (Activation) (None, None, None, 0 ['final\_conv[0][0]']

1)

==================================================================================================

Total params: 24,456,154

Trainable params: 24,438,804

Non-trainable params: 17,350

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

None

history1=model1.fit(X1,

y1,

batch\_size=16,

epochs=50,

verbose=1,

validation\_data=(X\_test, y\_test))

Epoch 1/50

11/11 [==============================] - 242s 22s/step - loss: 0.2800 - iou\_score: 0.0727 - f1-score: 0.1345 - val\_loss: 0.4472 - val\_iou\_score: 0.0014 - val\_f1-score: 0.0028

Epoch 2/50

11/11 [==============================] - 207s 19s/step - loss: 0.2587 - iou\_score: 0.2296 - f1-score: 0.3660 - val\_loss: 0.4174 - val\_iou\_score: 0.0060 - val\_f1-score: 0.0119

Epoch 3/50

11/11 [==============================] - 205s 19s/step - loss: 0.2372 - iou\_score: 0.3886 - f1-score: 0.5570 - val\_loss: 0.3635 - val\_iou\_score: 0.0154 - val\_f1-score: 0.0302

Epoch 4/50

11/11 [==============================] - 208s 19s/step - loss: 0.2216 - iou\_score: 0.4268 - f1-score: 0.5959 - val\_loss: 0.3549 - val\_iou\_score: 0.0531 - val\_f1-score: 0.1006

Epoch 5/50

11/11 [==============================] - 204s 19s/step - loss: 0.2101 - iou\_score: 0.4333 - f1-score: 0.5974 - val\_loss: 0.3160 - val\_iou\_score: 0.0024 - val\_f1-score: 0.0047

Epoch 6/50

11/11 [==============================] - 205s 19s/step - loss: 0.1925 - iou\_score: 0.5098 - f1-score: 0.6726 - val\_loss: 0.3029 - val\_iou\_score: 0.0290 - val\_f1-score: 0.0561

Epoch 7/50

11/11 [==============================] - 209s 19s/step - loss: 0.1845 - iou\_score: 0.5196 - f1-score: 0.6807 - val\_loss: 0.3019 - val\_iou\_score: 0.0679 - val\_f1-score: 0.1270

Epoch 8/50

11/11 [==============================] - 207s 19s/step - loss: 0.1750 - iou\_score: 0.5312 - f1-score: 0.6923 - val\_loss: 0.2826 - val\_iou\_score: 0.0699 - val\_f1-score: 0.1302

Epoch 9/50

11/11 [==============================] - 206s 19s/step - loss: 0.1653 - iou\_score: 0.5537 - f1-score: 0.7102 - val\_loss: 0.2716 - val\_iou\_score: 0.0489 - val\_f1-score: 0.0927

Epoch 10/50

11/11 [==============================] - 211s 19s/step - loss: 0.1562 - iou\_score: 0.5754 - f1-score: 0.7296 - val\_loss: 0.2627 - val\_iou\_score: 0.0551 - val\_f1-score: 0.1034

Epoch 11/50

11/11 [==============================] - 210s 19s/step - loss: 0.1475 - iou\_score: 0.6095 - f1-score: 0.7562 - val\_loss: 0.2533 - val\_iou\_score: 0.0417 - val\_f1-score: 0.0798

Epoch 12/50

11/11 [==============================] - 208s 19s/step - loss: 0.1418 - iou\_score: 0.6014 - f1-score: 0.7493 - val\_loss: 0.2415 - val\_iou\_score: 0.0383 - val\_f1-score: 0.0733

Epoch 13/50

11/11 [==============================] - 208s 19s/step - loss: 0.1369 - iou\_score: 0.6107 - f1-score: 0.7577 - val\_loss: 0.2403 - val\_iou\_score: 0.0516 - val\_f1-score: 0.0980

Epoch 14/50

11/11 [==============================] - 210s 19s/step - loss: 0.1295 - iou\_score: 0.6388 - f1-score: 0.7773 - val\_loss: 0.2383 - val\_iou\_score: 0.0395 - val\_f1-score: 0.0759

Epoch 15/50

11/11 [==============================] - 210s 19s/step - loss: 0.1239 - iou\_score: 0.6448 - f1-score: 0.7825 - val\_loss: 0.2325 - val\_iou\_score: 0.0436 - val\_f1-score: 0.0830

Epoch 16/50

11/11 [==============================] - 209s 19s/step - loss: 0.1203 - iou\_score: 0.6410 - f1-score: 0.7781 - val\_loss: 0.2309 - val\_iou\_score: 0.0578 - val\_f1-score: 0.1088

