

```
In [1]: %load_ext autoreload
        %autoreload 2
```

```
In [2]: ##autoreload # When utils.py is updated
        from utils_unet_resunet import *
        from tensorflow.keras.preprocessing.image import ImageDataGenerator
        from model.models import Model_3
        from model.losses import WBCE
        root_path = 'imgs/'
```

```
In [3]: # Define data type (L8-Landsat8, S2-Sentinel2, S1-Sentinel1)
        img_type = 'OPT'

        if img_type == 'FUSION':
            image_stack = np.load(root_path+'New_Images/fus_stack.npy')

        if img_type == 'OPT':
            image_stack = np.load(root_path+'New_Images/opt_stack.npy')

        if img_type == 'SAR':
            image_stack = np.load(root_path+'New_Images/sar_stack.npy')
        print('Image stack:', image_stack.shape)
```

Image stack: (17729, 9202, 8)

```
In [4]: # Create label mask
        #past_ref = past_ref1 + past_ref2 + clouds_2018 + clouds_2019
        #past_ref[past_ref>=1] = 1
        #buffer = 2
        #final_mask1 = mask_no_considered(ref_2019, buffer, past_ref)
        #del past_ref1, past_ref2, clouds_2018, clouds_2019
        final_mask1 = np.load(root_path+'New_Images/ref/'+ 'labels.npy')

        lim_x = 10000
        lim_y = 7000
        image_stack = image_stack[:lim_x, :lim_y, :]
        final_mask1 = final_mask1[:lim_x, :lim_y]
        #ref_2019 = ref_2019[:lim_x, :lim_y]

        h_, w_, channels = image_stack.shape
        print('image stack size: ', image_stack.shape)

        # Normalization
        type_norm = 1
        image_array = normalization(image_stack.copy(), type_norm)
        print(np.min(image_array), np.max(image_array))
        del image_stack

        # Print pertengate of each class (whole image)
        print('Total no-deforestaion class is {}'.format(len(final_mask1[final_mask1==0])))
        print('Total deforestaion class is {}'.format(len(final_mask1[final_mask1==1])))
        print('Total past deforestaion class is {}'.format(len(final_mask1[final_mask1==2])))
        print('Percentage of deforestaion class is {:.2f}'.format((len(final_mask1[final_mas
```

image stack size: (10000, 7000, 8)
 -4.987141 5.626766
 Total no-deforestaion class is 36326397

Total deforestation class is 1048775
 Total past deforestation class is 32624828
 Percentage of deforestation class is 2.89

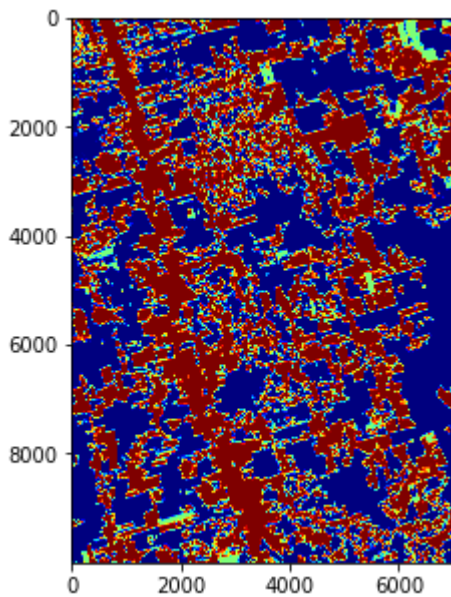
```
In [5]: # Create tile mask
mask_tiles = create_mask(final_mask1.shape[0], final_mask1.shape[1], grid_size=(5, 4))
image_array = image_array[:mask_tiles.shape[0], :mask_tiles.shape[1],:]
final_mask1 = final_mask1[:mask_tiles.shape[0], :mask_tiles.shape[1]]

print('mask: ', mask_tiles.shape)
print('image stack: ', image_array.shape)
print('ref :', final_mask1.shape)
#plt.imshow(mask_tiles)
```

Tiles size: 2000 1750
 Mask size: (10000, 7000)
 mask: (10000, 7000)
 image stack: (10000, 7000, 8)
 ref : (10000, 7000)

```
In [6]: plt.figure(figsize=(10,5))
plt.imshow(final_mask1, cmap = 'jet')
```

Out[6]: <matplotlib.image.AxesImage at 0x1cd00011340>



```
In [7]: # Define tiles for training, validation, and test sets
tiles_tr = [1,3,5,8,11,13,14,20]
tiles_val = [6,19]
tiles_ts = (list(set(np.arange(20)+1)-set(tiles_tr)-set(tiles_val)))

mask_tr_val = np.zeros((mask_tiles.shape)).astype('float32')
# Training and validation mask
for tr_ in tiles_tr:
    mask_tr_val[mask_tiles == tr_] = 1

for val_ in tiles_val:
    mask_tr_val[mask_tiles == val_] = 2

mask_amazon_ts = np.zeros((mask_tiles.shape)).astype('float32')
for ts_ in tiles_ts:
    mask_amazon_ts[mask_tiles == ts_] = 1
```

```
In [8]: # Create idx image to extract patches
overlap = 0.7
patch_size = 128
batch_size = 32
im_idx = create_idx_image(final_mask1)
patches_idx = extract_patches(im_idx, patch_size=(patch_size, patch_size), overlap=0.7)
patches_mask = extract_patches(mask_tr_val, patch_size=(patch_size, patch_size), overlap=0.7)
del im_idx
```

```
In [9]: # Selecting index trn val and test patches idx
idx_trn = np.squeeze(np.where(patches_mask.sum(axis=(1, 2)) == patch_size**2))
idx_val = np.squeeze(np.where(patches_mask.sum(axis=(1, 2)) == 2*patch_size**2))
del patches_mask

patches_idx_trn = patches_idx[idx_trn]
patches_idx_val = patches_idx[idx_val]
del idx_trn, idx_val

print('Number of training patches: ', len(patches_idx_trn), 'Number of validation patches: ', len(patches_idx_val))
```

Number of training patches: 17110 Number of validation patches 4116

```
In [10]: # Extract patches with at least 2% of deforestation class
X_train = retrieve_idx_percentage(final_mask1, patches_idx_trn, patch_size, percentage=0.02)
X_valid = retrieve_idx_percentage(final_mask1, patches_idx_val, patch_size, percentage=0.02)
print(X_train.shape, X_valid.shape)
del patches_idx_trn, patches_idx_val
```

(1158, 128, 128) (341, 128, 128)

```
In [11]: def batch_generator(batches, image, reference, target_size, number_class):
    """Take as input a Keras ImageGen (Iterator) and generate random
    crops from the image batches generated by the original iterator.
    """
    image = image.reshape(-1, image.shape[-1])
    reference = reference.reshape(final_mask1.shape[0]*final_mask1.shape[1])
    while True:
        batch_x, batch_y = next(batches)
        batch_x = np.squeeze(batch_x.astype('int64'))
        #print(batch_x.shape)
        batch_img = np.zeros((batch_x.shape[0], target_size, target_size, image.shape[-1]))
        batch_ref = np.zeros((batch_x.shape[0], target_size, target_size, number_class))

        for i in range(batch_x.shape[0]):
            if np.random.rand() > 0.5:
                batch_x[i] = np.rot90(batch_x[i], 1)
            batch_img[i] = image[batch_x[i]]
            batch_ref[i] = tf.keras.utils.to_categorical(reference[batch_x[i]], number_class)

        yield (batch_img, batch_ref)

train_datagen = ImageDataGenerator(horizontal_flip = True,
                                   vertical_flip = True)
valid_datagen = ImageDataGenerator(horizontal_flip = True,
                                   vertical_flip = True)

y_train = np.zeros((len(X_train)))
y_valid = np.zeros((len(X_valid)))

train_gen = train_datagen.flow(np.expand_dims(X_train, axis = -1), y_train,
                              batch_size=batch_size,
                              shuffle=True)
```

```

valid_gen = valid_datagen.flow(np.expand_dims(X_valid, axis = -1), y_valid,
                               batch_size=batch_size,
                               shuffle=False)

number_class = 3
train_gen_crops = batch_generator(train_gen, image_array, final_mask1, patch_size, n
valid_gen_crops = batch_generator(valid_gen, image_array, final_mask1, patch_size, n

```

In [12]:

```

exp = 1
path_exp = root_path+'experiments/exp'+str(exp)
path_models = path_exp+'/models'
path_maps = path_exp+'/pred_maps'

if not os.path.exists(path_exp):
    os.makedirs(path_exp)
if not os.path.exists(path_models):
    os.makedirs(path_models)
if not os.path.exists(path_maps):
    os.makedirs(path_maps)

```

In [13]:

```

# Define model
input_shape = (patch_size, patch_size, channels)
nb_filters = [32, 64, 128]

method = 'unet'
if method == 'unet':
    model = build_unet(input_shape, nb_filters, number_class)

if method == 'resunet':
    model = build_resunet(input_shape, nb_filters, number_class)

#model = Model_3(nb_filters, number_class)

```

In [14]:

```

# Parameters of the model
weights = [0.2, 0.8, 0]
adam = Adam(lr = 1e-3 , beta_1=0.9)
loss = weighted_categorical_crossentropy(weights)
#loss = WBCE(weights = weights)
#loss = WBCE(weights = weights, class_indexes = [0, 1])

```

In [15]:

```

metrics_all = []
times=30
for tm in range(0,times):
    print('time: ', tm)

    rows = patch_size
    cols = patch_size
    adam = Adam(lr = 1e-3 , beta_1=0.9)
    loss = weighted_categorical_crossentropy(weights)
    #loss = WBCE(weights = weights)
    #loss = WBCE(weights = weights, class_indexes = [0, 1])

    #if method == 'unet':
    #    model = build_unet(input_shape, nb_filters, number_class)

    #if method == 'resunet':
    #    model = build_resunet(input_shape, nb_filters, number_class)

```

```
#model = Model_3(nb_filters, number_class)
#model.build((None,)+input_shape)
model = build_unet(input_shape, nb_filters, number_class)

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

earlystop = EarlyStopping(monitor='val_loss', min_delta=0.0001, patience=10, ver
#earlystop = EarlyStopping(monitor='val_loss', min_delta=0.0001, patience=10, ve
checkpoint = ModelCheckpoint(path_models+ '/' + method + '_' +str(tm)+'.h5', monit
#checkpoint = ModelCheckpoint(path_models+ '/' + method + '_' +str(tm)+'.h5', moni
lr_reduce = ReduceLROnPlateau(factor=0.9, min_delta=0.0001, patience=5, verbose=
callbacks_list = [earlystop, checkpoint]
# train the model
start_training = time.time()
history = model.fit(train_gen_crops,
                    steps_per_epoch=len(X_train)*3//train_gen.batch_size,
                    validation_data=valid_gen_crops,
                    validation_steps=len(X_valid)*3//valid_gen.batch_size,
                    epochs=100,
                    callbacks=callbacks_list)
end_training = time.time() - start_training
metrics_all.append(end_training)
del model, history
```

time: 0
Model: "model_1"

Layer (type)	Output Shape	Param #	Connected to
=====			
=====			
input_2 (InputLayer)	[(None, 128, 128, 8) 0		

conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_2[0][0]

max_pooling2d_3 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]

conv2 (Conv2D)	(None, 64, 64, 64) 18496		max_pooling2d_3[0][0]

max_pooling2d_4 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]

conv3 (Conv2D)	(None, 32, 32, 128) 73856		max_pooling2d_4[0][0]

max_pooling2d_5 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]

conv4 (Conv2D)	(None, 16, 16, 128) 147584		max_pooling2d_5[0][0]

conv5 (Conv2D)	(None, 16, 16, 128) 147584		conv4[0][0]

conv6 (Conv2D)	(None, 16, 16, 128) 147584		conv5[0][0]

up_sampling2d_3 (UpSampling2D)	(None, 32, 32, 128)	0	conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128)	147584	up_sampling2d_3[0][0]
concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_4 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_4[0][0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_5 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_5[0][0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_1 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]
=====			
Total params: 869,635			
Trainable params: 869,635			
Non-trainable params: 0			

Epoch 1/100

108/108 [=====] - 10s 57ms/step - loss: 0.1030 - accuracy: 0.7292 - val_loss: 0.1099 - val_accuracy: 0.7675

Epoch 00001: val_loss improved from inf to 0.10990, saving model to imgs/experiments/exp1/models/unet_0.h5

Epoch 2/100

108/108 [=====] - 5s 45ms/step - loss: 0.0683 - accuracy: 0.8216 - val_loss: 0.1170 - val_accuracy: 0.7751

Epoch 00002: val_loss did not improve from 0.10990

Epoch 3/100

108/108 [=====] - 5s 45ms/step - loss: 0.0624 - accuracy: 0.8299 - val_loss: 0.1428 - val_accuracy: 0.7736

Epoch 00003: val_loss did not improve from 0.10990

Epoch 4/100

108/108 [=====] - 5s 45ms/step - loss: 0.0578 - accuracy: 0.8409 - val_loss: 0.1110 - val_accuracy: 0.7945

Epoch 00004: val_loss did not improve from 0.10990

Epoch 5/100

108/108 [=====] - 5s 45ms/step - loss: 0.0555 - accuracy: 0.8445 - val_loss: 0.1283 - val_accuracy: 0.7907

```
Epoch 00005: val_loss did not improve from 0.10990
Epoch 6/100
108/108 [=====] - 5s 45ms/step - loss: 0.0510 - accuracy:
0.8528 - val_loss: 0.1764 - val_accuracy: 0.7625

Epoch 00006: val_loss did not improve from 0.10990
Epoch 7/100
108/108 [=====] - 5s 45ms/step - loss: 0.0463 - accuracy:
0.8619 - val_loss: 0.1439 - val_accuracy: 0.7687

Epoch 00007: val_loss did not improve from 0.10990
Epoch 8/100
108/108 [=====] - 5s 45ms/step - loss: 0.0446 - accuracy:
0.8645 - val_loss: 0.1451 - val_accuracy: 0.7906

Epoch 00008: val_loss did not improve from 0.10990
Epoch 9/100
108/108 [=====] - 5s 46ms/step - loss: 0.0442 - accuracy:
0.8652 - val_loss: 0.1521 - val_accuracy: 0.7889

Epoch 00009: val_loss did not improve from 0.10990
Epoch 10/100
108/108 [=====] - 5s 46ms/step - loss: 0.0362 - accuracy:
0.8801 - val_loss: 0.1725 - val_accuracy: 0.7816

Epoch 00010: val_loss did not improve from 0.10990
Epoch 11/100
108/108 [=====] - 5s 46ms/step - loss: 0.0341 - accuracy:
0.8848 - val_loss: 0.1799 - val_accuracy: 0.7847

Epoch 00011: val_loss did not improve from 0.10990
Epoch 00011: early stopping
time: 1
Model: "model_2"
```

Layer (type)	Output Shape	Param #	Connected to
=====			
input_3 (InputLayer)	[(None, 128, 128, 8) 0		

conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_3[0][0]

max_pooling2d_6 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]

conv2 (Conv2D) [0]	(None, 64, 64, 64) 18496		max_pooling2d_6[0] [0]

max_pooling2d_7 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]

conv3 (Conv2D) [0]	(None, 32, 32, 128) 73856		max_pooling2d_7[0] [0]

max_pooling2d_8 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]

conv4 (Conv2D) [0]	(None, 16, 16, 128) 147584		max_pooling2d_8[0] [0]

conv5 (Conv2D)	(None, 16, 16, 128)	147584	conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128)	147584	conv5[0][0]
up_sampling2d_6 (UpSampling2D)	(None, 32, 32, 128)	0	conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128)	147584	up_sampling2d_6[0][0]
concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_7 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_7[0][0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_8 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_8[0][0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_2 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]

=====
Total params: 869,635
Trainable params: 869,635
Non-trainable params: 0

Epoch 1/100

108/108 [=====] - 6s 47ms/step - loss: 0.0971 - accuracy: 0.7458 - val_loss: 0.1123 - val_accuracy: 0.7555

Epoch 00001: val_loss improved from inf to 0.11229, saving model to imgs/experiments/exp1/models/unet_1.h5

Epoch 2/100

108/108 [=====] - 5s 46ms/step - loss: 0.0662 - accuracy: 0.8240 - val_loss: 0.1177 - val_accuracy: 0.7724

Epoch 00002: val_loss did not improve from 0.11229

Epoch 3/100

108/108 [=====] - 5s 47ms/step - loss: 0.0612 - accuracy: 0.8358 - val_loss: 0.0963 - val_accuracy: 0.8013

Epoch 00003: val_loss improved from 0.11229 to 0.09635, saving model to imgs/experiments/exp1/models/unet_1.h5

ents/exp1/models\unet_1.h5

Epoch 4/100

108/108 [=====] - 5s 48ms/step - loss: 0.0580 - accuracy: 0.8411 - val_loss: 0.1051 - val_accuracy: 0.7997

Epoch 00004: val_loss did not improve from 0.09635

Epoch 5/100

108/108 [=====] - 5s 47ms/step - loss: 0.0540 - accuracy: 0.8448 - val_loss: 0.1331 - val_accuracy: 0.7816

Epoch 00005: val_loss did not improve from 0.09635

Epoch 6/100

108/108 [=====] - 5s 48ms/step - loss: 0.0491 - accuracy: 0.8581 - val_loss: 0.1633 - val_accuracy: 0.7645

Epoch 00006: val_loss did not improve from 0.09635

Epoch 7/100

108/108 [=====] - 5s 49ms/step - loss: 0.0457 - accuracy: 0.8630 - val_loss: 0.1620 - val_accuracy: 0.78531 - ETA: 0s - loss: 0.0457 - accu

Epoch 00007: val_loss did not improve from 0.09635

Epoch 8/100

108/108 [=====] - 5s 50ms/step - loss: 0.0431 - accuracy: 0.8680 - val_loss: 0.1632 - val_accuracy: 0.7969

Epoch 00008: val_loss did not improve from 0.09635

Epoch 9/100

108/108 [=====] - 5s 51ms/step - loss: 0.0387 - accuracy: 0.8761 - val_loss: 0.1535 - val_accuracy: 0.7971

Epoch 00009: val_loss did not improve from 0.09635

Epoch 10/100

108/108 [=====] - 6s 55ms/step - loss: 0.0398 - accuracy: 0.8751 - val_loss: 0.1820 - val_accuracy: 0.7955

Epoch 00010: val_loss did not improve from 0.09635

Epoch 11/100

108/108 [=====] - 6s 54ms/step - loss: 0.0339 - accuracy: 0.8879 - val_loss: 0.1686 - val_accuracy: 0.7939

Epoch 00011: val_loss did not improve from 0.09635

Epoch 12/100

108/108 [=====] - 6s 53ms/step - loss: 0.0322 - accuracy: 0.8882 - val_loss: 0.1846 - val_accuracy: 0.7906

Epoch 00012: val_loss did not improve from 0.09635

Epoch 13/100

108/108 [=====] - 6s 52ms/step - loss: 0.0300 - accuracy: 0.8944 - val_loss: 0.2070 - val_accuracy: 0.7853

Epoch 00013: val_loss did not improve from 0.09635

Epoch 00013: early stopping

time: 2

Model: "model_3"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_4 (InputLayer)	[(None, 128, 128, 8) 0		
=====			
conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_4[0][0]

max_pooling2d_9 (MaxPooling2D)	(None, 64, 64, 32)	0	conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64)	18496	max_pooling2d_9[0]
max_pooling2d_10 (MaxPooling2D)	(None, 32, 32, 64)	0	conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128)	73856	max_pooling2d_10[0]
max_pooling2d_11 (MaxPooling2D)	(None, 16, 16, 128)	0	conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128)	147584	max_pooling2d_11[0]
conv5 (Conv2D)	(None, 16, 16, 128)	147584	conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128)	147584	conv5[0][0]
up_sampling2d_9 (UpSampling2D)	(None, 32, 32, 128)	0	conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128)	147584	up_sampling2d_9[0]
concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_10 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_10[0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_11 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_11[0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_3 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]
=====			
Total params: 869,635			
Trainable params: 869,635			

Non-trainable params: 0

Epoch 1/100

108/108 [=====] - 6s 53ms/step - loss: 0.0957 - accuracy: 0.7347 - val_loss: 0.0963 - val_accuracy: 0.7680

Epoch 00001: val_loss improved from inf to 0.09627, saving model to imgs/experiments/exp1/models\unet_2.h5

Epoch 2/100

108/108 [=====] - 6s 53ms/step - loss: 0.0655 - accuracy: 0.8257 - val_loss: 0.0983 - val_accuracy: 0.7838

Epoch 00002: val_loss did not improve from 0.09627

Epoch 3/100

108/108 [=====] - 6s 55ms/step - loss: 0.0615 - accuracy: 0.8345 - val_loss: 0.1086 - val_accuracy: 0.7851

Epoch 00003: val_loss did not improve from 0.09627

Epoch 4/100

108/108 [=====] - 6s 55ms/step - loss: 0.0564 - accuracy: 0.8436 - val_loss: 0.1533 - val_accuracy: 0.7877

Epoch 00004: val_loss did not improve from 0.09627

Epoch 5/100

108/108 [=====] - 6s 56ms/step - loss: 0.0563 - accuracy: 0.8428 - val_loss: 0.1443 - val_accuracy: 0.7819

Epoch 00005: val_loss did not improve from 0.09627

Epoch 6/100

108/108 [=====] - 6s 57ms/step - loss: 0.0508 - accuracy: 0.8542 - val_loss: 0.1676 - val_accuracy: 0.7795

Epoch 00006: val_loss did not improve from 0.09627

Epoch 7/100

108/108 [=====] - 6s 56ms/step - loss: 0.0499 - accuracy: 0.8550 - val_loss: 0.1560 - val_accuracy: 0.7795

Epoch 00007: val_loss did not improve from 0.09627

Epoch 8/100

108/108 [=====] - 6s 57ms/step - loss: 0.0474 - accuracy: 0.8601 - val_loss: 0.1744 - val_accuracy: 0.7831

Epoch 00008: val_loss did not improve from 0.09627

Epoch 9/100

108/108 [=====] - 6s 58ms/step - loss: 0.0400 - accuracy: 0.8722 - val_loss: 0.1960 - val_accuracy: 0.7824

Epoch 00009: val_loss did not improve from 0.09627

Epoch 10/100

108/108 [=====] - 6s 57ms/step - loss: 0.0377 - accuracy: 0.8772 - val_loss: 0.1798 - val_accuracy: 0.7920

Epoch 00010: val_loss did not improve from 0.09627

Epoch 11/100

108/108 [=====] - 6s 60ms/step - loss: 0.0378 - accuracy: 0.8767 - val_loss: 0.1864 - val_accuracy: 0.7904

Epoch 00011: val_loss did not improve from 0.09627

Epoch 00011: early stopping

time: 3

Model: "model_4"

Layer (type)

Output Shape

Param #

Connected to

=====		
=====		
input_5 (InputLayer)	[(None, 128, 128, 8) 0	
conv1 (Conv2D)	(None, 128, 128, 32) 2336	input_5[0][0]
max_pooling2d_12 (MaxPooling2D)	(None, 64, 64, 32) 0	conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64) 18496	max_pooling2d_12[0][0]
max_pooling2d_13 (MaxPooling2D)	(None, 32, 32, 64) 0	conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128) 73856	max_pooling2d_13[0][0]
max_pooling2d_14 (MaxPooling2D)	(None, 16, 16, 128) 0	conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128) 147584	max_pooling2d_14[0][0]
conv5 (Conv2D)	(None, 16, 16, 128) 147584	conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128) 147584	conv5[0][0]
up_sampling2d_12 (UpSampling2D)	(None, 32, 32, 128) 0	conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128) 147584	up_sampling2d_12[0][0]
concatenate3 (Concatenate)	(None, 32, 32, 256) 0	conv3[0][0] upsampling3[0][0]
up_sampling2d_13 (UpSampling2D)	(None, 64, 64, 256) 0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64) 147520	up_sampling2d_13[0][0]
concatenate2 (Concatenate)	(None, 64, 64, 128) 0	conv2[0][0] upsampling2[0][0]
up_sampling2d_14 (UpSampling2D)	(None, 128, 128, 128) 0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32) 36896	up_sampling2d_14[0][0]
concatenate1 (Concatenate)	(None, 128, 128, 64) 0	conv1[0][0]

```

conv2d_4 (Conv2D)                (None, 128, 128, 3) 195      concatenate1[0][0]
=====
Total params: 869,635
Trainable params: 869,635
Non-trainable params: 0

```

```

Epoch 1/100
108/108 [=====] - 7s 60ms/step - loss: 0.1034 - accuracy:
0.7316 - val_loss: 0.0967 - val_accuracy: 0.7812

Epoch 00001: val_loss improved from inf to 0.09672, saving model to imgs/experiment
s/exp1/models\unet_3.h5
Epoch 2/100
108/108 [=====] - 6s 60ms/step - loss: 0.0664 - accuracy:
0.8236 - val_loss: 0.0953 - val_accuracy: 0.7657

Epoch 00002: val_loss improved from 0.09672 to 0.09527, saving model to imgs/experim
ents/exp1/models\unet_3.h5
Epoch 3/100
108/108 [=====] - 7s 62ms/step - loss: 0.0610 - accuracy:
0.8338 - val_loss: 0.1143 - val_accuracy: 0.7765

Epoch 00003: val_loss did not improve from 0.09527
Epoch 4/100
108/108 [=====] - 7s 62ms/step - loss: 0.0577 - accuracy:
0.8425 - val_loss: 0.1252 - val_accuracy: 0.7668

Epoch 00004: val_loss did not improve from 0.09527
Epoch 5/100
108/108 [=====] - 7s 62ms/step - loss: 0.0556 - accuracy:
0.8466 - val_loss: 0.1350 - val_accuracy: 0.7849

Epoch 00005: val_loss did not improve from 0.09527
Epoch 6/100
108/108 [=====] - 7s 64ms/step - loss: 0.0529 - accuracy:
0.8492 - val_loss: 0.1392 - val_accuracy: 0.7876

Epoch 00006: val_loss did not improve from 0.09527
Epoch 7/100
108/108 [=====] - 7s 64ms/step - loss: 0.0494 - accuracy:
0.8546 - val_loss: 0.1299 - val_accuracy: 0.7840

Epoch 00007: val_loss did not improve from 0.09527
Epoch 8/100
108/108 [=====] - 7s 64ms/step - loss: 0.0442 - accuracy:
0.8637 - val_loss: 0.1427 - val_accuracy: 0.7935

Epoch 00008: val_loss did not improve from 0.09527
Epoch 9/100
108/108 [=====] - 7s 63ms/step - loss: 0.0420 - accuracy:
0.8681 - val_loss: 0.1250 - val_accuracy: 0.7949

Epoch 00009: val_loss did not improve from 0.09527
Epoch 10/100
108/108 [=====] - 7s 65ms/step - loss: 0.0378 - accuracy:
0.8778 - val_loss: 0.1304 - val_accuracy: 0.7957

Epoch 00010: val_loss did not improve from 0.09527
Epoch 11/100
108/108 [=====] - 7s 67ms/step - loss: 0.0367 - accuracy:

```

0.8782 - val_loss: 0.1386 - val_accuracy: 0.7966

Epoch 00011: val_loss did not improve from 0.09527

Epoch 12/100

108/108 [=====] - 7s 67ms/step - loss: 0.0352 - accuracy: 0.8832 - val_loss: 0.1673 - val_accuracy: 0.7931

Epoch 00012: val_loss did not improve from 0.09527

Epoch 00012: early stopping

time: 4

Model: "model_5"

Layer (type)	Output Shape	Param #	Connected to
input_6 (InputLayer)	[(None, 128, 128, 8) 0		
conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_6[0][0]
max_pooling2d_15 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64) 18496		max_pooling2d_15[0][0]
max_pooling2d_16 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128) 73856		max_pooling2d_16[0][0]
max_pooling2d_17 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128) 147584		max_pooling2d_17[0][0]
conv5 (Conv2D)	(None, 16, 16, 128) 147584		conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128) 147584		conv5[0][0]
up_sampling2d_15 (UpSampling2D)	(None, 32, 32, 128) 0		conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128) 147584		up_sampling2d_15[0][0]
concatenate3 (Concatenate)	(None, 32, 32, 256) 0		conv3[0][0] upsampling3[0][0]
up_sampling2d_16 (UpSampling2D)	(None, 64, 64, 256) 0		concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64) 147520		up_sampling2d_16[0][0]

concatenate2 (Concatenate)	(None, 64, 64, 128) 0	conv2[0][0] upsampling2[0][0]
up_sampling2d_17 (UpSampling2D)	(None, 128, 128, 128) 0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32) 36896	up_sampling2d_17[0][0]
concatenate1 (Concatenate)	(None, 128, 128, 64) 0	conv1[0][0] upsampling1[0][0]
conv2d_5 (Conv2D)	(None, 128, 128, 3) 195	concatenate1[0][0]
=====		
Total params: 869,635		
Trainable params: 869,635		
Non-trainable params: 0		

Epoch 1/100

108/108 [=====] - 8s 69ms/step - loss: 0.1038 - accuracy: 0.7293 - val_loss: 0.0907 - val_accuracy: 0.7869

Epoch 00001: val_loss improved from inf to 0.09072, saving model to imgs/experiments/exp1/models/unet_4.h5

Epoch 2/100

108/108 [=====] - 7s 66ms/step - loss: 0.0668 - accuracy: 0.8196 - val_loss: 0.0993 - val_accuracy: 0.7883s - ETA: 1s - ETA: 0s - loss: 0.0668 - accuracy

Epoch 00002: val_loss did not improve from 0.09072

Epoch 3/100

108/108 [=====] - 7s 67ms/step - loss: 0.0618 - accuracy: 0.8317 - val_loss: 0.1130 - val_accuracy: 0.7786

Epoch 00003: val_loss did not improve from 0.09072

Epoch 4/100

108/108 [=====] - 7s 69ms/step - loss: 0.0586 - accuracy: 0.8383 - val_loss: 0.0950 - val_accuracy: 0.7913

Epoch 00004: val_loss did not improve from 0.09072

Epoch 5/100

108/108 [=====] - 7s 69ms/step - loss: 0.0562 - accuracy: 0.8453 - val_loss: 0.1015 - val_accuracy: 0.7957

Epoch 00005: val_loss did not improve from 0.09072

Epoch 6/100

108/108 [=====] - 8s 71ms/step - loss: 0.0536 - accuracy: 0.8508 - val_loss: 0.1349 - val_accuracy: 0.7901

Epoch 00006: val_loss did not improve from 0.09072

Epoch 7/100

108/108 [=====] - 8s 71ms/step - loss: 0.0463 - accuracy: 0.8638 - val_loss: 0.1543 - val_accuracy: 0.7967

Epoch 00007: val_loss did not improve from 0.09072

Epoch 8/100

108/108 [=====] - 8s 72ms/step - loss: 0.0443 - accuracy: 0.8636 - val_loss: 0.1836 - val_accuracy: 0.7932

Epoch 00008: val_loss did not improve from 0.09072
 Epoch 9/100
 108/108 [=====] - 8s 73ms/step - loss: 0.0385 - accuracy: 0.8769 - val_loss: 0.1771 - val_accuracy: 0.7908

Epoch 00009: val_loss did not improve from 0.09072
 Epoch 10/100
 108/108 [=====] - 8s 76ms/step - loss: 0.0375 - accuracy: 0.8776 - val_loss: 0.1458 - val_accuracy: 0.7953

Epoch 00010: val_loss did not improve from 0.09072
 Epoch 11/100
 108/108 [=====] - 8s 72ms/step - loss: 0.0338 - accuracy: 0.8853 - val_loss: 0.1781 - val_accuracy: 0.7935

Epoch 00011: val_loss did not improve from 0.09072
 Epoch 00011: early stopping
 time: 5
 Model: "model_6"

Layer (type)	Output Shape	Param #	Connected to
input_7 (InputLayer)	[(None, 128, 128, 8) 0		
conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_7[0][0]
max_pooling2d_18 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]
conv2 (Conv2D) [0]	(None, 64, 64, 64) 18496		max_pooling2d_18[0]
max_pooling2d_19 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]
conv3 (Conv2D) [0]	(None, 32, 32, 128) 73856		max_pooling2d_19[0]
max_pooling2d_20 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]
conv4 (Conv2D) [0]	(None, 16, 16, 128) 147584		max_pooling2d_20[0]
conv5 (Conv2D)	(None, 16, 16, 128) 147584		conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128) 147584		conv5[0][0]
up_sampling2d_18 (UpSampling2D)	(None, 32, 32, 128) 0		conv6[0][0]
upsampling3 (Conv2D) [0]	(None, 32, 32, 128) 147584		up_sampling2d_18[0]

concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_19 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_19[0] [0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_20 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_20[0] [0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_6 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]
=====			
Total params: 869,635			
Trainable params: 869,635			
Non-trainable params: 0			

Epoch 1/100

108/108 [=====] - 10s 83ms/step - loss: 0.0993 - accuracy: 0.7551 - val_loss: 0.0879 - val_accuracy: 0.7835

Epoch 00001: val_loss improved from inf to 0.08788, saving model to imgs/experiments/exp1/models/unet_5.h5

Epoch 2/100

108/108 [=====] - 9s 79ms/step - loss: 0.0655 - accuracy: 0.8257 - val_loss: 0.0934 - val_accuracy: 0.7912

Epoch 00002: val_loss did not improve from 0.08788

Epoch 3/100

108/108 [=====] - 9s 79ms/step - loss: 0.0597 - accuracy: 0.8368 - val_loss: 0.1394 - val_accuracy: 0.7739

Epoch 00003: val_loss did not improve from 0.08788

Epoch 4/100

108/108 [=====] - 9s 84ms/step - loss: 0.0574 - accuracy: 0.8412 - val_loss: 0.1079 - val_accuracy: 0.7948

Epoch 00004: val_loss did not improve from 0.08788

Epoch 5/100

108/108 [=====] - 9s 80ms/step - loss: 0.0544 - accuracy: 0.8477 - val_loss: 0.1600 - val_accuracy: 0.7646: 0.0545 - ac

Epoch 00005: val_loss did not improve from 0.08788

Epoch 6/100

108/108 [=====] - 9s 84ms/step - loss: 0.0502 - accuracy: 0.8542 - val_loss: 0.1374 - val_accuracy: 0.7904

Epoch 00006: val_loss did not improve from 0.08788

Epoch 7/100

108/108 [=====] - 9s 85ms/step - loss: 0.0485 - accuracy: 0.8583 - val_loss: 0.1583 - val_accuracy: 0.7962

Epoch 00007: val_loss did not improve from 0.08788

Epoch 8/100

108/108 [=====] - 9s 82ms/step - loss: 0.0466 - accuracy: 0.8622 - val_loss: 0.1526 - val_accuracy: 0.7980

Epoch 00008: val_loss did not improve from 0.08788

Epoch 9/100

108/108 [=====] - 9s 86ms/step - loss: 0.0410 - accuracy: 0.8711 - val_loss: 0.1717 - val_accuracy: 0.7912

Epoch 00009: val_loss did not improve from 0.08788

Epoch 10/100

108/108 [=====] - 9s 87ms/step - loss: 0.0365 - accuracy: 0.8803 - val_loss: 0.1955 - val_accuracy: 0.7975ccu - ETA: 0s - loss: 0

Epoch 00010: val_loss did not improve from 0.08788

Epoch 11/100

108/108 [=====] - 9s 86ms/step - loss: 0.0343 - accuracy: 0.8861 - val_loss: 0.1528 - val_accuracy: 0.8007

Epoch 00011: val_loss did not improve from 0.08788

Epoch 00011: early stopping

time: 6

Model: "model_7"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_8 (InputLayer)	[(None, 128, 128, 8) 0		
conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_8[0][0]
max_pooling2d_21 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64) 18496		max_pooling2d_21[0][0]
max_pooling2d_22 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128) 73856		max_pooling2d_22[0][0]
max_pooling2d_23 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128) 147584		max_pooling2d_23[0][0]
conv5 (Conv2D)	(None, 16, 16, 128) 147584		conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128) 147584		conv5[0][0]

up_sampling2d_21 (UpSampling2D)	(None, 32, 32, 128)	0	conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128)	147584	up_sampling2d_21[0][0]
concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_22 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_22[0][0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_23 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_23[0][0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_7 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]
=====			
Total params: 869,635			
Trainable params: 869,635			
Non-trainable params: 0			