Epoch 17/50

11/11 [==============================] - 208s 19s/step - loss: 0.1142 - iou\_score: 0.6506 - f1-score: 0.7868 - val\_loss: 0.2259 - val\_iou\_score: 0.0856 - val\_f1-score: 0.1575

Epoch 18/50

11/11 [==============================] - 209s 19s/step - loss: 0.1121 - iou\_score: 0.6572 - f1-score: 0.7875 - val\_loss: 0.2263 - val\_iou\_score: 0.0237 - val\_f1-score: 0.0458

Epoch 19/50

11/11 [==============================] - 211s 19s/step - loss: 0.1045 - iou\_score: 0.6807 - f1-score: 0.8087 - val\_loss: 0.2199 - val\_iou\_score: 0.0667 - val\_f1-score: 0.1243

Epoch 20/50

11/11 [==============================] - 208s 19s/step - loss: 0.1007 - iou\_score: 0.6993 - f1-score: 0.8225 - val\_loss: 0.2224 - val\_iou\_score: 0.0375 - val\_f1-score: 0.0713

Epoch 21/50

11/11 [==============================] - 207s 19s/step - loss: 0.0959 - iou\_score: 0.7047 - f1-score: 0.8250 - val\_loss: 0.2237 - val\_iou\_score: 0.0397 - val\_f1-score: 0.0760

Epoch 22/50

11/11 [==============================] - 208s 19s/step - loss: 0.0908 - iou\_score: 0.7279 - f1-score: 0.8416 - val\_loss: 0.2232 - val\_iou\_score: 0.0326 - val\_f1-score: 0.0630

Epoch 23/50

11/11 [==============================] - 211s 19s/step - loss: 0.0879 - iou\_score: 0.7274 - f1-score: 0.8404 - val\_loss: 0.2233 - val\_iou\_score: 0.0277 - val\_f1-score: 0.0538

Epoch 24/50

11/11 [==============================] - 208s 19s/step - loss: 0.0892 - iou\_score: 0.7086 - f1-score: 0.8286 - val\_loss: 0.2204 - val\_iou\_score: 0.0517 - val\_f1-score: 0.0981

Epoch 25/50

11/11 [==============================] - 208s 19s/step - loss: 0.0839 - iou\_score: 0.7242 - f1-score: 0.8388 - val\_loss: 0.2220 - val\_iou\_score: 0.0208 - val\_f1-score: 0.0405

Epoch 26/50

11/11 [==============================] - 207s 19s/step - loss: 0.0819 - iou\_score: 0.7190 - f1-score: 0.8358 - val\_loss: 0.2179 - val\_iou\_score: 0.0643 - val\_f1-score: 0.1207

Epoch 27/50

11/11 [==============================] - 209s 19s/step - loss: 0.0789 - iou\_score: 0.7360 - f1-score: 0.8465 - val\_loss: 0.2242 - val\_iou\_score: 0.0167 - val\_f1-score: 0.0326

Epoch 28/50

11/11 [==============================] - 206s 19s/step - loss: 0.0753 - iou\_score: 0.7371 - f1-score: 0.8471 - val\_loss: 0.2236 - val\_iou\_score: 0.0347 - val\_f1-score: 0.0667

Epoch 29/50

11/11 [==============================] - 207s 19s/step - loss: 0.0719 - iou\_score: 0.7603 - f1-score: 0.8628 - val\_loss: 0.2254 - val\_iou\_score: 0.0237 - val\_f1-score: 0.0457

Epoch 30/50

11/11 [==============================] - 207s 19s/step - loss: 0.0718 - iou\_score: 0.7551 - f1-score: 0.8593 - val\_loss: 0.2276 - val\_iou\_score: 0.0165 - val\_f1-score: 0.0323

Epoch 31/50

11/11 [==============================] - 206s 19s/step - loss: 0.0691 - iou\_score: 0.7479 - f1-score: 0.8542 - val\_loss: 0.2276 - val\_iou\_score: 0.0281 - val\_f1-score: 0.0545

Epoch 32/50

11/11 [==============================] - 207s 19s/step - loss: 0.0671 - iou\_score: 0.7605 - f1-score: 0.8627 - val\_loss: 0.2278 - val\_iou\_score: 0.0187 - val\_f1-score: 0.0364

Epoch 33/50

11/11 [==============================] - 209s 19s/step - loss: 0.0650 - iou\_score: 0.7585 - f1-score: 0.8613 - val\_loss: 0.2254 - val\_iou\_score: 0.0285 - val\_f1-score: 0.0551