Epoch 1/100

108/108 [=====] - 10s 87ms/step - loss: 0.0939 - accuracy: 0.7444 - val_loss: 0.0915 - val_accuracy: 0.7802

Epoch 00001: val_loss improved from inf to 0.09152, saving model to imgs/experiments/exp1/models/unet_6.h5

Epoch 2/100

108/108 [=====] - 9s 86ms/step - loss: 0.0670 - accuracy: 0.8210 - val_loss: 0.1216 - val_accuracy: 0.7596

Epoch 00002: val_loss did not improve from 0.09152

Epoch 3/100

108/108 [=====] - 9s 85ms/step - loss: 0.0615 - accuracy: 0.8325 - val_loss: 0.1679 - val_accuracy: 0.7680

Epoch 00003: val_loss did not improve from 0.09152

Epoch 4/100

108/108 [=====] - 10s 89ms/step - loss: 0.0571 - accuracy: 0.8399 - val_loss: 0.1331 - val_accuracy: 0.7716

Epoch 00004: val_loss did not improve from 0.09152

Epoch 5/100

108/108 [=====] - 9s 88ms/step - loss: 0.0537 - accuracy:

0.8481 - val_loss: 0.1586 - val_accuracy: 0.7742

Epoch 00005: val_loss did not improve from 0.09152

Epoch 6/100

108/108 [=====] - 10s 89ms/step - loss: 0.0501 - accuracy: 0.8541 - val_loss: 0.1664 - val_accuracy: 0.7875

Epoch 00006: val_loss did not improve from 0.09152

Epoch 7/100

108/108 [=====] - 10s 91ms/step - loss: 0.0482 - accuracy: 0.8575 - val_loss: 0.1462 - val_accuracy: 0.7552

Epoch 00007: val_loss did not improve from 0.09152

Epoch 8/100

108/108 [=====] - 10s 96ms/step - loss: 0.0498 - accuracy: 0.8534 - val_loss: 0.1729 - val_accuracy: 0.7883

Epoch 00008: val_loss did not improve from 0.09152

Epoch 9/100

108/108 [=====] - 10s 94ms/step - loss: 0.0388 - accuracy: 0.8737 - val_loss: 0.1535 - val_accuracy: 0.7903

Epoch 00009: val_loss did not improve from 0.09152

Epoch 10/100

108/108 [=====] - 10s 95ms/step - loss: 0.0367 - accuracy: 0.8806 - val_loss: 0.1711 - val_accuracy: 0.7955

Epoch 00010: val_loss did not improve from 0.09152

Epoch 11/100

108/108 [=====] - 10s 92ms/step - loss: 0.0332 - accuracy: 0.8869 - val_loss: 0.1511 - val_accuracy: 0.7970

Epoch 00011: val_loss did not improve from 0.09152

Epoch 00011: early stopping

time: 7

Model: "model_8"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_9 (InputLayer)	[(None, 128, 128, 8) 0		
conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_9[0][0]
max_pooling2d_24 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64) 18496		max_pooling2d_24[0][0]
max_pooling2d_25 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128) 73856		max_pooling2d_25[0][0]
max_pooling2d_26 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128) 147584		max_pooling2d_26[0]

[0]

conv5 (Conv2D)	(None, 16, 16, 128)	147584	conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128)	147584	conv5[0][0]
up_sampling2d_24 (UpSampling2D)	(None, 32, 32, 128)	0	conv6[0][0]
upsampling3 (Conv2D) [0]	(None, 32, 32, 128)	147584	up_sampling2d_24[0] [0]
concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_25 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D) [0]	(None, 64, 64, 64)	147520	up_sampling2d_25[0] [0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_26 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D) [0]	(None, 128, 128, 32)	36896	up_sampling2d_26[0] [0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_8 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]

=====

Total params: 869,635
 Trainable params: 869,635
 Non-trainable params: 0

Epoch 1/100

108/108 [=====] - 11s 94ms/step - loss: 0.1020 - accuracy:
 0.7316 - val_loss: 0.1007 - val_accuracy: 0.7794

Epoch 00001: val_loss improved from inf to 0.10066, saving model to imgs/experiment
 s/exp1/models\unet_7.h5

Epoch 2/100

108/108 [=====] - 10s 95ms/step - loss: 0.0665 - accuracy:
 0.8259 - val_loss: 0.1007 - val_accuracy: 0.7835

Epoch 00002: val_loss did not improve from 0.10066

Epoch 3/100

108/108 [=====] - 10s 96ms/step - loss: 0.0610 - accuracy:
 0.8351 - val_loss: 0.1402 - val_accuracy: 0.7813

Epoch 00003: val_loss did not improve from 0.10066
 Epoch 4/100
 108/108 [=====] - 10s 95ms/step - loss: 0.0577 - accuracy: 0.8397 - val_loss: 0.1289 - val_accuracy: 0.7817

Epoch 00004: val_loss did not improve from 0.10066
 Epoch 5/100
 108/108 [=====] - 10s 96ms/step - loss: 0.0543 - accuracy: 0.8478 - val_loss: 0.1233 - val_accuracy: 0.7698

Epoch 00005: val_loss did not improve from 0.10066
 Epoch 6/100
 108/108 [=====] - 11s 98ms/step - loss: 0.0498 - accuracy: 0.8554 - val_loss: 0.1217 - val_accuracy: 0.7923

Epoch 00006: val_loss did not improve from 0.10066
 Epoch 7/100
 108/108 [=====] - 11s 99ms/step - loss: 0.0457 - accuracy: 0.8638 - val_loss: 0.1503 - val_accuracy: 0.7725

Epoch 00007: val_loss did not improve from 0.10066
 Epoch 8/100
 108/108 [=====] - 11s 99ms/step - loss: 0.0431 - accuracy: 0.8658 - val_loss: 0.1550 - val_accuracy: 0.7925

Epoch 00008: val_loss did not improve from 0.10066
 Epoch 9/100
 108/108 [=====] - 11s 99ms/step - loss: 0.0395 - accuracy: 0.8748 - val_loss: 0.1429 - val_accuracy: 0.7894

Epoch 00009: val_loss did not improve from 0.10066
 Epoch 10/100
 108/108 [=====] - 11s 100ms/step - loss: 0.0355 - accuracy: 0.8824 - val_loss: 0.1587 - val_accuracy: 0.7951

Epoch 00010: val_loss did not improve from 0.10066
 Epoch 11/100
 108/108 [=====] - 11s 101ms/step - loss: 0.0331 - accuracy: 0.8874 - val_loss: 0.1655 - val_accuracy: 0.7905

Epoch 00011: val_loss did not improve from 0.10066
 Epoch 00011: early stopping
 time: 8
 Model: "model_9"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_10 (InputLayer)	[(None, 128, 128, 8)]	0	

conv1 (Conv2D)	(None, 128, 128, 32)	2336	input_10[0][0]

max_pooling2d_27 (MaxPooling2D)	(None, 64, 64, 32)	0	conv1[0][0]

conv2 (Conv2D)	(None, 64, 64, 64)	18496	max_pooling2d_27[0][0]

max_pooling2d_28 (MaxPooling2D)	(None, 32, 32, 64)	0	conv2[0][0]

conv3 (Conv2D)	(None, 32, 32, 128)	73856	max_pooling2d_28[0]
<hr/>			
max_pooling2d_29 (MaxPooling2D)	(None, 16, 16, 128)	0	conv3[0][0]
<hr/>			
conv4 (Conv2D)	(None, 16, 16, 128)	147584	max_pooling2d_29[0]
<hr/>			
conv5 (Conv2D)	(None, 16, 16, 128)	147584	conv4[0][0]
<hr/>			
conv6 (Conv2D)	(None, 16, 16, 128)	147584	conv5[0][0]
<hr/>			
up_sampling2d_27 (UpSampling2D)	(None, 32, 32, 128)	0	conv6[0][0]
<hr/>			
upsampling3 (Conv2D)	(None, 32, 32, 128)	147584	up_sampling2d_27[0]
<hr/>			
concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
<hr/>			
up_sampling2d_28 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
<hr/>			
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_28[0]
<hr/>			
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
<hr/>			
up_sampling2d_29 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
<hr/>			
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_29[0]
<hr/>			
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
<hr/>			
conv2d_9 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]

=====

Total params: 869,635

Trainable params: 869,635

Non-trainable params: 0

Epoch 1/100

108/108 [=====] - 12s 105ms/step - loss: 0.0943 - accuracy: 0.7555 - val_loss: 0.0974 - val_accuracy: 0.7893

Epoch 00001: val_loss improved from inf to 0.09742, saving model to imgs/experiment s/exp1/models\unet_8.h5

Epoch 2/100

108/108 [=====] - 11s 103ms/step - loss: 0.0672 - accuracy: 0.8226 - val_loss: 0.1040 - val_accuracy: 0.7827

Epoch 00002: val_loss did not improve from 0.09742

Epoch 3/100

108/108 [=====] - 11s 101ms/step - loss: 0.0597 - accuracy: 0.8368 - val_loss: 0.1081 - val_accuracy: 0.7829

Epoch 00003: val_loss did not improve from 0.09742

Epoch 4/100

108/108 [=====] - 11s 105ms/step - loss: 0.0595 - accuracy: 0.8382 - val_loss: 0.1649 - val_accuracy: 0.7339

Epoch 00004: val_loss did not improve from 0.09742

Epoch 5/100

108/108 [=====] - 11s 100ms/step - loss: 0.0555 - accuracy: 0.8439 - val_loss: 0.1362 - val_accuracy: 0.7926

Epoch 00005: val_loss did not improve from 0.09742

Epoch 6/100

108/108 [=====] - 11s 107ms/step - loss: 0.0512 - accuracy: 0.8539 - val_loss: 0.1263 - val_accuracy: 0.7774

Epoch 00006: val_loss did not improve from 0.09742

Epoch 7/100

108/108 [=====] - 12s 107ms/step - loss: 0.0480 - accuracy: 0.8598 - val_loss: 0.1344 - val_accuracy: 0.7923

Epoch 00007: val_loss did not improve from 0.09742

Epoch 8/100

108/108 [=====] - 12s 109ms/step - loss: 0.0436 - accuracy: 0.8675 - val_loss: 0.1426 - val_accuracy: 0.7923

Epoch 00008: val_loss did not improve from 0.09742

Epoch 9/100

108/108 [=====] - 12s 112ms/step - loss: 0.0403 - accuracy: 0.8741 - val_loss: 0.1807 - val_accuracy: 0.7835

Epoch 00009: val_loss did not improve from 0.09742

Epoch 10/100

108/108 [=====] - 12s 114ms/step - loss: 0.0401 - accuracy: 0.8738 - val_loss: 0.1706 - val_accuracy: 0.7967

Epoch 00010: val_loss did not improve from 0.09742

Epoch 11/100

108/108 [=====] - 13s 118ms/step - loss: 0.0336 - accuracy: 0.8866 - val_loss: 0.1732 - val_accuracy: 0.7964

Epoch 00011: val_loss did not improve from 0.09742

Epoch 00011: early stopping

time: 9

Model: "model_10"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_11 (InputLayer)	[(None, 128, 128, 8)]	0	
=====			
conv1 (Conv2D)	(None, 128, 128, 32)	2336	input_11[0][0]
=====			
max_pooling2d_30 (MaxPooling2D)	(None, 64, 64, 32)	0	conv1[0][0]
=====			

conv2 (Conv2D)	(None, 64, 64, 64)	18496	max_pooling2d_30[0]
max_pooling2d_31 (MaxPooling2D)	(None, 32, 32, 64)	0	conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128)	73856	max_pooling2d_31[0]
max_pooling2d_32 (MaxPooling2D)	(None, 16, 16, 128)	0	conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128)	147584	max_pooling2d_32[0]
conv5 (Conv2D)	(None, 16, 16, 128)	147584	conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128)	147584	conv5[0][0]
up_sampling2d_30 (UpSampling2D)	(None, 32, 32, 128)	0	conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128)	147584	up_sampling2d_30[0]
concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_31 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_31[0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_32 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_32[0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_10 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]
=====			
Total params: 869,635			
Trainable params: 869,635			
Non-trainable params: 0			

```

Epoch 1/100
108/108 [=====] - 15s 132ms/step - loss: 0.0966 - accuracy:
0.7423 - val_loss: 0.0949 - val_accuracy: 0.7709

Epoch 00001: val_loss improved from inf to 0.09486, saving model to imgs/experiment
s/exp1/models\UNET_9.h5
Epoch 2/100
108/108 [=====] - 14s 127ms/step - loss: 0.0657 - accuracy:
0.8255 - val_loss: 0.1109 - val_accuracy: 0.7704

Epoch 00002: val_loss did not improve from 0.09486
Epoch 3/100
108/108 [=====] - 14s 134ms/step - loss: 0.0605 - accuracy:
0.8337 - val_loss: 0.1344 - val_accuracy: 0.7762

Epoch 00003: val_loss did not improve from 0.09486
Epoch 4/100
108/108 [=====] - 14s 126ms/step - loss: 0.0583 - accuracy:
0.8403 - val_loss: 0.1197 - val_accuracy: 0.7790

Epoch 00004: val_loss did not improve from 0.09486
Epoch 5/100
108/108 [=====] - 14s 132ms/step - loss: 0.0532 - accuracy:
0.8495 - val_loss: 0.1378 - val_accuracy: 0.7875

Epoch 00005: val_loss did not improve from 0.09486
Epoch 6/100
108/108 [=====] - 14s 127ms/step - loss: 0.0551 - accuracy:
0.8456 - val_loss: 0.1350 - val_accuracy: 0.7933

Epoch 00006: val_loss did not improve from 0.09486
Epoch 7/100
108/108 [=====] - 14s 130ms/step - loss: 0.0484 - accuracy:
0.8608 - val_loss: 0.1585 - val_accuracy: 0.7854

Epoch 00007: val_loss did not improve from 0.09486
Epoch 8/100
108/108 [=====] - 14s 130ms/step - loss: 0.0419 - accuracy:
0.8691 - val_loss: 0.1341 - val_accuracy: 0.7812

Epoch 00008: val_loss did not improve from 0.09486
Epoch 9/100
108/108 [=====] - 14s 130ms/step - loss: 0.0409 - accuracy:
0.8711 - val_loss: 0.1582 - val_accuracy: 0.7957

Epoch 00009: val_loss did not improve from 0.09486
Epoch 10/100
108/108 [=====] - 14s 131ms/step - loss: 0.0368 - accuracy:
0.8803 - val_loss: 0.1652 - val_accuracy: 0.7806

Epoch 00010: val_loss did not improve from 0.09486
Epoch 11/100
108/108 [=====] - 14s 133ms/step - loss: 0.0341 - accuracy:
0.8835 - val_loss: 0.1715 - val_accuracy: 0.7845

Epoch 00011: val_loss did not improve from 0.09486
Epoch 00011: early stopping
time: 10
Model: "model_11"

```

Layer (type)	Output Shape	Param #	Connected to
=====			
=====			

input_12 (InputLayer)	[(None, 128, 128, 8) 0	
conv1 (Conv2D)	(None, 128, 128, 32) 2336	input_12[0][0]
max_pooling2d_33 (MaxPooling2D)	(None, 64, 64, 32) 0	conv1[0][0]
conv2 (Conv2D) [0]	(None, 64, 64, 64) 18496	max_pooling2d_33[0]
max_pooling2d_34 (MaxPooling2D)	(None, 32, 32, 64) 0	conv2[0][0]
conv3 (Conv2D) [0]	(None, 32, 32, 128) 73856	max_pooling2d_34[0]
max_pooling2d_35 (MaxPooling2D)	(None, 16, 16, 128) 0	conv3[0][0]
conv4 (Conv2D) [0]	(None, 16, 16, 128) 147584	max_pooling2d_35[0]
conv5 (Conv2D)	(None, 16, 16, 128) 147584	conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128) 147584	conv5[0][0]
up_sampling2d_33 (UpSampling2D)	(None, 32, 32, 128) 0	conv6[0][0]
upsampling3 (Conv2D) [0]	(None, 32, 32, 128) 147584	up_sampling2d_33[0]
concatenate3 (Concatenate)	(None, 32, 32, 256) 0	conv3[0][0] upsampling3[0][0]
up_sampling2d_34 (UpSampling2D)	(None, 64, 64, 256) 0	concatenate3[0][0]
upsampling2 (Conv2D) [0]	(None, 64, 64, 64) 147520	up_sampling2d_34[0]
concatenate2 (Concatenate)	(None, 64, 64, 128) 0	conv2[0][0] upsampling2[0][0]
up_sampling2d_35 (UpSampling2D)	(None, 128, 128, 128) 0	concatenate2[0][0]
upsampling1 (Conv2D) [0]	(None, 128, 128, 32) 36896	up_sampling2d_35[0]
concatenate1 (Concatenate)	(None, 128, 128, 64) 0	conv1[0][0] upsampling1[0][0]

```

conv2d_11 (Conv2D)                (None, 128, 128, 3) 195      concatenate1[0][0]
=====
Total params: 869,635
Trainable params: 869,635
Non-trainable params: 0
=====

Epoch 1/100
108/108 [=====] - 15s 132ms/step - loss: 0.0927 - accuracy:
0.7432 - val_loss: 0.0973 - val_accuracy: 0.7832

Epoch 00001: val_loss improved from inf to 0.09732, saving model to imgs/experiment
s/exp1/models\unet_10.h5
Epoch 2/100
108/108 [=====] - 14s 135ms/step - loss: 0.0654 - accuracy:
0.8261 - val_loss: 0.1065 - val_accuracy: 0.7750

Epoch 00002: val_loss did not improve from 0.09732
Epoch 3/100
108/108 [=====] - 15s 138ms/step - loss: 0.0618 - accuracy:
0.8309 - val_loss: 0.0860 - val_accuracy: 0.7821

Epoch 00003: val_loss improved from 0.09732 to 0.08598, saving model to imgs/experim
ents/exp1/models\unet_10.h5
Epoch 4/100
108/108 [=====] - 15s 138ms/step - loss: 0.0637 - accuracy:
0.8274 - val_loss: 0.1229 - val_accuracy: 0.7781

Epoch 00004: val_loss did not improve from 0.08598
Epoch 5/100
108/108 [=====] - 14s 134ms/step - loss: 0.0553 - accuracy:
0.8444 - val_loss: 0.1385 - val_accuracy: 0.7721

Epoch 00005: val_loss did not improve from 0.08598
Epoch 6/100
108/108 [=====] - 14s 135ms/step - loss: 0.0524 - accuracy:
0.8494 - val_loss: 0.1600 - val_accuracy: 0.7650

Epoch 00006: val_loss did not improve from 0.08598
Epoch 7/100
108/108 [=====] - 15s 141ms/step - loss: 0.0482 - accuracy:
0.8576 - val_loss: 0.1339 - val_accuracy: 0.7601

Epoch 00007: val_loss did not improve from 0.08598
Epoch 8/100
108/108 [=====] - 15s 140ms/step - loss: 0.0448 - accuracy:
0.8641 - val_loss: 0.1665 - val_accuracy: 0.7776

Epoch 00008: val_loss did not improve from 0.08598
Epoch 9/100
108/108 [=====] - 15s 139ms/step - loss: 0.0426 - accuracy:
0.8694 - val_loss: 0.1567 - val_accuracy: 0.7776

Epoch 00009: val_loss did not improve from 0.08598
Epoch 10/100
108/108 [=====] - 15s 140ms/step - loss: 0.0369 - accuracy:
0.8793 - val_loss: 0.1639 - val_accuracy: 0.7917

Epoch 00010: val_loss did not improve from 0.08598
Epoch 11/100
108/108 [=====] - 15s 142ms/step - loss: 0.0346 - accuracy:
0.8831 - val_loss: 0.1711 - val_accuracy: 0.7942

```

Epoch 00011: val_loss did not improve from 0.08598

Epoch 12/100

108/108 [=====] - 15s 141ms/step - loss: 0.0322 - accuracy: 0.8892 - val_loss: 0.1755 - val_accuracy: 0.7895

Epoch 00012: val_loss did not improve from 0.08598

Epoch 13/100

108/108 [=====] - 16s 145ms/step - loss: 0.0305 - accuracy: 0.8926 - val_loss: 0.1885 - val_accuracy: 0.7949

Epoch 00013: val_loss did not improve from 0.08598

Epoch 00013: early stopping

time: 11

Model: "model_12"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_13 (InputLayer)	[(None, 128, 128, 8) 0		
conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_13[0][0]
max_pooling2d_36 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64) 18496		max_pooling2d_36[0][0]
max_pooling2d_37 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128) 73856		max_pooling2d_37[0][0]
max_pooling2d_38 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128) 147584		max_pooling2d_38[0][0]
conv5 (Conv2D)	(None, 16, 16, 128) 147584		conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128) 147584		conv5[0][0]
up_sampling2d_36 (UpSampling2D)	(None, 32, 32, 128) 0		conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128) 147584		up_sampling2d_36[0][0]
concatenate3 (Concatenate)	(None, 32, 32, 256) 0		conv3[0][0] upsampling3[0][0]
up_sampling2d_37 (UpSampling2D)	(None, 64, 64, 256) 0		concatenate3[0][0]

upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_37[0] [0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_38 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_38[0] [0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_12 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0] =====
Total params: 869,635			
Trainable params: 869,635			
Non-trainable params: 0			

Epoch 1/100

108/108 [=====] - 16s 146ms/step - loss: 0.0987 - accuracy: 0.7339 - val_loss: 0.0936 - val_accuracy: 0.7782

Epoch 00001: val_loss improved from inf to 0.09360, saving model to imgs/experiments/exp1/models/unet_11.h5

Epoch 2/100

108/108 [=====] - 16s 146ms/step - loss: 0.0672 - accuracy: 0.8233 - val_loss: 0.1283 - val_accuracy: 0.7637

Epoch 00002: val_loss did not improve from 0.09360

Epoch 3/100

108/108 [=====] - 15s 141ms/step - loss: 0.0611 - accuracy: 0.8342 - val_loss: 0.1279 - val_accuracy: 0.7754

Epoch 00003: val_loss did not improve from 0.09360

Epoch 4/100

108/108 [=====] - 16s 146ms/step - loss: 0.0588 - accuracy: 0.8381 - val_loss: 0.1675 - val_accuracy: 0.7700

Epoch 00004: val_loss did not improve from 0.09360

Epoch 5/100

108/108 [=====] - 15s 144ms/step - loss: 0.0545 - accuracy: 0.8453 - val_loss: 0.1644 - val_accuracy: 0.7762

Epoch 00005: val_loss did not improve from 0.09360

Epoch 6/100

108/108 [=====] - 16s 145ms/step - loss: 0.0502 - accuracy: 0.8530 - val_loss: 0.1864 - val_accuracy: 0.7727

Epoch 00006: val_loss did not improve from 0.09360

Epoch 7/100

108/108 [=====] - 16s 145ms/step - loss: 0.0456 - accuracy: 0.8603 - val_loss: 0.1647 - val_accuracy: 0.7953

Epoch 00007: val_loss did not improve from 0.09360

Epoch 8/100

108/108 [=====] - 15s 144ms/step - loss: 0.0412 - accuracy: 0.8707 - val_loss: 0.1360 - val_accuracy: 0.7941

Epoch 00008: val_loss did not improve from 0.09360

Epoch 9/100

108/108 [=====] - 16s 149ms/step - loss: 0.0385 - accuracy: 0.8755 - val_loss: 0.1463 - val_accuracy: 0.7897

Epoch 00009: val_loss did not improve from 0.09360

Epoch 10/100

108/108 [=====] - 16s 152ms/step - loss: 0.0359 - accuracy: 0.8798 - val_loss: 0.1579 - val_accuracy: 0.7884

Epoch 00010: val_loss did not improve from 0.09360

Epoch 11/100

108/108 [=====] - 16s 149ms/step - loss: 0.0356 - accuracy: 0.8814 - val_loss: 0.1372 - val_accuracy: 0.7924

Epoch 00011: val_loss did not improve from 0.09360

Epoch 00011: early stopping

time: 12

Model: "model_13"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_14 (InputLayer)	[(None, 128, 128, 8) 0		
conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_14[0][0]
max_pooling2d_39 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64) 18496		max_pooling2d_39[0][0]
max_pooling2d_40 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128) 73856		max_pooling2d_40[0][0]
max_pooling2d_41 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128) 147584		max_pooling2d_41[0][0]
conv5 (Conv2D)	(None, 16, 16, 128) 147584		conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128) 147584		conv5[0][0]
up_sampling2d_39 (UpSampling2D)	(None, 32, 32, 128) 0		conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128) 147584		up_sampling2d_39[0][0]

concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_40 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_40[0] [0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_41 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_41[0] [0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_13 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]
=====			
Total params: 869,635			
Trainable params: 869,635			
Non-trainable params: 0			
Epoch 1/100			
108/108 [=====] - 16s 147ms/step - loss: 0.1003 - accuracy: 0.7526 - val_loss: 0.1209 - val_accuracy: 0.7409			
Epoch 00001: val_loss improved from inf to 0.12087, saving model to imgs/experiments/exp1/models/unet_12.h5			
Epoch 2/100			
108/108 [=====] - 16s 146ms/step - loss: 0.0650 - accuracy: 0.8252 - val_loss: 0.1229 - val_accuracy: 0.7748			
Epoch 00002: val_loss did not improve from 0.12087			
Epoch 3/100			
108/108 [=====] - 16s 146ms/step - loss: 0.0611 - accuracy: 0.8330 - val_loss: 0.1338 - val_accuracy: 0.7714			
Epoch 00003: val_loss did not improve from 0.12087			
Epoch 4/100			
108/108 [=====] - 16s 149ms/step - loss: 0.0575 - accuracy: 0.8409 - val_loss: 0.1462 - val_accuracy: 0.7746			
Epoch 00004: val_loss did not improve from 0.12087			
Epoch 5/100			
108/108 [=====] - 16s 145ms/step - loss: 0.0537 - accuracy: 0.8484 - val_loss: 0.1725 - val_accuracy: 0.7275			
Epoch 00005: val_loss did not improve from 0.12087			
Epoch 6/100			
108/108 [=====] - 16s 149ms/step - loss: 0.0518 - accuracy: 0.8515 - val_loss: 0.1695 - val_accuracy: 0.7724			

Epoch 00006: val_loss did not improve from 0.12087
 Epoch 7/100
 108/108 [=====] - 16s 151ms/step - loss: 0.0481 - accuracy: 0.8584 - val_loss: 0.1579 - val_accuracy: 0.7800

Epoch 00007: val_loss did not improve from 0.12087
 Epoch 8/100
 108/108 [=====] - 16s 149ms/step - loss: 0.0448 - accuracy: 0.8636 - val_loss: 0.1678 - val_accuracy: 0.7748

Epoch 00008: val_loss did not improve from 0.12087
 Epoch 9/100
 108/108 [=====] - 16s 149ms/step - loss: 0.0394 - accuracy: 0.8728 - val_loss: 0.1553 - val_accuracy: 0.7894

Epoch 00009: val_loss did not improve from 0.12087
 Epoch 10/100
 108/108 [=====] - 16s 150ms/step - loss: 0.0370 - accuracy: 0.8785 - val_loss: 0.1405 - val_accuracy: 0.7941

Epoch 00010: val_loss did not improve from 0.12087
 Epoch 11/100
 108/108 [=====] - 16s 150ms/step - loss: 0.0340 - accuracy: 0.8840 - val_loss: 0.1533 - val_accuracy: 0.7814

Epoch 00011: val_loss did not improve from 0.12087
 Epoch 00011: early stopping
 time: 13
 Model: "model_14"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_15 (InputLayer)	[(None, 128, 128, 8) 0		
conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_15[0][0]
max_pooling2d_42 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64) 18496		max_pooling2d_42[0][0]
max_pooling2d_43 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128) 73856		max_pooling2d_43[0][0]
max_pooling2d_44 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128) 147584		max_pooling2d_44[0][0]
conv5 (Conv2D)	(None, 16, 16, 128) 147584		conv4[0][0]

conv6 (Conv2D)	(None, 16, 16, 128)	147584	conv5[0][0]
up_sampling2d_42 (UpSampling2D)	(None, 32, 32, 128)	0	conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128)	147584	up_sampling2d_42[0][0]
concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_43 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_43[0][0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_44 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_44[0][0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_14 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]

=====

Total params: 869,635

Trainable params: 869,635

Non-trainable params: 0

Epoch 1/100

108/108 [=====] - 17s 148ms/step - loss: 0.0983 - accuracy: 0.7375 - val_loss: 0.0983 - val_accuracy: 0.7743

Epoch 00001: val_loss improved from inf to 0.09825, saving model to imgs/experiments/exp1/models/unet_13.h5

Epoch 2/100

108/108 [=====] - 17s 156ms/step - loss: 0.0658 - accuracy: 0.8241 - val_loss: 0.1329 - val_accuracy: 0.7741

Epoch 00002: val_loss did not improve from 0.09825

Epoch 3/100

108/108 [=====] - 16s 146ms/step - loss: 0.0607 - accuracy: 0.8325 - val_loss: 0.1553 - val_accuracy: 0.7669

Epoch 00003: val_loss did not improve from 0.09825

Epoch 4/100

108/108 [=====] - 16s 153ms/step - loss: 0.0576 - accuracy: 0.8397 - val_loss: 0.1595 - val_accuracy: 0.7720

Epoch 00004: val_loss did not improve from 0.09825

Epoch 5/100
 108/108 [=====] - 16s 149ms/step - loss: 0.0539 - accuracy: 0.8473 - val_loss: 0.1605 - val_accuracy: 0.7767

Epoch 00005: val_loss did not improve from 0.09825

Epoch 6/100
 108/108 [=====] - 16s 148ms/step - loss: 0.0492 - accuracy: 0.8545 - val_loss: 0.1699 - val_accuracy: 0.7897

Epoch 00006: val_loss did not improve from 0.09825

Epoch 7/100
 108/108 [=====] - 17s 156ms/step - loss: 0.0464 - accuracy: 0.8606 - val_loss: 0.1780 - val_accuracy: 0.7906

Epoch 00007: val_loss did not improve from 0.09825

Epoch 8/100
 108/108 [=====] - 17s 154ms/step - loss: 0.0420 - accuracy: 0.8684 - val_loss: 0.1787 - val_accuracy: 0.7930

Epoch 00008: val_loss did not improve from 0.09825

Epoch 9/100
 108/108 [=====] - 17s 155ms/step - loss: 0.0370 - accuracy: 0.8791 - val_loss: 0.1711 - val_accuracy: 0.7993

Epoch 00009: val_loss did not improve from 0.09825

Epoch 10/100
 108/108 [=====] - 16s 150ms/step - loss: 0.0344 - accuracy: 0.8844 - val_loss: 0.1459 - val_accuracy: 0.7964

Epoch 00010: val_loss did not improve from 0.09825

Epoch 11/100
 108/108 [=====] - 16s 154ms/step - loss: 0.0324 - accuracy: 0.8895 - val_loss: 0.1646 - val_accuracy: 0.7960

Epoch 00011: val_loss did not improve from 0.09825

Epoch 00011: early stopping
 time: 14
 Model: "model_15"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_16 (InputLayer)	[(None, 128, 128, 8) 0		

conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_16[0][0]

max_pooling2d_45 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]

conv2 (Conv2D)	(None, 64, 64, 64) 18496		max_pooling2d_45[0][0]

max_pooling2d_46 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]

conv3 (Conv2D)	(None, 32, 32, 128) 73856		max_pooling2d_46[0][0]

max_pooling2d_47 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]

conv4 (Conv2D)	(None, 16, 16, 128)	147584	max_pooling2d_47[0]
conv5 (Conv2D)	(None, 16, 16, 128)	147584	conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128)	147584	conv5[0][0]
up_sampling2d_45 (UpSampling2D)	(None, 32, 32, 128)	0	conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128)	147584	up_sampling2d_45[0]
concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_46 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_46[0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_47 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_47[0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]

conv2d_15 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]
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=====
Total params: 869,635
Trainable params: 869,635
Non-trainable params: 0

```

Epoch 1/100

108/108 [=====] - 18s 165ms/step - loss: 0.0994 - accuracy: 0.7470 - val_loss: 0.1069 - val_accuracy: 0.7582

Epoch 00001: val_loss improved from inf to 0.10685, saving model to imgs/experiment s/exp1/models/unet_14.h5

Epoch 2/100

108/108 [=====] - 16s 150ms/step - loss: 0.0670 - accuracy: 0.8216 - val_loss: 0.1157 - val_accuracy: 0.7724

Epoch 00002: val_loss did not improve from 0.10685

Epoch 3/100

108/108 [=====] - 16s 150ms/step - loss: 0.0617 - accuracy:

0.8313 - val_loss: 0.1254 - val_accuracy: 0.7828

Epoch 00003: val_loss did not improve from 0.10685

Epoch 4/100

108/108 [=====] - 16s 149ms/step - loss: 0.0590 - accuracy: 0.8368 - val_loss: 0.1469 - val_accuracy: 0.7610

Epoch 00004: val_loss did not improve from 0.10685

Epoch 5/100

108/108 [=====] - 16s 153ms/step - loss: 0.0566 - accuracy: 0.8426 - val_loss: 0.1391 - val_accuracy: 0.7772

Epoch 00005: val_loss did not improve from 0.10685

Epoch 6/100

108/108 [=====] - 16s 152ms/step - loss: 0.0539 - accuracy: 0.8475 - val_loss: 0.1498 - val_accuracy: 0.7904

Epoch 00006: val_loss did not improve from 0.10685

Epoch 7/100

108/108 [=====] - 16s 151ms/step - loss: 0.0511 - accuracy: 0.8534 - val_loss: 0.1486 - val_accuracy: 0.7918

Epoch 00007: val_loss did not improve from 0.10685

Epoch 8/100

108/108 [=====] - 17s 155ms/step - loss: 0.0480 - accuracy: 0.8586 - val_loss: 0.1545 - val_accuracy: 0.7879

Epoch 00008: val_loss did not improve from 0.10685

Epoch 9/100

108/108 [=====] - 17s 157ms/step - loss: 0.0448 - accuracy: 0.8640 - val_loss: 0.1591 - val_accuracy: 0.7896

Epoch 00009: val_loss did not improve from 0.10685

Epoch 10/100

108/108 [=====] - 16s 152ms/step - loss: 0.0404 - accuracy: 0.8726 - val_loss: 0.1309 - val_accuracy: 0.7982

Epoch 00010: val_loss did not improve from 0.10685

Epoch 11/100

108/108 [=====] - 16s 150ms/step - loss: 0.0386 - accuracy: 0.8759 - val_loss: 0.1411 - val_accuracy: 0.7874

Epoch 00011: val_loss did not improve from 0.10685

Epoch 00011: early stopping

time: 15

Model: "model_16"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_17 (InputLayer)	[(None, 128, 128, 8)]	0	

conv1 (Conv2D)	(None, 128, 128, 32)	2336	input_17[0][0]

max_pooling2d_48 (MaxPooling2D)	(None, 64, 64, 32)	0	conv1[0][0]

conv2 (Conv2D)	(None, 64, 64, 64)	18496	max_pooling2d_48[0][0]

max_pooling2d_49 (MaxPooling2D)	(None, 32, 32, 64)	0	conv2[0][0]

conv3 (Conv2D)	(None, 32, 32, 128)	73856	max_pooling2d_49[0]
max_pooling2d_50 (MaxPooling2D)	(None, 16, 16, 128)	0	conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128)	147584	max_pooling2d_50[0]
conv5 (Conv2D)	(None, 16, 16, 128)	147584	conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128)	147584	conv5[0][0]
up_sampling2d_48 (UpSampling2D)	(None, 32, 32, 128)	0	conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128)	147584	up_sampling2d_48[0]
concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_49 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_49[0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_50 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_50[0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_16 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]
=====			
Total params: 869,635			
Trainable params: 869,635			
Non-trainable params: 0			

Epoch 1/100

108/108 [=====] - 17s 150ms/step - loss: 0.1009 - accuracy: 0.7283 - val_loss: 0.1045 - val_accuracy: 0.7556

Epoch 00001: val_loss improved from inf to 0.10448, saving model to imgs/experiment