Epoch 34/50

11/11 [==============================] - 207s 19s/step - loss: 0.0635 - iou\_score: 0.7651 - f1-score: 0.8647 - val\_loss: 0.2282 - val\_iou\_score: 0.0240 - val\_f1-score: 0.0464

Epoch 35/50

11/11 [==============================] - 207s 19s/step - loss: 0.0609 - iou\_score: 0.7741 - f1-score: 0.8717 - val\_loss: 0.2252 - val\_iou\_score: 0.0382 - val\_f1-score: 0.0732

Epoch 36/50

11/11 [==============================] - 207s 19s/step - loss: 0.0587 - iou\_score: 0.7873 - f1-score: 0.8798 - val\_loss: 0.2273 - val\_iou\_score: 0.0244 - val\_f1-score: 0.0473

Epoch 37/50

11/11 [==============================] - 206s 19s/step - loss: 0.0577 - iou\_score: 0.7849 - f1-score: 0.8780 - val\_loss: 0.2272 - val\_iou\_score: 0.0411 - val\_f1-score: 0.0785

Epoch 38/50

11/11 [==============================] - 207s 19s/step - loss: 0.0556 - iou\_score: 0.8065 - f1-score: 0.8923 - val\_loss: 0.2288 - val\_iou\_score: 0.0311 - val\_f1-score: 0.0598

Epoch 39/50

11/11 [==============================] - 210s 19s/step - loss: 0.0530 - iou\_score: 0.8079 - f1-score: 0.8925 - val\_loss: 0.2329 - val\_iou\_score: 0.0275 - val\_f1-score: 0.0529

Epoch 40/50

11/11 [==============================] - 207s 19s/step - loss: 0.0518 - iou\_score: 0.8080 - f1-score: 0.8927 - val\_loss: 0.2337 - val\_iou\_score: 0.0272 - val\_f1-score: 0.0527

Epoch 41/50

11/11 [==============================] - 207s 19s/step - loss: 0.0516 - iou\_score: 0.8030 - f1-score: 0.8895 - val\_loss: 0.2335 - val\_iou\_score: 0.0319 - val\_f1-score: 0.0616

Epoch 42/50

11/11 [==============================] - 207s 19s/step - loss: 0.0493 - iou\_score: 0.8183 - f1-score: 0.8986 - val\_loss: 0.2342 - val\_iou\_score: 0.0307 - val\_f1-score: 0.0592

Epoch 43/50

11/11 [==============================] - 207s 19s/step - loss: 0.0486 - iou\_score: 0.8195 - f1-score: 0.9003 - val\_loss: 0.2325 - val\_iou\_score: 0.0419 - val\_f1-score: 0.0800

Epoch 44/50

11/11 [==============================] - 207s 19s/step - loss: 0.0475 - iou\_score: 0.8115 - f1-score: 0.8945 - val\_loss: 0.2345 - val\_iou\_score: 0.0328 - val\_f1-score: 0.0632

Epoch 45/50

11/11 [==============================] - 207s 19s/step - loss: 0.0476 - iou\_score: 0.8061 - f1-score: 0.8910 - val\_loss: 0.2343 - val\_iou\_score: 0.0432 - val\_f1-score: 0.0824

Epoch 46/50

11/11 [==============================] - 207s 19s/step - loss: 0.0472 - iou\_score: 0.8068 - f1-score: 0.8925 - val\_loss: 0.2355 - val\_iou\_score: 0.0309 - val\_f1-score: 0.0594

Epoch 47/50

11/11 [==============================] - 207s 19s/step - loss: 0.0465 - iou\_score: 0.8025 - f1-score: 0.8888 - val\_loss: 0.2335 - val\_iou\_score: 0.0458 - val\_f1-score: 0.0873

Epoch 48/50

11/11 [==============================] - 208s 19s/step - loss: 0.0454 - iou\_score: 0.8041 - f1-score: 0.8900 - val\_loss: 0.2388 - val\_iou\_score: 0.0271 - val\_f1-score: 0.0524

Epoch 49/50

11/11 [==============================] - 209s 19s/step - loss: 0.0440 - iou\_score: 0.8063 - f1-score: 0.8911 - val\_loss: 0.2396 - val\_iou\_score: 0.0442 - val\_f1-score: 0.0842

Epoch 50/50

11/11 [==============================] - 208s 19s/step - loss: 0.0441 - iou\_score: 0.8105 - f1-score: 0.8935 - val\_loss: 0.2400 - val\_iou\_score: 0.0338 - val\_f1-score: 0.0651