```

s/exp1/models\unet_15.h5
Epoch 2/100
108/108 [=====] - 16s 148ms/step - loss: 0.0664 - accuracy:
0.8249 - val_loss: 0.1155 - val_accuracy: 0.7768

Epoch 00002: val_loss did not improve from 0.10448
Epoch 3/100
108/108 [=====] - 16s 151ms/step - loss: 0.0623 - accuracy:
0.8348 - val_loss: 0.1301 - val_accuracy: 0.7765

Epoch 00003: val_loss did not improve from 0.10448
Epoch 4/100
108/108 [=====] - 16s 151ms/step - loss: 0.0581 - accuracy:
0.8403 - val_loss: 0.1733 - val_accuracy: 0.7572

Epoch 00004: val_loss did not improve from 0.10448
Epoch 5/100
108/108 [=====] - 16s 145ms/step - loss: 0.0552 - accuracy:
0.8460 - val_loss: 0.1655 - val_accuracy: 0.7753

Epoch 00005: val_loss did not improve from 0.10448
Epoch 6/100
108/108 [=====] - 16s 150ms/step - loss: 0.0511 - accuracy:
0.8528 - val_loss: 0.1548 - val_accuracy: 0.7914

Epoch 00006: val_loss did not improve from 0.10448
Epoch 7/100
108/108 [=====] - 16s 153ms/step - loss: 0.0485 - accuracy:
0.8594 - val_loss: 0.1707 - val_accuracy: 0.7782

Epoch 00007: val_loss did not improve from 0.10448
Epoch 8/100
108/108 [=====] - 16s 149ms/step - loss: 0.0441 - accuracy:
0.8665 - val_loss: 0.1778 - val_accuracy: 0.7718

Epoch 00008: val_loss did not improve from 0.10448
Epoch 9/100
108/108 [=====] - 16s 148ms/step - loss: 0.0397 - accuracy:
0.8760 - val_loss: 0.1635 - val_accuracy: 0.7851

Epoch 00009: val_loss did not improve from 0.10448
Epoch 10/100
108/108 [=====] - 16s 149ms/step - loss: 0.0366 - accuracy:
0.8803 - val_loss: 0.1373 - val_accuracy: 0.8002

Epoch 00010: val_loss did not improve from 0.10448
Epoch 11/100
108/108 [=====] - 16s 149ms/step - loss: 0.0343 - accuracy:
0.8856 - val_loss: 0.1574 - val_accuracy: 0.7769

Epoch 00011: val_loss did not improve from 0.10448
Epoch 00011: early stopping
time: 16
Model: "model_17"

```

Layer (type)	Output Shape	Param #	Connected to
=====			
input_18 (InputLayer)	[(None, 128, 128, 8) 0		
=====			
conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_18[0][0]
=====			

max_pooling2d_51 (MaxPooling2D)	(None, 64, 64, 32)	0	conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64)	18496	max_pooling2d_51[0][0]
max_pooling2d_52 (MaxPooling2D)	(None, 32, 32, 64)	0	conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128)	73856	max_pooling2d_52[0][0]
max_pooling2d_53 (MaxPooling2D)	(None, 16, 16, 128)	0	conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128)	147584	max_pooling2d_53[0][0]
conv5 (Conv2D)	(None, 16, 16, 128)	147584	conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128)	147584	conv5[0][0]
up_sampling2d_51 (UpSampling2D)	(None, 32, 32, 128)	0	conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128)	147584	up_sampling2d_51[0][0]
concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_52 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_52[0][0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_53 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_53[0][0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_17 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]
=====			
Total params: 869,635			
Trainable params: 869,635			

Non-trainable params: 0

Epoch 1/100

108/108 [=====] - 17s 150ms/step - loss: 0.0965 - accuracy: 0.7453 - val_loss: 0.1157 - val_accuracy: 0.7591

Epoch 00001: val_loss improved from inf to 0.11574, saving model to imgs/experiments/exp1/models\UNET_16.h5

Epoch 2/100

108/108 [=====] - 16s 150ms/step - loss: 0.0669 - accuracy: 0.8225 - val_loss: 0.1285 - val_accuracy: 0.7627

Epoch 00002: val_loss did not improve from 0.11574

Epoch 3/100

108/108 [=====] - 16s 151ms/step - loss: 0.0602 - accuracy: 0.8371 - val_loss: 0.1372 - val_accuracy: 0.7646

Epoch 00003: val_loss did not improve from 0.11574

Epoch 4/100

108/108 [=====] - 16s 149ms/step - loss: 0.0577 - accuracy: 0.8412 - val_loss: 0.1501 - val_accuracy: 0.7742

Epoch 00004: val_loss did not improve from 0.11574

Epoch 5/100

108/108 [=====] - 16s 147ms/step - loss: 0.0542 - accuracy: 0.8478 - val_loss: 0.1661 - val_accuracy: 0.7738

Epoch 00005: val_loss did not improve from 0.11574

Epoch 6/100

108/108 [=====] - 16s 147ms/step - loss: 0.0532 - accuracy: 0.8510 - val_loss: 0.1572 - val_accuracy: 0.7788

Epoch 00006: val_loss did not improve from 0.11574

Epoch 7/100

108/108 [=====] - 16s 148ms/step - loss: 0.0470 - accuracy: 0.8611 - val_loss: 0.1621 - val_accuracy: 0.7795

Epoch 00007: val_loss did not improve from 0.11574

Epoch 8/100

108/108 [=====] - 16s 149ms/step - loss: 0.0410 - accuracy: 0.8724 - val_loss: 0.1475 - val_accuracy: 0.7923

Epoch 00008: val_loss did not improve from 0.11574

Epoch 9/100

108/108 [=====] - 16s 148ms/step - loss: 0.0378 - accuracy: 0.8770 - val_loss: 0.1676 - val_accuracy: 0.7930

Epoch 00009: val_loss did not improve from 0.11574

Epoch 10/100

108/108 [=====] - 16s 148ms/step - loss: 0.0358 - accuracy: 0.8823 - val_loss: 0.1537 - val_accuracy: 0.7946

Epoch 00010: val_loss did not improve from 0.11574

Epoch 11/100

108/108 [=====] - 16s 150ms/step - loss: 0.0334 - accuracy: 0.8862 - val_loss: 0.1592 - val_accuracy: 0.7941

Epoch 00011: val_loss did not improve from 0.11574

Epoch 00011: early stopping

time: 17

Model: "model_18"

Layer (type)	Output Shape	Param #	Connected to
--------------	--------------	---------	--------------

=====		
=====		
input_19 (InputLayer)	[(None, 128, 128, 8) 0	
conv1 (Conv2D)	(None, 128, 128, 32) 2336	input_19[0][0]
max_pooling2d_54 (MaxPooling2D)	(None, 64, 64, 32) 0	conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64) 18496	max_pooling2d_54[0]
max_pooling2d_55 (MaxPooling2D)	(None, 32, 32, 64) 0	conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128) 73856	max_pooling2d_55[0]
max_pooling2d_56 (MaxPooling2D)	(None, 16, 16, 128) 0	conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128) 147584	max_pooling2d_56[0]
conv5 (Conv2D)	(None, 16, 16, 128) 147584	conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128) 147584	conv5[0][0]
up_sampling2d_54 (UpSampling2D)	(None, 32, 32, 128) 0	conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128) 147584	up_sampling2d_54[0]
concatenate3 (Concatenate)	(None, 32, 32, 256) 0	conv3[0][0] upsampling3[0][0]
up_sampling2d_55 (UpSampling2D)	(None, 64, 64, 256) 0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64) 147520	up_sampling2d_55[0]
concatenate2 (Concatenate)	(None, 64, 64, 128) 0	conv2[0][0] upsampling2[0][0]
up_sampling2d_56 (UpSampling2D)	(None, 128, 128, 128) 0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32) 36896	up_sampling2d_56[0]
concatenate1 (Concatenate)	(None, 128, 128, 64) 0	conv1[0][0]

```

conv2d_18 (Conv2D)                (None, 128, 128, 3) 195      concatenate1[0][0]
=====
Total params: 869,635
Trainable params: 869,635
Non-trainable params: 0

```

```

Epoch 1/100
108/108 [=====] - 17s 148ms/step - loss: 0.1016 - accuracy:
0.7235 - val_loss: 0.1105 - val_accuracy: 0.7818

Epoch 00001: val_loss improved from inf to 0.11050, saving model to imgs/experiment
s/exp1/models\unet_17.h5
Epoch 2/100
108/108 [=====] - 16s 149ms/step - loss: 0.0673 - accuracy:
0.8211 - val_loss: 0.1098 - val_accuracy: 0.7778

Epoch 00002: val_loss improved from 0.11050 to 0.10976, saving model to imgs/experim
ents/exp1/models\unet_17.h5
Epoch 3/100
108/108 [=====] - 16s 150ms/step - loss: 0.0624 - accuracy:
0.8320 - val_loss: 0.1319 - val_accuracy: 0.7710

Epoch 00003: val_loss did not improve from 0.10976
Epoch 4/100
108/108 [=====] - 16s 150ms/step - loss: 0.0572 - accuracy:
0.8425 - val_loss: 0.1541 - val_accuracy: 0.7726

Epoch 00004: val_loss did not improve from 0.10976
Epoch 5/100
108/108 [=====] - 16s 151ms/step - loss: 0.0557 - accuracy:
0.8442 - val_loss: 0.1426 - val_accuracy: 0.7667

Epoch 00005: val_loss did not improve from 0.10976
Epoch 6/100
108/108 [=====] - 16s 151ms/step - loss: 0.0510 - accuracy:
0.8521 - val_loss: 0.1451 - val_accuracy: 0.7752

Epoch 00006: val_loss did not improve from 0.10976
Epoch 7/100
108/108 [=====] - 16s 152ms/step - loss: 0.0461 - accuracy:
0.8614 - val_loss: 0.1606 - val_accuracy: 0.7796

Epoch 00007: val_loss did not improve from 0.10976
Epoch 8/100
108/108 [=====] - 16s 150ms/step - loss: 0.0441 - accuracy:
0.8653 - val_loss: 0.1577 - val_accuracy: 0.7955

Epoch 00008: val_loss did not improve from 0.10976
Epoch 9/100
108/108 [=====] - 20s 183ms/step - loss: 0.0418 - accuracy:
0.8698 - val_loss: 0.1633 - val_accuracy: 0.7943

Epoch 00009: val_loss did not improve from 0.10976
Epoch 10/100
108/108 [=====] - 19s 174ms/step - loss: 0.0360 - accuracy:
0.8807 - val_loss: 0.1582 - val_accuracy: 0.7953

Epoch 00010: val_loss did not improve from 0.10976
Epoch 11/100
108/108 [=====] - 17s 156ms/step - loss: 0.0349 - accuracy:

```

0.8832 - val_loss: 0.1669 - val_accuracy: 0.7875

Epoch 00011: val_loss did not improve from 0.10976

Epoch 12/100

108/108 [=====] - 17s 155ms/step - loss: 0.0324 - accuracy:

0.8874 - val_loss: 0.1980 - val_accuracy: 0.7898

Epoch 00012: val_loss did not improve from 0.10976

Epoch 00012: early stopping

time: 18

Model: "model_19"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_20 (InputLayer)	[(None, 128, 128, 8) 0		
conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_20[0][0]
max_pooling2d_57 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64) 18496		max_pooling2d_57[0][0]
max_pooling2d_58 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128) 73856		max_pooling2d_58[0][0]
max_pooling2d_59 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128) 147584		max_pooling2d_59[0][0]
conv5 (Conv2D)	(None, 16, 16, 128) 147584		conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128) 147584		conv5[0][0]
up_sampling2d_57 (UpSampling2D)	(None, 32, 32, 128) 0		conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128) 147584		up_sampling2d_57[0][0]
concatenate3 (Concatenate)	(None, 32, 32, 256) 0		conv3[0][0] upsampling3[0][0]
up_sampling2d_58 (UpSampling2D)	(None, 64, 64, 256) 0		concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64) 147520		up_sampling2d_58[0][0]

concatenate2 (Concatenate)	(None, 64, 64, 128) 0	conv2[0][0] upsampling2[0][0]
up_sampling2d_59 (UpSampling2D)	(None, 128, 128, 128) 0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32) 36896	up_sampling2d_59[0][0]
concatenate1 (Concatenate)	(None, 128, 128, 64) 0	conv1[0][0] upsampling1[0][0]
conv2d_19 (Conv2D)	(None, 128, 128, 3) 195	concatenate1[0][0]
=====		
Total params: 869,635		
Trainable params: 869,635		
Non-trainable params: 0		

Epoch 1/100

108/108 [=====] - 20s 177ms/step - loss: 0.0992 - accuracy: 0.7464 - val_loss: 0.1029 - val_accuracy: 0.7729

Epoch 00001: val_loss improved from inf to 0.10292, saving model to imgs/experiments/exp1/models/unet_18.h5

Epoch 2/100

108/108 [=====] - 17s 155ms/step - loss: 0.0658 - accuracy: 0.8275 - val_loss: 0.1088 - val_accuracy: 0.7892

Epoch 00002: val_loss did not improve from 0.10292

Epoch 3/100

108/108 [=====] - 17s 156ms/step - loss: 0.0612 - accuracy: 0.8337 - val_loss: 0.1321 - val_accuracy: 0.7637

Epoch 00003: val_loss did not improve from 0.10292

Epoch 4/100

108/108 [=====] - 17s 159ms/step - loss: 0.0565 - accuracy: 0.8439 - val_loss: 0.1402 - val_accuracy: 0.7722

Epoch 00004: val_loss did not improve from 0.10292

Epoch 5/100

108/108 [=====] - 17s 157ms/step - loss: 0.0553 - accuracy: 0.8447 - val_loss: 0.0976 - val_accuracy: 0.7898

Epoch 00005: val_loss improved from 0.10292 to 0.09758, saving model to imgs/experiments/exp1/models/unet_18.h5

Epoch 6/100

108/108 [=====] - 17s 157ms/step - loss: 0.0552 - accuracy: 0.8403 - val_loss: 0.1397 - val_accuracy: 0.7845

Epoch 00006: val_loss did not improve from 0.09758

Epoch 7/100

108/108 [=====] - 17s 159ms/step - loss: 0.0489 - accuracy: 0.8584 - val_loss: 0.1682 - val_accuracy: 0.7936

Epoch 00007: val_loss did not improve from 0.09758

Epoch 8/100

108/108 [=====] - 17s 155ms/step - loss: 0.0488 - accuracy: 0.8570 - val_loss: 0.1656 - val_accuracy: 0.7787

Epoch 00008: val_loss did not improve from 0.09758
 Epoch 9/100
 108/108 [=====] - 17s 158ms/step - loss: 0.0449 - accuracy: 0.8640 - val_loss: 0.1447 - val_accuracy: 0.7884

Epoch 00009: val_loss did not improve from 0.09758
 Epoch 10/100
 108/108 [=====] - 17s 156ms/step - loss: 0.0407 - accuracy: 0.8712 - val_loss: 0.1470 - val_accuracy: 0.7793

Epoch 00010: val_loss did not improve from 0.09758
 Epoch 11/100
 108/108 [=====] - 17s 159ms/step - loss: 0.0374 - accuracy: 0.8788 - val_loss: 0.2017 - val_accuracy: 0.7670

Epoch 00011: val_loss did not improve from 0.09758
 Epoch 12/100
 108/108 [=====] - 17s 155ms/step - loss: 0.0350 - accuracy: 0.8826 - val_loss: 0.2033 - val_accuracy: 0.7881

Epoch 00012: val_loss did not improve from 0.09758
 Epoch 13/100
 108/108 [=====] - 17s 157ms/step - loss: 0.0316 - accuracy: 0.8903 - val_loss: 0.2088 - val_accuracy: 0.7849

Epoch 00013: val_loss did not improve from 0.09758
 Epoch 14/100
 108/108 [=====] - 17s 155ms/step - loss: 0.0324 - accuracy: 0.8898 - val_loss: 0.2065 - val_accuracy: 0.7904

Epoch 00014: val_loss did not improve from 0.09758
 Epoch 15/100
 108/108 [=====] - 17s 158ms/step - loss: 0.0303 - accuracy: 0.8950 - val_loss: 0.2283 - val_accuracy: 0.7791

Epoch 00015: val_loss did not improve from 0.09758
 Epoch 00015: early stopping
 time: 19
 Model: "model_20"

Layer (type)	Output Shape	Param #	Connected to
input_21 (InputLayer)	[(None, 128, 128, 8) 0		
conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_21[0][0]
max_pooling2d_60 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64) 18496		max_pooling2d_60[0][0]
max_pooling2d_61 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128) 73856		max_pooling2d_61[0][0]

max_pooling2d_62 (MaxPooling2D)	(None, 16, 16, 128)	0	conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128)	147584	max_pooling2d_62[0][0]
conv5 (Conv2D)	(None, 16, 16, 128)	147584	conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128)	147584	conv5[0][0]
up_sampling2d_60 (UpSampling2D)	(None, 32, 32, 128)	0	conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128)	147584	up_sampling2d_60[0][0]
concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_61 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_61[0][0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_62 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_62[0][0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_20 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]
=====			
Total params: 869,635			
Trainable params: 869,635			
Non-trainable params: 0			

Epoch 1/100

108/108 [=====] - 18s 157ms/step - loss: 0.0980 - accuracy: 0.7502 - val_loss: 0.1038 - val_accuracy: 0.7769

Epoch 00001: val_loss improved from inf to 0.10376, saving model to imgs/experiments/exp1/models/unet_19.h5

Epoch 2/100

108/108 [=====] - 17s 157ms/step - loss: 0.0655 - accuracy: 0.8271 - val_loss: 0.0939 - val_accuracy: 0.7886

Epoch 00002: val_loss improved from 0.10376 to 0.09386, saving model to imgs/experiments/exp2/models/unet_19.h5

ents/exp1/models\unet_19.h5

Epoch 3/100

108/108 [=====] - 17s 161ms/step - loss: 0.0639 - accuracy: 0.8292 - val_loss: 0.1089 - val_accuracy: 0.7787

Epoch 00003: val_loss did not improve from 0.09386

Epoch 4/100

108/108 [=====] - 17s 160ms/step - loss: 0.0573 - accuracy: 0.8428 - val_loss: 0.1203 - val_accuracy: 0.7731

Epoch 00004: val_loss did not improve from 0.09386

Epoch 5/100

108/108 [=====] - 17s 159ms/step - loss: 0.0556 - accuracy: 0.8460 - val_loss: 0.0983 - val_accuracy: 0.8012

Epoch 00005: val_loss did not improve from 0.09386

Epoch 6/100

108/108 [=====] - 17s 161ms/step - loss: 0.0517 - accuracy: 0.8523 - val_loss: 0.1181 - val_accuracy: 0.7935

Epoch 00006: val_loss did not improve from 0.09386

Epoch 7/100

108/108 [=====] - 17s 161ms/step - loss: 0.0462 - accuracy: 0.8625 - val_loss: 0.1308 - val_accuracy: 0.7800

Epoch 00007: val_loss did not improve from 0.09386

Epoch 8/100

108/108 [=====] - 17s 162ms/step - loss: 0.0455 - accuracy: 0.8634 - val_loss: 0.1406 - val_accuracy: 0.7943

Epoch 00008: val_loss did not improve from 0.09386

Epoch 9/100

108/108 [=====] - 17s 162ms/step - loss: 0.0405 - accuracy: 0.8727 - val_loss: 0.1625 - val_accuracy: 0.7955

Epoch 00009: val_loss did not improve from 0.09386

Epoch 10/100

108/108 [=====] - 17s 159ms/step - loss: 0.0383 - accuracy: 0.8775 - val_loss: 0.1759 - val_accuracy: 0.7880

Epoch 00010: val_loss did not improve from 0.09386

Epoch 11/100

108/108 [=====] - 17s 157ms/step - loss: 0.0341 - accuracy: 0.8845 - val_loss: 0.2012 - val_accuracy: 0.7982

Epoch 00011: val_loss did not improve from 0.09386

Epoch 12/100

108/108 [=====] - 17s 158ms/step - loss: 0.0315 - accuracy: 0.8905 - val_loss: 0.1869 - val_accuracy: 0.7933

Epoch 00012: val_loss did not improve from 0.09386

Epoch 00012: early stopping

time: 20

Model: "model_21"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_22 (InputLayer)	[(None, 128, 128, 8)]	0	

conv1 (Conv2D)	(None, 128, 128, 32)	2336	input_22[0][0]

max_pooling2d_63 (MaxPooling2D)	(None, 64, 64, 32)	0	conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64)	18496	max_pooling2d_63[0]
max_pooling2d_64 (MaxPooling2D)	(None, 32, 32, 64)	0	conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128)	73856	max_pooling2d_64[0]
max_pooling2d_65 (MaxPooling2D)	(None, 16, 16, 128)	0	conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128)	147584	max_pooling2d_65[0]
conv5 (Conv2D)	(None, 16, 16, 128)	147584	conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128)	147584	conv5[0][0]
up_sampling2d_63 (UpSampling2D)	(None, 32, 32, 128)	0	conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128)	147584	up_sampling2d_63[0]
concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_64 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_64[0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_65 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_65[0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_21 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]
=====			
Total params: 869,635			
Trainable params: 869,635			

Non-trainable params: 0

Epoch 1/100

108/108 [=====] - 18s 163ms/step - loss: 0.0935 - accuracy: 0.7402 - val_loss: 0.1194 - val_accuracy: 0.7528

Epoch 00001: val_loss improved from inf to 0.11935, saving model to imgs/experiments/exp1/models/unet_20.h5

Epoch 2/100

108/108 [=====] - 17s 157ms/step - loss: 0.0648 - accuracy: 0.8273 - val_loss: 0.1170 - val_accuracy: 0.7629

Epoch 00002: val_loss improved from 0.11935 to 0.11700, saving model to imgs/experiments/exp1/models/unet_20.h5

Epoch 3/100

108/108 [=====] - 17s 159ms/step - loss: 0.0625 - accuracy: 0.8329 - val_loss: 0.1164 - val_accuracy: 0.7740

Epoch 00003: val_loss improved from 0.11700 to 0.11639, saving model to imgs/experiments/exp1/models/unet_20.h5

Epoch 4/100

108/108 [=====] - 17s 159ms/step - loss: 0.0580 - accuracy: 0.8410 - val_loss: 0.1405 - val_accuracy: 0.7622

Epoch 00004: val_loss did not improve from 0.11639

Epoch 5/100

108/108 [=====] - 17s 162ms/step - loss: 0.0557 - accuracy: 0.8463 - val_loss: 0.1278 - val_accuracy: 0.7689

Epoch 00005: val_loss did not improve from 0.11639

Epoch 6/100

108/108 [=====] - 17s 160ms/step - loss: 0.0539 - accuracy: 0.8470 - val_loss: 0.1329 - val_accuracy: 0.7773

Epoch 00006: val_loss did not improve from 0.11639

Epoch 7/100

108/108 [=====] - 17s 162ms/step - loss: 0.0497 - accuracy: 0.8545 - val_loss: 0.1633 - val_accuracy: 0.7745

Epoch 00007: val_loss did not improve from 0.11639

Epoch 8/100

108/108 [=====] - 17s 159ms/step - loss: 0.0498 - accuracy: 0.8567 - val_loss: 0.1605 - val_accuracy: 0.7776

Epoch 00008: val_loss did not improve from 0.11639

Epoch 9/100

108/108 [=====] - 17s 159ms/step - loss: 0.0431 - accuracy: 0.8680 - val_loss: 0.1607 - val_accuracy: 0.7862

Epoch 00009: val_loss did not improve from 0.11639

Epoch 10/100

108/108 [=====] - 17s 159ms/step - loss: 0.0404 - accuracy: 0.8727 - val_loss: 0.1841 - val_accuracy: 0.7910

Epoch 00010: val_loss did not improve from 0.11639

Epoch 11/100

108/108 [=====] - 17s 158ms/step - loss: 0.0384 - accuracy: 0.8770 - val_loss: 0.1925 - val_accuracy: 0.7896

Epoch 00011: val_loss did not improve from 0.11639

Epoch 12/100

108/108 [=====] - 17s 160ms/step - loss: 0.0344 - accuracy: 0.8851 - val_loss: 0.1753 - val_accuracy: 0.7915

Epoch 00012: val_loss did not improve from 0.11639

Epoch 13/100

108/108 [=====] - 17s 161ms/step - loss: 0.0343 - accuracy: 0.8840 - val_loss: 0.1887 - val_accuracy: 0.7897

Epoch 00013: val_loss did not improve from 0.11639

Epoch 00013: early stopping

time: 21

Model: "model_22"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_23 (InputLayer)	[(None, 128, 128, 8) 0		
conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_23[0][0]
max_pooling2d_66 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64) 18496		max_pooling2d_66[0][0]
max_pooling2d_67 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128) 73856		max_pooling2d_67[0][0]
max_pooling2d_68 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128) 147584		max_pooling2d_68[0][0]
conv5 (Conv2D)	(None, 16, 16, 128) 147584		conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128) 147584		conv5[0][0]
up_sampling2d_66 (UpSampling2D)	(None, 32, 32, 128) 0		conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128) 147584		up_sampling2d_66[0][0]
concatenate3 (Concatenate)	(None, 32, 32, 256) 0		conv3[0][0] upsampling3[0][0]
up_sampling2d_67 (UpSampling2D)	(None, 64, 64, 256) 0		concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64) 147520		up_sampling2d_67[0][0]

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concatenate2 (Concatenate)	(None, 64, 64, 128) 0	conv2[0][0] upsampling2[0][0]
<hr/>		
up_sampling2d_68 (UpSampling2D)	(None, 128, 128, 128 0	concatenate2[0][0]
<hr/>		
upsampling1 (Conv2D)	(None, 128, 128, 32) 36896	up_sampling2d_68[0] [0]
<hr/>		
concatenate1 (Concatenate)	(None, 128, 128, 64) 0	conv1[0][0] upsampling1[0][0]
<hr/>		
conv2d_22 (Conv2D)	(None, 128, 128, 3) 195	concatenate1[0][0]
<hr/>		

=====

Total params: 869,635
Trainable params: 869,635
Non-trainable params: 0

=====

Epoch 1/100

108/108 [=====] - 18s 165ms/step - loss: 0.0964 - accuracy: 0.7492 - val_loss: 0.1021 - val_accuracy: 0.7730

Epoch 00001: val_loss improved from inf to 0.10210, saving model to imgs/experiments/exp1/models\unet_21.h5

Epoch 2/100

108/108 [=====] - 18s 163ms/step - loss: 0.0659 - accuracy: 0.8237 - val_loss: 0.0928 - val_accuracy: 0.7776

Epoch 00002: val_loss improved from 0.10210 to 0.09276, saving model to imgs/experiments/exp1/models\unet_21.h5

Epoch 3/100

108/108 [=====] - 18s 164ms/step - loss: 0.0637 - accuracy: 0.8288 - val_loss: 0.1098 - val_accuracy: 0.7863

Epoch 00003: val_loss did not improve from 0.09276

Epoch 4/100

108/108 [=====] - 17s 160ms/step - loss: 0.0576 - accuracy: 0.8400 - val_loss: 0.1311 - val_accuracy: 0.7788

Epoch 00004: val_loss did not improve from 0.09276

Epoch 5/100

108/108 [=====] - 17s 158ms/step - loss: 0.0552 - accuracy: 0.8445 - val_loss: 0.1572 - val_accuracy: 0.7625

Epoch 00005: val_loss did not improve from 0.09276

Epoch 6/100

108/108 [=====] - 17s 161ms/step - loss: 0.0506 - accuracy: 0.8545 - val_loss: 0.1359 - val_accuracy: 0.7916

Epoch 00006: val_loss did not improve from 0.09276

Epoch 7/100

108/108 [=====] - 17s 162ms/step - loss: 0.0481 - accuracy: 0.8581 - val_loss: 0.1617 - val_accuracy: 0.7712

Epoch 00007: val_loss did not improve from 0.09276

Epoch 8/100

108/108 [=====] - 17s 160ms/step - loss: 0.0430 - accuracy: 0.8694 - val_loss: 0.1581 - val_accuracy: 0.7955

Epoch 00008: val_loss did not improve from 0.09276

localhost:8889/nbconvert/html/Ferrari/proj_1/projeto/02-Train and Eval.ipynb?download=false

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Epoch 9/100

108/108 [=====] - 17s 161ms/step - loss: 0.0387 - accuracy: 0.8763 - val_loss: 0.1728 - val_accuracy: 0.7844

Epoch 00009: val_loss did not improve from 0.09276

Epoch 10/100

108/108 [=====] - 17s 161ms/step - loss: 0.0358 - accuracy: 0.8808 - val_loss: 0.1688 - val_accuracy: 0.7916

Epoch 00010: val_loss did not improve from 0.09276

Epoch 11/100

108/108 [=====] - 18s 164ms/step - loss: 0.0359 - accuracy: 0.8828 - val_loss: 0.1962 - val_accuracy: 0.7930

Epoch 00011: val_loss did not improve from 0.09276

Epoch 12/100

108/108 [=====] - 17s 162ms/step - loss: 0.0322 - accuracy: 0.8892 - val_loss: 0.1793 - val_accuracy: 0.7940

Epoch 00012: val_loss did not improve from 0.09276

Epoch 00012: early stopping

time: 22

Model: "model_23"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_24 (InputLayer)	[(None, 128, 128, 8) 0		
conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_24[0][0]
max_pooling2d_69 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64) 18496		max_pooling2d_69[0][0]
max_pooling2d_70 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128) 73856		max_pooling2d_70[0][0]
max_pooling2d_71 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128) 147584		max_pooling2d_71[0][0]
conv5 (Conv2D)	(None, 16, 16, 128) 147584		conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128) 147584		conv5[0][0]
up_sampling2d_69 (UpSampling2D)	(None, 32, 32, 128) 0		conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128) 147584		up_sampling2d_69[0]

[0]

concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_70 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_70[0] [0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_71 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_71[0] [0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_23 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]

=====

Total params: 869,635
 Trainable params: 869,635
 Non-trainable params: 0

Epoch 1/100

108/108 [=====] - 18s 163ms/step - loss: 0.1033 - accuracy:
 0.7161 - val_loss: 0.0923 - val_accuracy: 0.7773

Epoch 00001: val_loss improved from inf to 0.09225, saving model to imgs/experiments/exp1/models/unet_22.h5

Epoch 2/100

108/108 [=====] - 18s 169ms/step - loss: 0.0678 - accuracy:
 0.8239 - val_loss: 0.1009 - val_accuracy: 0.7876

Epoch 00002: val_loss did not improve from 0.09225

Epoch 3/100

108/108 [=====] - 20s 187ms/step - loss: 0.0598 - accuracy:
 0.8398 - val_loss: 0.1365 - val_accuracy: 0.7516

Epoch 00003: val_loss did not improve from 0.09225

Epoch 4/100

108/108 [=====] - 19s 175ms/step - loss: 0.0564 - accuracy:
 0.8441 - val_loss: 0.1246 - val_accuracy: 0.7832

Epoch 00004: val_loss did not improve from 0.09225

Epoch 5/100

108/108 [=====] - 17s 162ms/step - loss: 0.0549 - accuracy:
 0.8482 - val_loss: 0.1384 - val_accuracy: 0.7616

Epoch 00005: val_loss did not improve from 0.09225

Epoch 6/100

108/108 [=====] - 17s 162ms/step - loss: 0.0509 - accuracy:

0.8550 - val_loss: 0.1353 - val_accuracy: 0.7905

Epoch 00006: val_loss did not improve from 0.09225

Epoch 7/100

108/108 [=====] - 18s 164ms/step - loss: 0.0453 - accuracy: 0.8653 - val_loss: 0.1250 - val_accuracy: 0.7948

Epoch 00007: val_loss did not improve from 0.09225

Epoch 8/100

108/108 [=====] - 18s 164ms/step - loss: 0.0423 - accuracy: 0.8707 - val_loss: 0.1501 - val_accuracy: 0.7917

Epoch 00008: val_loss did not improve from 0.09225

Epoch 9/100

108/108 [=====] - 18s 163ms/step - loss: 0.0396 - accuracy: 0.8754 - val_loss: 0.1203 - val_accuracy: 0.7911

Epoch 00009: val_loss did not improve from 0.09225

Epoch 10/100

108/108 [=====] - 18s 164ms/step - loss: 0.0368 - accuracy: 0.8812 - val_loss: 0.1726 - val_accuracy: 0.7912

Epoch 00010: val_loss did not improve from 0.09225

Epoch 11/100

108/108 [=====] - 20s 182ms/step - loss: 0.0334 - accuracy: 0.8875 - val_loss: 0.1702 - val_accuracy: 0.7872

Epoch 00011: val_loss did not improve from 0.09225

Epoch 00011: early stopping

time: 23

Model: "model_24"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_25 (InputLayer)	[(None, 128, 128, 8) 0		

conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_25[0][0]

max_pooling2d_72 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]

conv2 (Conv2D)	(None, 64, 64, 64) 18496		max_pooling2d_72[0][0]

max_pooling2d_73 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]

conv3 (Conv2D)	(None, 32, 32, 128) 73856		max_pooling2d_73[0][0]

max_pooling2d_74 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]

conv4 (Conv2D)	(None, 16, 16, 128) 147584		max_pooling2d_74[0][0]

conv5 (Conv2D)	(None, 16, 16, 128) 147584		conv4[0][0]

conv6 (Conv2D)	(None, 16, 16, 128)	147584	conv5[0][0]
up_sampling2d_72 (UpSampling2D)	(None, 32, 32, 128)	0	conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128)	147584	up_sampling2d_72[0][0]
concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_73 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_73[0][0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_74 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_74[0][0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_24 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]
=====			
Total params: 869,635			
Trainable params: 869,635			
Non-trainable params: 0			

Epoch 1/100

108/108 [=====] - 19s 167ms/step - loss: 0.1057 - accuracy: 0.7029 - val_loss: 0.0936 - val_accuracy: 0.7831

Epoch 00001: val_loss improved from inf to 0.09364, saving model to imgs/experiments/exp1/models/unet_23.h5

Epoch 2/100

108/108 [=====] - 18s 169ms/step - loss: 0.0661 - accuracy: 0.8251 - val_loss: 0.1243 - val_accuracy: 0.7664

Epoch 00002: val_loss did not improve from 0.09364

Epoch 3/100

108/108 [=====] - 18s 166ms/step - loss: 0.0614 - accuracy: 0.8325 - val_loss: 0.1191 - val_accuracy: 0.7541

Epoch 00003: val_loss did not improve from 0.09364

Epoch 4/100

108/108 [=====] - 18s 165ms/step - loss: 0.0600 - accuracy: 0.8377 - val_loss: 0.1267 - val_accuracy: 0.7809

Epoch 00004: val_loss did not improve from 0.09364
Epoch 5/100
108/108 [=====] - 18s 166ms/step - loss: 0.0573 - accuracy: 0.8432 - val_loss: 0.1410 - val_accuracy: 0.7711

Epoch 00005: val_loss did not improve from 0.09364
Epoch 6/100
108/108 [=====] - 18s 167ms/step - loss: 0.0541 - accuracy: 0.8487 - val_loss: 0.1277 - val_accuracy: 0.7785

Epoch 00006: val_loss did not improve from 0.09364
Epoch 7/100
108/108 [=====] - 18s 167ms/step - loss: 0.0519 - accuracy: 0.8518 - val_loss: 0.1422 - val_accuracy: 0.7884

Epoch 00007: val_loss did not improve from 0.09364
Epoch 8/100
108/108 [=====] - 18s 168ms/step - loss: 0.0477 - accuracy: 0.8587 - val_loss: 0.1268 - val_accuracy: 0.7904

Epoch 00008: val_loss did not improve from 0.09364
Epoch 9/100
108/108 [=====] - 18s 170ms/step - loss: 0.0462 - accuracy: 0.8610 - val_loss: 0.1193 - val_accuracy: 0.7919

Epoch 00009: val_loss did not improve from 0.09364
Epoch 10/100
108/108 [=====] - 18s 169ms/step - loss: 0.0422 - accuracy: 0.8688 - val_loss: 0.1583 - val_accuracy: 0.7974

Epoch 00010: val_loss did not improve from 0.09364
Epoch 11/100
108/108 [=====] - 18s 170ms/step - loss: 0.0389 - accuracy: 0.8739 - val_loss: 0.1492 - val_accuracy: 0.7934

Epoch 00011: val_loss did not improve from 0.09364
Epoch 00011: early stopping
time: 24
Model: "model_25"

Layer (type)	Output Shape	Param #	Connected to
input_26 (InputLayer)	[(None, 128, 128, 8) 0		
conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_26[0][0]
max_pooling2d_75 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]
conv2 (Conv2D) [0]	(None, 64, 64, 64) 18496		max_pooling2d_75[0][0]
max_pooling2d_76 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]
conv3 (Conv2D) [0]	(None, 32, 32, 128) 73856		max_pooling2d_76[0][0]
max_pooling2d_77 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]

conv4 (Conv2D)	(None, 16, 16, 128)	147584	max_pooling2d_77[0][0]
conv5 (Conv2D)	(None, 16, 16, 128)	147584	conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128)	147584	conv5[0][0]
up_sampling2d_75 (UpSampling2D)	(None, 32, 32, 128)	0	conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128)	147584	up_sampling2d_75[0][0]
concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_76 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_76[0][0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_77 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_77[0][0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_25 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]
=====			
Total params: 869,635			
Trainable params: 869,635			
Non-trainable params: 0			

Epoch 1/100

108/108 [=====] - 19s 168ms/step - loss: 0.0950 - accuracy: 0.7424 - val_loss: 0.1062 - val_accuracy: 0.7323

Epoch 00001: val_loss improved from inf to 0.10623, saving model to imgs/experiments/exp1/models/unet_24.h5

Epoch 2/100

108/108 [=====] - 18s 169ms/step - loss: 0.0668 - accuracy: 0.8248 - val_loss: 0.1018 - val_accuracy: 0.7889

Epoch 00002: val_loss improved from 0.10623 to 0.10185, saving model to imgs/experiments/exp1/models/unet_24.h5

Epoch 3/100
 108/108 [=====] - 18s 166ms/step - loss: 0.0592 - accuracy: 0.8365 - val_loss: 0.1330 - val_accuracy: 0.7684

Epoch 00003: val_loss did not improve from 0.10185

Epoch 4/100
 108/108 [=====] - 18s 168ms/step - loss: 0.0568 - accuracy: 0.8418 - val_loss: 0.1119 - val_accuracy: 0.7872

Epoch 00004: val_loss did not improve from 0.10185

Epoch 5/100
 108/108 [=====] - 18s 168ms/step - loss: 0.0536 - accuracy: 0.8459 - val_loss: 0.1617 - val_accuracy: 0.7879

Epoch 00005: val_loss did not improve from 0.10185

Epoch 6/100
 108/108 [=====] - 18s 168ms/step - loss: 0.0490 - accuracy: 0.8553 - val_loss: 0.1825 - val_accuracy: 0.7890

Epoch 00006: val_loss did not improve from 0.10185

Epoch 7/100
 108/108 [=====] - 18s 168ms/step - loss: 0.0445 - accuracy: 0.8646 - val_loss: 0.1732 - val_accuracy: 0.7773

Epoch 00007: val_loss did not improve from 0.10185

Epoch 8/100
 108/108 [=====] - 18s 168ms/step - loss: 0.0421 - accuracy: 0.8711 - val_loss: 0.1559 - val_accuracy: 0.7936

Epoch 00008: val_loss did not improve from 0.10185

Epoch 9/100
 108/108 [=====] - 18s 168ms/step - loss: 0.0395 - accuracy: 0.8747 - val_loss: 0.2022 - val_accuracy: 0.7932

Epoch 00009: val_loss did not improve from 0.10185

Epoch 10/100
 108/108 [=====] - 18s 170ms/step - loss: 0.0349 - accuracy: 0.8837 - val_loss: 0.2170 - val_accuracy: 0.7868

Epoch 00010: val_loss did not improve from 0.10185

Epoch 11/100
 108/108 [=====] - 19s 176ms/step - loss: 0.0327 - accuracy: 0.8879 - val_loss: 0.1816 - val_accuracy: 0.7934

Epoch 00011: val_loss did not improve from 0.10185

Epoch 12/100
 108/108 [=====] - 19s 173ms/step - loss: 0.0307 - accuracy: 0.8923 - val_loss: 0.1778 - val_accuracy: 0.7807

Epoch 00012: val_loss did not improve from 0.10185

Epoch 00012: early stopping

time: 25

Model: "model_26"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_27 (InputLayer)	[(None, 128, 128, 8)]	0	
<hr/>			
conv1 (Conv2D)	(None, 128, 128, 32)	2336	input_27[0][0]
<hr/>			
max_pooling2d_78 (MaxPooling2D)	(None, 64, 64, 32)	0	conv1[0][0]

conv2 (Conv2D)	(None, 64, 64, 64)	18496	max_pooling2d_78[0]
max_pooling2d_79 (MaxPooling2D)	(None, 32, 32, 64)	0	conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128)	73856	max_pooling2d_79[0]
max_pooling2d_80 (MaxPooling2D)	(None, 16, 16, 128)	0	conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128)	147584	max_pooling2d_80[0]
conv5 (Conv2D)	(None, 16, 16, 128)	147584	conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128)	147584	conv5[0][0]
up_sampling2d_78 (UpSampling2D)	(None, 32, 32, 128)	0	conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128)	147584	up_sampling2d_78[0]
concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_79 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_79[0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_80 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_80[0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_26 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]
=====			
Total params: 869,635			
Trainable params: 869,635			
Non-trainable params: 0			

```

Epoch 1/100
108/108 [=====] - 19s 170ms/step - loss: 0.0920 - accuracy:
0.7629 - val_loss: 0.1052 - val_accuracy: 0.7616

Epoch 00001: val_loss improved from inf to 0.10525, saving model to imgs/experiment
s/exp1/models\UNET_25.h5
Epoch 2/100
108/108 [=====] - 18s 170ms/step - loss: 0.0669 - accuracy:
0.8259 - val_loss: 0.1330 - val_accuracy: 0.7697

Epoch 00002: val_loss did not improve from 0.10525
Epoch 3/100
108/108 [=====] - 19s 173ms/step - loss: 0.0619 - accuracy:
0.8331 - val_loss: 0.1191 - val_accuracy: 0.7900

Epoch 00003: val_loss did not improve from 0.10525
Epoch 4/100
108/108 [=====] - 18s 169ms/step - loss: 0.0601 - accuracy:
0.8371 - val_loss: 0.1586 - val_accuracy: 0.7688

Epoch 00004: val_loss did not improve from 0.10525
Epoch 5/100
108/108 [=====] - 18s 169ms/step - loss: 0.0569 - accuracy:
0.8412 - val_loss: 0.1436 - val_accuracy: 0.7597

Epoch 00005: val_loss did not improve from 0.10525
Epoch 6/100
108/108 [=====] - 18s 169ms/step - loss: 0.0567 - accuracy:
0.8404 - val_loss: 0.1513 - val_accuracy: 0.7898

Epoch 00006: val_loss did not improve from 0.10525
Epoch 7/100
108/108 [=====] - 19s 174ms/step - loss: 0.0491 - accuracy:
0.8548 - val_loss: 0.1663 - val_accuracy: 0.7715

Epoch 00007: val_loss did not improve from 0.10525
Epoch 8/100
108/108 [=====] - 18s 172ms/step - loss: 0.0467 - accuracy:
0.8594 - val_loss: 0.1821 - val_accuracy: 0.7880

Epoch 00008: val_loss did not improve from 0.10525
Epoch 9/100
108/108 [=====] - 19s 175ms/step - loss: 0.0419 - accuracy:
0.8700 - val_loss: 0.1868 - val_accuracy: 0.7790

Epoch 00009: val_loss did not improve from 0.10525
Epoch 10/100
108/108 [=====] - 18s 171ms/step - loss: 0.0390 - accuracy:
0.8752 - val_loss: 0.1738 - val_accuracy: 0.7827

Epoch 00010: val_loss did not improve from 0.10525
Epoch 11/100
108/108 [=====] - 18s 167ms/step - loss: 0.0359 - accuracy:
0.8803 - val_loss: 0.1590 - val_accuracy: 0.7924

Epoch 00011: val_loss did not improve from 0.10525
Epoch 00011: early stopping
time: 26
Model: "model_27"

```

Layer (type)	Output Shape	Param #	Connected to
=====			

=====		
input_28 (InputLayer)	[(None, 128, 128, 8) 0	
conv1 (Conv2D)	(None, 128, 128, 32) 2336	input_28[0][0]
max_pooling2d_81 (MaxPooling2D)	(None, 64, 64, 32) 0	conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64) 18496	max_pooling2d_81[0]
max_pooling2d_82 (MaxPooling2D)	(None, 32, 32, 64) 0	conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128) 73856	max_pooling2d_82[0]
max_pooling2d_83 (MaxPooling2D)	(None, 16, 16, 128) 0	conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128) 147584	max_pooling2d_83[0]
conv5 (Conv2D)	(None, 16, 16, 128) 147584	conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128) 147584	conv5[0][0]
up_sampling2d_81 (UpSampling2D)	(None, 32, 32, 128) 0	conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128) 147584	up_sampling2d_81[0]
concatenate3 (Concatenate)	(None, 32, 32, 256) 0	conv3[0][0] upsampling3[0][0]
up_sampling2d_82 (UpSampling2D)	(None, 64, 64, 256) 0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64) 147520	up_sampling2d_82[0]
concatenate2 (Concatenate)	(None, 64, 64, 128) 0	conv2[0][0] upsampling2[0][0]
up_sampling2d_83 (UpSampling2D)	(None, 128, 128, 128) 0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32) 36896	up_sampling2d_83[0]
concatenate1 (Concatenate)	(None, 128, 128, 64) 0	conv1[0][0] upsampling1[0][0]

```

conv2d_27 (Conv2D)                (None, 128, 128, 3) 195      concatenate1[0][0]
=====
=====
Total params: 869,635
Trainable params: 869,635
Non-trainable params: 0

```

```

Epoch 1/100
108/108 [=====] - 19s 173ms/step - loss: 0.1101 - accuracy:
0.7178 - val_loss: 0.1010 - val_accuracy: 0.7856

Epoch 00001: val_loss improved from inf to 0.10103, saving model to imgs/experiment
s/exp1/models\unet_26.h5
Epoch 2/100
108/108 [=====] - 18s 170ms/step - loss: 0.0661 - accuracy:
0.8254 - val_loss: 0.1220 - val_accuracy: 0.7755

Epoch 00002: val_loss did not improve from 0.10103
Epoch 3/100
108/108 [=====] - 18s 169ms/step - loss: 0.0620 - accuracy:
0.8335 - val_loss: 0.1435 - val_accuracy: 0.7650

Epoch 00003: val_loss did not improve from 0.10103
Epoch 4/100
108/108 [=====] - 18s 169ms/step - loss: 0.0573 - accuracy:
0.8433 - val_loss: 0.1175 - val_accuracy: 0.7871

Epoch 00004: val_loss did not improve from 0.10103
Epoch 5/100
108/108 [=====] - 18s 171ms/step - loss: 0.0547 - accuracy:
0.8470 - val_loss: 0.1297 - val_accuracy: 0.7812

Epoch 00005: val_loss did not improve from 0.10103
Epoch 6/100
108/108 [=====] - 18s 171ms/step - loss: 0.0501 - accuracy:
0.8567 - val_loss: 0.1296 - val_accuracy: 0.7893

Epoch 00006: val_loss did not improve from 0.10103
Epoch 7/100
108/108 [=====] - 18s 167ms/step - loss: 0.0478 - accuracy:
0.8579 - val_loss: 0.1458 - val_accuracy: 0.7727

Epoch 00007: val_loss did not improve from 0.10103
Epoch 8/100
108/108 [=====] - 18s 169ms/step - loss: 0.0437 - accuracy:
0.8668 - val_loss: 0.1433 - val_accuracy: 0.7883

Epoch 00008: val_loss did not improve from 0.10103
Epoch 9/100
108/108 [=====] - 18s 169ms/step - loss: 0.0403 - accuracy:
0.8730 - val_loss: 0.1530 - val_accuracy: 0.7947

Epoch 00009: val_loss did not improve from 0.10103
Epoch 10/100
108/108 [=====] - 18s 170ms/step - loss: 0.0358 - accuracy:
0.8823 - val_loss: 0.1617 - val_accuracy: 0.7892

Epoch 00010: val_loss did not improve from 0.10103
Epoch 11/100
108/108 [=====] - 18s 171ms/step - loss: 0.0352 - accuracy:
0.8835 - val_loss: 0.1436 - val_accuracy: 0.7984

```

Epoch 00011: val_loss did not improve from 0.10103
 Epoch 00011: early stopping
 time: 27
 Model: "model_28"

Layer (type)	Output Shape	Param #	Connected to
input_29 (InputLayer)	[(None, 128, 128, 8) 0		
conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_29[0][0]
max_pooling2d_84 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64) 18496		max_pooling2d_84[0][0]
max_pooling2d_85 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128) 73856		max_pooling2d_85[0][0]
max_pooling2d_86 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128) 147584		max_pooling2d_86[0][0]
conv5 (Conv2D)	(None, 16, 16, 128) 147584		conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128) 147584		conv5[0][0]
up_sampling2d_84 (UpSampling2D)	(None, 32, 32, 128) 0		conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128) 147584		up_sampling2d_84[0][0]
concatenate3 (Concatenate)	(None, 32, 32, 256) 0		conv3[0][0] upsampling3[0][0]
up_sampling2d_85 (UpSampling2D)	(None, 64, 64, 256) 0		concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64) 147520		up_sampling2d_85[0][0]
concatenate2 (Concatenate)	(None, 64, 64, 128) 0		conv2[0][0] upsampling2[0][0]
up_sampling2d_86 (UpSampling2D)	(None, 128, 128, 128) 0		concatenate2[0][0]

upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_86[0][0]
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concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
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conv2d_28 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]
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=====

Total params: 869,635
Trainable params: 869,635
Non-trainable params: 0

Epoch 1/100

108/108 [=====] - 22s 197ms/step - loss: 0.0957 - accuracy: 0.7574 - val_loss: 0.1091 - val_accuracy: 0.7757

Epoch 00001: val_loss improved from inf to 0.10914, saving model to imgs/experiments/exp1/models\unet_27.h5

Epoch 2/100

108/108 [=====] - 19s 174ms/step - loss: 0.0655 - accuracy: 0.8259 - val_loss: 0.1117 - val_accuracy: 0.7865

Epoch 00002: val_loss did not improve from 0.10914

Epoch 3/100

108/108 [=====] - 19s 173ms/step - loss: 0.0610 - accuracy: 0.8334 - val_loss: 0.1544 - val_accuracy: 0.7781

Epoch 00003: val_loss did not improve from 0.10914

Epoch 4/100

108/108 [=====] - 18s 172ms/step - loss: 0.0574 - accuracy: 0.8405 - val_loss: 0.1647 - val_accuracy: 0.7950

Epoch 00004: val_loss did not improve from 0.10914

Epoch 5/100

108/108 [=====] - 19s 176ms/step - loss: 0.0543 - accuracy: 0.8463 - val_loss: 0.1581 - val_accuracy: 0.7608

Epoch 00005: val_loss did not improve from 0.10914

Epoch 6/100

108/108 [=====] - 19s 177ms/step - loss: 0.0539 - accuracy: 0.8476 - val_loss: 0.1721 - val_accuracy: 0.7799

Epoch 00006: val_loss did not improve from 0.10914

Epoch 7/100

108/108 [=====] - 19s 174ms/step - loss: 0.0465 - accuracy: 0.8614 - val_loss: 0.1552 - val_accuracy: 0.7923

Epoch 00007: val_loss did not improve from 0.10914

Epoch 8/100

108/108 [=====] - 19s 179ms/step - loss: 0.0424 - accuracy: 0.8689 - val_loss: 0.1573 - val_accuracy: 0.7921

Epoch 00008: val_loss did not improve from 0.10914

Epoch 9/100

108/108 [=====] - 19s 175ms/step - loss: 0.0387 - accuracy: 0.8754 - val_loss: 0.1779 - val_accuracy: 0.7962

Epoch 00009: val_loss did not improve from 0.10914

Epoch 10/100

108/108 [=====] - 19s 174ms/step - loss: 0.0352 - accuracy: 0.8831 - val_loss: 0.1684 - val_accuracy: 0.7965

Epoch 00010: val_loss did not improve from 0.10914

Epoch 11/100

108/108 [=====] - 19s 173ms/step - loss: 0.0321 - accuracy: 0.8894 - val_loss: 0.1584 - val_accuracy: 0.7868

Epoch 00011: val_loss did not improve from 0.10914

Epoch 00011: early stopping

time: 28

Model: "model_29"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_30 (InputLayer)	[(None, 128, 128, 8) 0		
conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_30[0][0]
max_pooling2d_87 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64) 18496		max_pooling2d_87[0][0]
max_pooling2d_88 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128) 73856		max_pooling2d_88[0][0]
max_pooling2d_89 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128) 147584		max_pooling2d_89[0][0]
conv5 (Conv2D)	(None, 16, 16, 128) 147584		conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128) 147584		conv5[0][0]
up_sampling2d_87 (UpSampling2D)	(None, 32, 32, 128) 0		conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128) 147584		up_sampling2d_87[0][0]
concatenate3 (Concatenate)	(None, 32, 32, 256) 0		conv3[0][0] upsampling3[0][0]
up_sampling2d_88 (UpSampling2D)	(None, 64, 64, 256) 0		concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64) 147520		up_sampling2d_88[0]

[0]

concatenate2 (Concatenate)	(None, 64, 64, 128) 0	conv2[0][0] upsampling2[0][0]
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up_sampling2d_89 (UpSampling2D)	(None, 128, 128, 128) 0	concatenate2[0][0]
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upsampling1 (Conv2D)	(None, 128, 128, 32) 36896	up_sampling2d_89[0][0]
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concatenate1 (Concatenate)	(None, 128, 128, 64) 0	conv1[0][0] upsampling1[0][0]
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conv2d_29 (Conv2D)	(None, 128, 128, 3) 195	concatenate1[0][0]
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=====

Total params: 869,635
 Trainable params: 869,635
 Non-trainable params: 0

Epoch 1/100

108/108 [=====] - 19s 174ms/step - loss: 0.1059 - accuracy: 0.7092 - val_loss: 0.1018 - val_accuracy: 0.7768

Epoch 00001: val_loss improved from inf to 0.10180, saving model to imgs/experiments/exp1/models/unet_28.h5

Epoch 2/100

108/108 [=====] - 19s 176ms/step - loss: 0.0668 - accuracy: 0.8256 - val_loss: 0.1125 - val_accuracy: 0.7662

Epoch 00002: val_loss did not improve from 0.10180

Epoch 3/100

108/108 [=====] - 19s 175ms/step - loss: 0.0618 - accuracy: 0.8327 - val_loss: 0.1038 - val_accuracy: 0.7876

Epoch 00003: val_loss did not improve from 0.10180

Epoch 4/100

108/108 [=====] - 19s 174ms/step - loss: 0.0591 - accuracy: 0.8407 - val_loss: 0.1048 - val_accuracy: 0.7867

Epoch 00004: val_loss did not improve from 0.10180

Epoch 5/100

108/108 [=====] - 19s 177ms/step - loss: 0.0550 - accuracy: 0.8467 - val_loss: 0.1609 - val_accuracy: 0.7479

Epoch 00005: val_loss did not improve from 0.10180

Epoch 6/100

108/108 [=====] - 19s 175ms/step - loss: 0.0518 - accuracy: 0.8527 - val_loss: 0.1529 - val_accuracy: 0.7633

Epoch 00006: val_loss did not improve from 0.10180

Epoch 7/100

108/108 [=====] - 19s 174ms/step - loss: 0.0471 - accuracy: 0.8605 - val_loss: 0.1289 - val_accuracy: 0.7675

Epoch 00007: val_loss did not improve from 0.10180

Epoch 8/100

108/108 [=====] - 19s 176ms/step - loss: 0.0455 - accuracy: 0.8643 - val_loss: 0.1496 - val_accuracy: 0.7780

Epoch 00008: val_loss did not improve from 0.10180
 Epoch 9/100
 108/108 [=====] - 19s 174ms/step - loss: 0.0424 - accuracy: 0.8701 - val_loss: 0.1598 - val_accuracy: 0.7866

Epoch 00009: val_loss did not improve from 0.10180
 Epoch 10/100
 108/108 [=====] - 19s 176ms/step - loss: 0.0381 - accuracy: 0.8762 - val_loss: 0.1572 - val_accuracy: 0.7987

Epoch 00010: val_loss did not improve from 0.10180
 Epoch 11/100
 108/108 [=====] - 19s 176ms/step - loss: 0.0346 - accuracy: 0.8841 - val_loss: 0.1489 - val_accuracy: 0.7839

Epoch 00011: val_loss did not improve from 0.10180
 Epoch 00011: early stopping
 time: 29
 Model: "model_30"

Layer (type)	Output Shape	Param #	Connected to
input_31 (InputLayer)	[(None, 128, 128, 8) 0		
conv1 (Conv2D)	(None, 128, 128, 32) 2336		input_31[0][0]
max_pooling2d_90 (MaxPooling2D)	(None, 64, 64, 32) 0		conv1[0][0]
conv2 (Conv2D)	(None, 64, 64, 64) 18496		max_pooling2d_90[0][0]
max_pooling2d_91 (MaxPooling2D)	(None, 32, 32, 64) 0		conv2[0][0]
conv3 (Conv2D)	(None, 32, 32, 128) 73856		max_pooling2d_91[0][0]
max_pooling2d_92 (MaxPooling2D)	(None, 16, 16, 128) 0		conv3[0][0]
conv4 (Conv2D)	(None, 16, 16, 128) 147584		max_pooling2d_92[0][0]
conv5 (Conv2D)	(None, 16, 16, 128) 147584		conv4[0][0]
conv6 (Conv2D)	(None, 16, 16, 128) 147584		conv5[0][0]
up_sampling2d_90 (UpSampling2D)	(None, 32, 32, 128) 0		conv6[0][0]
upsampling3 (Conv2D)	(None, 32, 32, 128) 147584		up_sampling2d_90[0][0]

concatenate3 (Concatenate)	(None, 32, 32, 256)	0	conv3[0][0] upsampling3[0][0]
up_sampling2d_91 (UpSampling2D)	(None, 64, 64, 256)	0	concatenate3[0][0]
upsampling2 (Conv2D)	(None, 64, 64, 64)	147520	up_sampling2d_91[0] [0]
concatenate2 (Concatenate)	(None, 64, 64, 128)	0	conv2[0][0] upsampling2[0][0]
up_sampling2d_92 (UpSampling2D)	(None, 128, 128, 128)	0	concatenate2[0][0]
upsampling1 (Conv2D)	(None, 128, 128, 32)	36896	up_sampling2d_92[0] [0]
concatenate1 (Concatenate)	(None, 128, 128, 64)	0	conv1[0][0] upsampling1[0][0]
conv2d_30 (Conv2D)	(None, 128, 128, 3)	195	concatenate1[0][0]
=====			
Total params: 869,635			
Trainable params: 869,635			
Non-trainable params: 0			

Epoch 1/100

108/108 [=====] - 19s 175ms/step - loss: 0.0930 - accuracy: 0.7710 - val_loss: 0.0995 - val_accuracy: 0.7855

Epoch 00001: val_loss improved from inf to 0.09947, saving model to imgs/experiments/exp1/models/unet_29.h5

Epoch 2/100

108/108 [=====] - 19s 176ms/step - loss: 0.0665 - accuracy: 0.8250 - val_loss: 0.1066 - val_accuracy: 0.7636

Epoch 00002: val_loss did not improve from 0.09947

Epoch 3/100

108/108 [=====] - 19s 173ms/step - loss: 0.0607 - accuracy: 0.8351 - val_loss: 0.1173 - val_accuracy: 0.7756

Epoch 00003: val_loss did not improve from 0.09947

Epoch 4/100

108/108 [=====] - 19s 174ms/step - loss: 0.0605 - accuracy: 0.8357 - val_loss: 0.1426 - val_accuracy: 0.7837

Epoch 00004: val_loss did not improve from 0.09947

Epoch 5/100

108/108 [=====] - 20s 188ms/step - loss: 0.0558 - accuracy: 0.8463 - val_loss: 0.1613 - val_accuracy: 0.7855

Epoch 00005: val_loss did not improve from 0.09947

Epoch 6/100

108/108 [=====] - 21s 198ms/step - loss: 0.0518 - accuracy: 0.8546 - val_loss: 0.1361 - val_accuracy: 0.7714

Epoch 00006: val_loss did not improve from 0.09947

Epoch 7/100

108/108 [=====] - 20s 184ms/step - loss: 0.0494 - accuracy: 0.8570 - val_loss: 0.1735 - val_accuracy: 0.7965

Epoch 00007: val_loss did not improve from 0.09947

Epoch 8/100

108/108 [=====] - 20s 183ms/step - loss: 0.0459 - accuracy: 0.8633 - val_loss: 0.1809 - val_accuracy: 0.7846

Epoch 00008: val_loss did not improve from 0.09947

Epoch 9/100

108/108 [=====] - 19s 178ms/step - loss: 0.0432 - accuracy: 0.8694 - val_loss: 0.1581 - val_accuracy: 0.7943

Epoch 00009: val_loss did not improve from 0.09947

Epoch 10/100

108/108 [=====] - 19s 180ms/step - loss: 0.0398 - accuracy: 0.8747 - val_loss: 0.1509 - val_accuracy: 0.7963

Epoch 00010: val_loss did not improve from 0.09947

Epoch 11/100

108/108 [=====] - 19s 178ms/step - loss: 0.0355 - accuracy: 0.8829 - val_loss: 0.1409 - val_accuracy: 0.7926

Epoch 00011: val_loss did not improve from 0.09947

Epoch 00011: early stopping

In [16]:

```
# Test Loop
time_ts = []
n_pool = 3
n_rows = 5
n_cols = 4
rows, cols = image_array.shape[:2]
pad_rows = rows - np.ceil(rows/(n_rows*2**n_pool))*n_rows*2**n_pool
pad_cols = cols - np.ceil(cols/(n_cols*2**n_pool))*n_cols*2**n_pool
print(pad_rows, pad_cols)

npad = ((0, int(abs(pad_rows))), (0, int(abs(pad_cols))), (0, 0))
image1_pad = np.pad(image_array, pad_width=npad, mode='reflect')

h, w, c = image1_pad.shape
patch_size_rows = h//n_rows
patch_size_cols = w//n_cols
num_patches_x = int(h/patch_size_rows)
num_patches_y = int(w/patch_size_cols)

input_shape=(patch_size_rows,patch_size_cols, c)

if method == 'unet':
    new_model = build_unet(input_shape, nb_filters, number_class)

# if method == 'resunet':
#     new_model = build_resunet(input_shape, nb_filters, number_class)

# new_model = Model_3(nb_filters, number_class)
# new_model.build((None,)+input_shape)

for tm in range(0,times):
    print('time: ', tm)
    model = load_model(path_models+ '/' + method + '_' +str(tm)+'.h5', compile=False)

    for l in range(1, len(model.layers)):
        new_model.layers[l].set_weights(model.layers[l].get_weights())
```

```

new_model.load_weights(path_models+ '/' + method + '_' +str(tm)+'.h5')

start_test = time.time()
patch_t = []

for i in range(0,num_patches_y):
    for j in range(0,num_patches_x):
        patch = image1_pad[patch_size_rows*j:patch_size_rows*(j+1), patch_size_c
        predictions_ = new_model.predict(np.expand_dims(patch, axis=0))
        del patch
        patch_t.append(predictions_[::,:,1])
        del predictions_
    end_test = time.time() - start_test
    patches_pred = np.asarray(patch_t).astype(np.float32)

    prob_reconstructed = pred_reconstruct(h, w, num_patches_x, num_patches_y, patch_s
    np.save(path_maps+'/'+'prob_'+str(tm)+'.npy',prob_reconstructed)

    time_ts.append(end_test)
    del prob_reconstructed, patches_pred
    #del model
time_ts_array = np.asarray(time_ts)
# Save test time
np.save(path_exp+'/metrics_ts.npy', time_ts_array)

```

```

0.0 -8.0
time: 0
time: 1
time: 2
time: 3
time: 4
time: 5
time: 6
time: 7
time: 8
time: 9
time: 10
time: 11
time: 12
time: 13
time: 14
time: 15
time: 16
time: 17
time: 18
time: 19
time: 20
time: 21
time: 22
time: 23
time: 24
time: 25
time: 26
time: 27
time: 28
time: 29

```

In [17]:

```

# Compute mean of the tm predictions maps
prob_rec = np.zeros((image1_pad.shape[0],image1_pad.shape[1], times))

for tm in range (0, times):
    print(tm)
    prob_rec[:, :, tm] = np.load(path_maps+'/'+'prob_'+str(tm)+'.npy').astype(np.float

```

```
mean_prob = np.mean(prob_rec, axis = -1)
np.save(path_maps+'/prob_mean.npy', mean_prob)
```

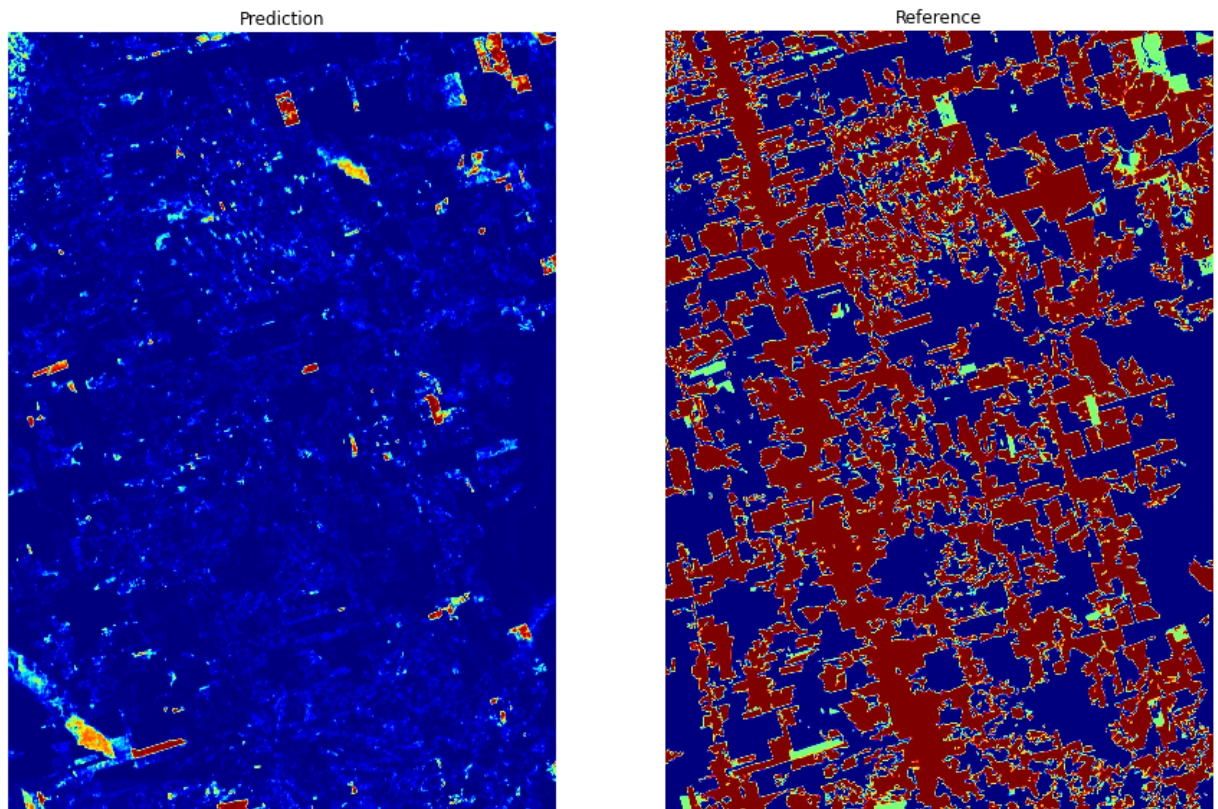
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29

In [18]:

```
# Plot mean map and reference
fig = plt.figure(figsize=(15,10))
ax1 = fig.add_subplot(121)
plt.title('Prediction')
ax1.imshow(mean_prob, cmap = 'jet')
ax1.axis('off')

ax2 = fig.add_subplot(122)
plt.title('Reference')
ax2.imshow(final_mask1, cmap = 'jet')
ax2.axis('off')
```

Out[18]: (-0.5, 6999.5, 9999.5, -0.5)



In [19]:

```
# Computing metrics
mean_prob = mean_prob[:final_mask1.shape[0], :final_mask1.shape[1]]
ref1 = np.ones_like(final_mask1).astype(np.float32)

ref1[final_mask1 == 2] = 0
TileMask = mask_amazon_ts * ref1
GTTruePositives = final_mask1==1

Npoints = 50
Pmax = np.max(mean_prob[GTTruePositives * TileMask ==1])
ProbList = np.linspace(Pmax,0,Npoints)

metrics_ = matrices_AA_recall(ProbList, mean_prob, final_mask1, mask_amazon_ts, 625)
np.save(path_exp+'/acc_metrics.npy',metrics_)
```

0.9964422404766082

D:\Ferrari\proj_1\projeto\utils_unet_resunet.py:200: RuntimeWarning: invalid value encountered in longlong_scalars

precision_ = TP/(TP+FP)

0.9761066845485142

0.9557711286204201

0.9354355726923261

0.915100016764232

0.894764460836138

0.8744289049080439

0.8540933489799499

0.8337577930518558

0.8134222371237618

0.7930866811956678

0.7727511252675737

0.7524155693394797

0.7320800134113856

0.7117444574832916

0.6914089015551976

0.6710733456271035

0.6507377896990094

0.6304022337709154

```

0.6100666778428214
0.5897311219147273
0.5693955659866333
0.5490600100585392
0.5287244541304452
0.5083888982023512
0.4880533422742571
0.4677177863461631
0.447382230418069
0.427046674489975
0.4067111185618809
0.3863755626337869
0.3660400067056928
0.3457044507775988
0.3253688948495048
0.3050333389214107
0.2846977829933167
0.2643622270652226
0.24402667113712861
0.2236911152090345
0.2033555592809405
0.1830200033528464
0.1626844474247524
0.14234889149665841
0.12201333556856431
0.10167777964047031
0.0813422237123762
0.06100666778428221
0.0406711118561881
0.020335555928094107
0.0

```

```

In [20]: # Complete NaN values
metrics_copy = metrics_.copy()
metrics_copy = complete_nan_values(metrics_copy)

```

```

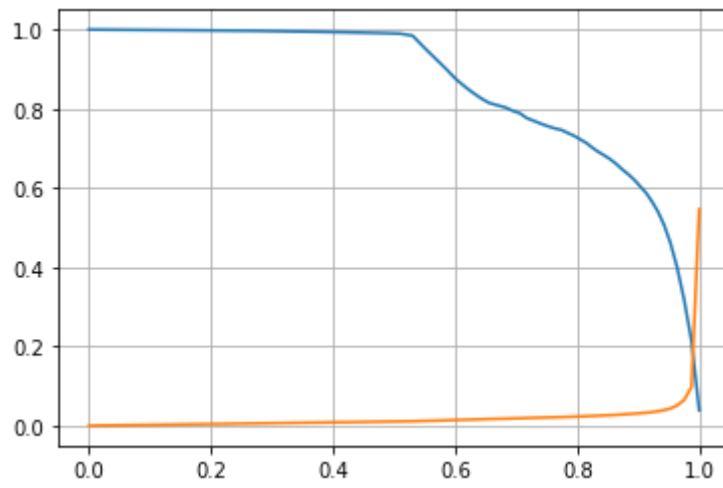
In [21]: # Compute Mean Average Precision (mAP) score
Recall = metrics_copy[:,0]
Precision = metrics_copy[:,1]
AA = metrics_copy[:,2]

DeltaR = Recall[1:]-Recall[:-1]
AP = np.sum(Precision[:-1]*DeltaR)
print('mAP', AP)

# Plot Recall vs. Precision curve
plt.close('all')
plt.plot(metrics_copy[:,0],metrics_copy[:,1])
plt.plot(metrics_copy[:,0],metrics_copy[:,2])
plt.grid()

```

```
mAP 0.867591404167759
```



In []: