

```
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 = 'FUSION'

        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, 12)

```
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, 12)
 -4.987141 6.424306
 Total no-deforestaion class is 36326397

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

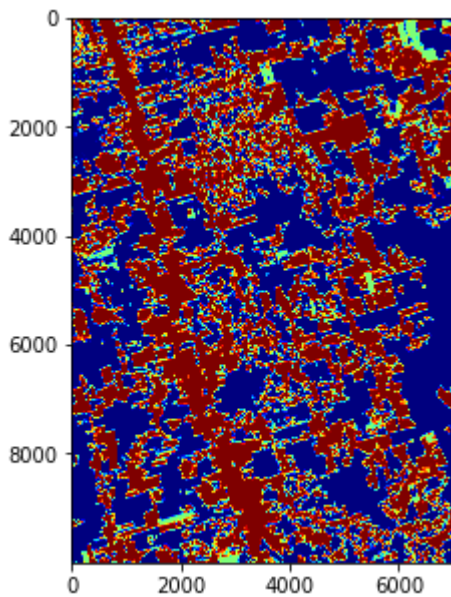
```
In [5]: # Create tile mask
mask_tiles = create_mask(final_mask1.shape[0], final_mask1.shape[1], grid_size=(5, 4))
image_array = image_array[:mask_tiles.shape[0], :mask_tiles.shape[1],:]
final_mask1 = final_mask1[:mask_tiles.shape[0], :mask_tiles.shape[1]]

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, 12)
 ref : (10000, 7000)

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

Out[6]: <matplotlib.image.AxesImage at 0x2651ca332b0>



```
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 = 2
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.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', moni
checkpoint = ModelCheckpoint(path_models+ '/' + method + '_' +str(tm)+'.h5', monit
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_3_1"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |

=====
 Total params: 1,406,327
 Trainable params: 1,406,313
 Non-trainable params: 14

Epoch 1/100
108/108 [=====] - 22s 150ms/step - opt_accuracy: 0.8252 - s
ar_accuracy: 0.7209 - fus_accuracy: 0.8158 - opt_loss: 0.0970 - sar_loss: 0.1450 - f
usion_loss: 0.1040 - loss: 0.3460 - val_opt_accuracy: 0.8390 - val_sar_accuracy: 0.7
486 - val_fus_accuracy: 0.8243 - val_opt_loss: 0.1033 - val_sar_loss: 0.1257 - val_f
usion_loss: 0.1056 - val_loss: 0.3346

Epoch 00001: val_loss improved from inf to 0.33457, saving model to imgs/experiment
s/exp2/models\UNET_0.h5

Epoch 2/100
108/108 [=====] - 14s 125ms/step - opt_accuracy: 0.8690 - s
ar_accuracy: 0.7472 - fus_accuracy: 0.8602 - opt_loss: 0.0761 - sar_loss: 0.1358 - f
usion_loss: 0.0794 - loss: 0.2913 - val_opt_accuracy: 0.8442 - val_sar_accuracy: 0.7
576 - val_fus_accuracy: 0.8374 - val_opt_loss: 0.1153 - val_sar_loss: 0.1252 - val_f
usion_loss: 0.1122 - val_loss: 0.3526

Epoch 00002: val_loss did not improve from 0.33457

Epoch 3/100
108/108 [=====] - 14s 126ms/step - opt_accuracy: 0.8827 - s

ar_accuracy: 0.7554 - fus_accuracy: 0.8770 - opt_loss: 0.0675 - sar_loss: 0.1272 - fusion_loss: 0.0696 - loss: 0.2643 - val_opt_accuracy: 0.8539 - val_sar_accuracy: 0.7796 - val_fus_accuracy: 0.8510 - val_opt_loss: 0.1082 - val_sar_loss: 0.1237 - val_fusion_loss: 0.1082 - val_loss: 0.3401

Epoch 00003: val_loss did not improve from 0.33457

Epoch 4/100

108/108 [=====] - 14s 127ms/step - opt_accuracy: 0.8891 - sar_accuracy: 0.7326 - fus_accuracy: 0.8871 - opt_loss: 0.0634 - sar_loss: 0.1396 - fusion_loss: 0.0641 - loss: 0.2671 - val_opt_accuracy: 0.8611 - val_sar_accuracy: 0.7408 - val_fus_accuracy: 0.8601 - val_opt_loss: 0.1030 - val_sar_loss: 0.1208 - val_fusion_loss: 0.1005 - val_loss: 0.3243

Epoch 00004: val_loss improved from 0.33457 to 0.32430, saving model to imgs/experiments/exp2/models\unet_0.h5

Epoch 5/100

108/108 [=====] - 14s 129ms/step - opt_accuracy: 0.8913 - sar_accuracy: 0.7309 - fus_accuracy: 0.8903 - opt_loss: 0.0612 - sar_loss: 0.1397 - fusion_loss: 0.0614 - loss: 0.2623 - val_opt_accuracy: 0.8530 - val_sar_accuracy: 0.7385 - val_fus_accuracy: 0.8508 - val_opt_loss: 0.1226 - val_sar_loss: 0.1221 - val_fusion_loss: 0.1201 - val_loss: 0.3647

Epoch 00005: val_loss did not improve from 0.32430

Epoch 6/100

108/108 [=====] - 14s 131ms/step - opt_accuracy: 0.8921 - sar_accuracy: 0.7350 - fus_accuracy: 0.8916 - opt_loss: 0.0596 - sar_loss: 0.1384 - fusion_loss: 0.0597 - loss: 0.2577 - val_opt_accuracy: 0.8589 - val_sar_accuracy: 0.7455 - val_fus_accuracy: 0.8594 - val_opt_loss: 0.1218 - val_sar_loss: 0.1236 - val_fusion_loss: 0.1199 - val_loss: 0.3652

Epoch 00006: val_loss did not improve from 0.32430

Epoch 7/100

108/108 [=====] - 14s 132ms/step - opt_accuracy: 0.8980 - sar_accuracy: 0.7365 - fus_accuracy: 0.8975 - opt_loss: 0.0548 - sar_loss: 0.1402 - fusion_loss: 0.0549 - loss: 0.2499 - val_opt_accuracy: 0.8566 - val_sar_accuracy: 0.7452 - val_fus_accuracy: 0.8559 - val_opt_loss: 0.1230 - val_sar_loss: 0.1237 - val_fusion_loss: 0.1230 - val_loss: 0.3697

Epoch 00007: val_loss did not improve from 0.32430

Epoch 8/100

108/108 [=====] - 14s 133ms/step - opt_accuracy: 0.9028 - sar_accuracy: 0.7406 - fus_accuracy: 0.9024 - opt_loss: 0.0503 - sar_loss: 0.1372 - fusion_loss: 0.0504 - loss: 0.2379 - val_opt_accuracy: 0.8611 - val_sar_accuracy: 0.7487 - val_fus_accuracy: 0.8610 - val_opt_loss: 0.1484 - val_sar_loss: 0.1226 - val_fusion_loss: 0.1487 - val_loss: 0.4197

Epoch 00008: val_loss did not improve from 0.32430

Epoch 9/100

108/108 [=====] - 15s 136ms/step - opt_accuracy: 0.9056 - sar_accuracy: 0.7418 - fus_accuracy: 0.9049 - opt_loss: 0.0481 - sar_loss: 0.1376 - fusion_loss: 0.0484 - loss: 0.2341 - val_opt_accuracy: 0.8616 - val_sar_accuracy: 0.7504 - val_fus_accuracy: 0.8613 - val_opt_loss: 0.1601 - val_sar_loss: 0.1215 - val_fusion_loss: 0.1599 - val_loss: 0.4415

Epoch 00009: val_loss did not improve from 0.32430

Epoch 10/100

108/108 [=====] - 15s 137ms/step - opt_accuracy: 0.9106 - sar_accuracy: 0.7417 - fus_accuracy: 0.9105 - opt_loss: 0.0441 - sar_loss: 0.1377 - fusion_loss: 0.0442 - loss: 0.2260 - val_opt_accuracy: 0.8581 - val_sar_accuracy: 0.7540 - val_fus_accuracy: 0.8574 - val_opt_loss: 0.1700 - val_sar_loss: 0.1210 - val_fusion_loss: 0.1703 - val_loss: 0.4613

Epoch 00010: val_loss did not improve from 0.32430

Epoch 11/100

108/108 [=====] - 15s 139ms/step - opt_accuracy: 0.9136 - s

ar_accuracy: 0.7424 - fus_accuracy: 0.9134 - opt_loss: 0.0418 - sar_loss: 0.1375 - fusion_loss: 0.0419 - loss: 0.2212 - val_opt_accuracy: 0.8615 - val_sar_accuracy: 0.7565 - val_fus_accuracy: 0.8611 - val_opt_loss: 0.1835 - val_sar_loss: 0.1200 - val_fusion_loss: 0.1840 - val_loss: 0.4874

Epoch 00011: val_loss did not improve from 0.32430

Epoch 12/100

108/108 [=====] - 15s 142ms/step - opt_accuracy: 0.9154 - sar_accuracy: 0.7439 - fus_accuracy: 0.9153 - opt_loss: 0.0405 - sar_loss: 0.1376 - fusion_loss: 0.0405 - loss: 0.2186 - val_opt_accuracy: 0.8596 - val_sar_accuracy: 0.7574 - val_fus_accuracy: 0.8595 - val_opt_loss: 0.2148 - val_sar_loss: 0.1192 - val_fusion_loss: 0.2153 - val_loss: 0.5493

Epoch 00012: val_loss did not improve from 0.32430

Epoch 13/100

108/108 [=====] - 16s 144ms/step - opt_accuracy: 0.9154 - sar_accuracy: 0.7445 - fus_accuracy: 0.9153 - opt_loss: 0.0400 - sar_loss: 0.1375 - fusion_loss: 0.0401 - loss: 0.2175 - val_opt_accuracy: 0.8642 - val_sar_accuracy: 0.7569 - val_fus_accuracy: 0.8639 - val_opt_loss: 0.1771 - val_sar_loss: 0.1204 - val_fusion_loss: 0.1776 - val_loss: 0.4751

Epoch 00013: val_loss did not improve from 0.32430

Epoch 14/100

108/108 [=====] - 16s 146ms/step - opt_accuracy: 0.9194 - sar_accuracy: 0.7410 - fus_accuracy: 0.9189 - opt_loss: 0.0372 - sar_loss: 0.1385 - fusion_loss: 0.0375 - loss: 0.2132 - val_opt_accuracy: 0.8605 - val_sar_accuracy: 0.7542 - val_fus_accuracy: 0.8601 - val_opt_loss: 0.2001 - val_sar_loss: 0.1193 - val_fusion_loss: 0.2001 - val_loss: 0.5195

Epoch 00014: val_loss did not improve from 0.32430

Epoch 00014: early stopping

time: 1

Model: "model_3_2"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |

Total params: 1,406,327

Trainable params: 1,406,313

Non-trainable params: 14

Epoch 1/100

108/108 [=====] - 18s 154ms/step - opt_accuracy: 0.8370 - sar_accuracy: 0.7371 - fus_accuracy: 0.8229 - opt_loss: 0.0949 - sar_loss: 0.1402 - fusion_loss: 0.1013 - loss: 0.3364 - val_opt_accuracy: 0.8256 - val_sar_accuracy: 0.7513 - val_fus_accuracy: 0.8294 - val_opt_loss: 0.1147 - val_sar_loss: 0.1217 - val_fusion_loss: 0.1042 - val_loss: 0.3406

Epoch 00001: val_loss improved from inf to 0.34058, saving model to imgs/experiment s/exp2/models\unet_1.h5

Epoch 2/100

108/108 [=====] - 16s 149ms/step - opt_accuracy: 0.8711 - sar_accuracy: 0.7438 - fus_accuracy: 0.8644 - opt_loss: 0.0761 - sar_loss: 0.1383 - fusion_loss: 0.0781 - loss: 0.2925 - val_opt_accuracy: 0.8443 - val_sar_accuracy: 0.7

519 - val_fus_accuracy: 0.8437 - val_opt_loss: 0.1003 - val_sar_loss: 0.1232 - val_fusion_loss: 0.0959 - val_loss: 0.3194

Epoch 00002: val_loss improved from 0.34058 to 0.31938, saving model to imgs/experiments/exp2/models\unet_1.h5

Epoch 3/100

108/108 [=====] - 16s 150ms/step - opt_accuracy: 0.8811 - sar_accuracy: 0.7614 - fus_accuracy: 0.8767 - opt_loss: 0.0688 - sar_loss: 0.1299 - fusion_loss: 0.0703 - loss: 0.2691 - val_opt_accuracy: 0.8417 - val_sar_accuracy: 0.7776 - val_fus_accuracy: 0.8399 - val_opt_loss: 0.1420 - val_sar_loss: 0.1186 - val_fusion_loss: 0.1346 - val_loss: 0.3952

Epoch 00003: val_loss did not improve from 0.31938

Epoch 4/100

108/108 [=====] - 16s 152ms/step - opt_accuracy: 0.8875 - sar_accuracy: 0.7720 - fus_accuracy: 0.8840 - opt_loss: 0.0632 - sar_loss: 0.1205 - fusion_loss: 0.0643 - loss: 0.2480 - val_opt_accuracy: 0.8464 - val_sar_accuracy: 0.7824 - val_fus_accuracy: 0.8461 - val_opt_loss: 0.1571 - val_sar_loss: 0.1175 - val_fusion_loss: 0.1501 - val_loss: 0.4246

Epoch 00004: val_loss did not improve from 0.31938

Epoch 5/100

108/108 [=====] - 17s 154ms/step - opt_accuracy: 0.8868 - sar_accuracy: 0.7633 - fus_accuracy: 0.8845 - opt_loss: 0.0643 - sar_loss: 0.1287 - fusion_loss: 0.0650 - loss: 0.2581 - val_opt_accuracy: 0.8330 - val_sar_accuracy: 0.7863 - val_fus_accuracy: 0.8360 - val_opt_loss: 0.1810 - val_sar_loss: 0.1256 - val_fusion_loss: 0.1779 - val_loss: 0.4845

Epoch 00005: val_loss did not improve from 0.31938

Epoch 6/100

108/108 [=====] - 17s 155ms/step - opt_accuracy: 0.8925 - sar_accuracy: 0.7817 - fus_accuracy: 0.8908 - opt_loss: 0.0576 - sar_loss: 0.1160 - fusion_loss: 0.0580 - loss: 0.2316 - val_opt_accuracy: 0.8451 - val_sar_accuracy: 0.7945 - val_fus_accuracy: 0.8440 - val_opt_loss: 0.1613 - val_sar_loss: 0.1262 - val_fusion_loss: 0.1597 - val_loss: 0.4472

Epoch 00006: val_loss did not improve from 0.31938

Epoch 7/100

108/108 [=====] - 17s 154ms/step - opt_accuracy: 0.8955 - sar_accuracy: 0.7802 - fus_accuracy: 0.8940 - opt_loss: 0.0550 - sar_loss: 0.1156 - fusion_loss: 0.0555 - loss: 0.2260 - val_opt_accuracy: 0.8505 - val_sar_accuracy: 0.7865 - val_fus_accuracy: 0.8505 - val_opt_loss: 0.1541 - val_sar_loss: 0.1268 - val_fusion_loss: 0.1513 - val_loss: 0.4323

Epoch 00007: val_loss did not improve from 0.31938

Epoch 8/100

108/108 [=====] - 17s 157ms/step - opt_accuracy: 0.8993 - sar_accuracy: 0.7886 - fus_accuracy: 0.8981 - opt_loss: 0.0521 - sar_loss: 0.1112 - fusion_loss: 0.0523 - loss: 0.2156 - val_opt_accuracy: 0.8461 - val_sar_accuracy: 0.7637 - val_fus_accuracy: 0.8456 - val_opt_loss: 0.1778 - val_sar_loss: 0.1254 - val_fusion_loss: 0.1729 - val_loss: 0.4761

Epoch 00008: val_loss did not improve from 0.31938

Epoch 9/100

108/108 [=====] - 17s 157ms/step - opt_accuracy: 0.9021 - sar_accuracy: 0.7923 - fus_accuracy: 0.9009 - opt_loss: 0.0498 - sar_loss: 0.1096 - fusion_loss: 0.0501 - loss: 0.2095 - val_opt_accuracy: 0.8520 - val_sar_accuracy: 0.7952 - val_fus_accuracy: 0.8515 - val_opt_loss: 0.1751 - val_sar_loss: 0.1461 - val_fusion_loss: 0.1749 - val_loss: 0.4961

Epoch 00009: val_loss did not improve from 0.31938

Epoch 10/100

108/108 [=====] - 17s 159ms/step - opt_accuracy: 0.9069 - sar_accuracy: 0.8000 - fus_accuracy: 0.9060 - opt_loss: 0.0455 - sar_loss: 0.1046 - fusion_loss: 0.0456 - loss: 0.1957 - val_opt_accuracy: 0.8594 - val_sar_accuracy: 0.8

001 - val_fus_accuracy: 0.8583 - val_opt_loss: 0.1746 - val_sar_loss: 0.1800 - val_fusion_loss: 0.1802 - val_loss: 0.5348

Epoch 00010: val_loss did not improve from 0.31938

Epoch 11/100

108/108 [=====] - 17s 160ms/step - opt_accuracy: 0.9090 - sar_accuracy: 0.7938 - fus_accuracy: 0.9082 - opt_loss: 0.0443 - sar_loss: 0.1094 - fusion_loss: 0.0445 - loss: 0.1982 - val_opt_accuracy: 0.8565 - val_sar_accuracy: 0.8030 - val_fus_accuracy: 0.8564 - val_opt_loss: 0.1802 - val_sar_loss: 0.1426 - val_fusion_loss: 0.1795 - val_loss: 0.5022

Epoch 00011: val_loss did not improve from 0.31938

Epoch 12/100

108/108 [=====] - 17s 161ms/step - opt_accuracy: 0.9128 - sar_accuracy: 0.8038 - fus_accuracy: 0.9122 - opt_loss: 0.0411 - sar_loss: 0.1024 - fusion_loss: 0.0412 - loss: 0.1847 - val_opt_accuracy: 0.8575 - val_sar_accuracy: 0.7943 - val_fus_accuracy: 0.8571 - val_opt_loss: 0.1389 - val_sar_loss: 0.1314 - val_fusion_loss: 0.1391 - val_loss: 0.4093

Epoch 00012: val_loss did not improve from 0.31938

Epoch 00012: early stopping

time: 2

Model: "model_3_3"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |

Total params: 1,406,327

Trainable params: 1,406,313

Non-trainable params: 14

Epoch 1/100

108/108 [=====] - 20s 164ms/step - opt_accuracy: 0.8282 - sar_accuracy: 0.7373 - fus_accuracy: 0.8116 - opt_loss: 0.0965 - sar_loss: 0.1404 - fusion_loss: 0.1090 - loss: 0.3459 - val_opt_accuracy: 0.8314 - val_sar_accuracy: 0.7663 - val_fus_accuracy: 0.8252 - val_opt_loss: 0.1094 - val_sar_loss: 0.1210 - val_fusion_loss: 0.1142 - val_loss: 0.3446

Epoch 00001: val_loss improved from inf to 0.34458, saving model to imgs/experiments/exp2/models/unet_2.h5

Epoch 2/100

108/108 [=====] - 17s 162ms/step - opt_accuracy: 0.8725 - sar_accuracy: 0.7704 - fus_accuracy: 0.8602 - opt_loss: 0.0745 - sar_loss: 0.1256 - fusion_loss: 0.0794 - loss: 0.2795 - val_opt_accuracy: 0.8472 - val_sar_accuracy: 0.7885 - val_fus_accuracy: 0.8441 - val_opt_loss: 0.1148 - val_sar_loss: 0.1251 - val_fusion_loss: 0.1214 - val_loss: 0.3613

Epoch 00002: val_loss did not improve from 0.34458

Epoch 3/100

108/108 [=====] - 18s 163ms/step - opt_accuracy: 0.8792 - sar_accuracy: 0.7874 - fus_accuracy: 0.8716 - opt_loss: 0.0697 - sar_loss: 0.1143 - fusion_loss: 0.0723 - loss: 0.2563 - val_opt_accuracy: 0.8529 - val_sar_accuracy: 0.7966 - val_fus_accuracy: 0.8521 - val_opt_loss: 0.1224 - val_sar_loss: 0.1306 - val_fusion_loss: 0.1267 - val_loss: 0.3797

Epoch 00003: val_loss did not improve from 0.34458
Epoch 4/100
108/108 [=====] - 18s 166ms/step - opt_accuracy: 0.8868 - sar_accuracy: 0.7918 - fus_accuracy: 0.8814 - opt_loss: 0.0640 - sar_loss: 0.1112 - fusion_loss: 0.0657 - loss: 0.2410 - val_opt_accuracy: 0.8512 - val_sar_accuracy: 0.7990 - val_fus_accuracy: 0.8496 - val_opt_loss: 0.1521 - val_sar_loss: 0.1446 - val_fusion_loss: 0.1557 - val_loss: 0.4525

Epoch 00004: val_loss did not improve from 0.34458
Epoch 5/100
108/108 [=====] - 18s 164ms/step - opt_accuracy: 0.8926 - sar_accuracy: 0.7938 - fus_accuracy: 0.8891 - opt_loss: 0.0586 - sar_loss: 0.1087 - fusion_loss: 0.0596 - loss: 0.2268 - val_opt_accuracy: 0.8543 - val_sar_accuracy: 0.7949 - val_fus_accuracy: 0.8534 - val_opt_loss: 0.1632 - val_sar_loss: 0.1237 - val_fusion_loss: 0.1622 - val_loss: 0.4491

Epoch 00005: val_loss did not improve from 0.34458
Epoch 6/100
108/108 [=====] - 18s 170ms/step - opt_accuracy: 0.8956 - sar_accuracy: 0.7961 - fus_accuracy: 0.8934 - opt_loss: 0.0573 - sar_loss: 0.1095 - fusion_loss: 0.0578 - loss: 0.2246 - val_opt_accuracy: 0.8535 - val_sar_accuracy: 0.8068 - val_fus_accuracy: 0.8542 - val_opt_loss: 0.1619 - val_sar_loss: 0.1479 - val_fusion_loss: 0.1653 - val_loss: 0.4751

Epoch 00006: val_loss did not improve from 0.34458
Epoch 7/100
108/108 [=====] - 18s 168ms/step - opt_accuracy: 0.8996 - sar_accuracy: 0.8000 - fus_accuracy: 0.8978 - opt_loss: 0.0530 - sar_loss: 0.1054 - fusion_loss: 0.0534 - loss: 0.2117 - val_opt_accuracy: 0.8609 - val_sar_accuracy: 0.8048 - val_fus_accuracy: 0.8600 - val_opt_loss: 0.1671 - val_sar_loss: 0.1578 - val_fusion_loss: 0.1728 - val_loss: 0.4976

Epoch 00007: val_loss did not improve from 0.34458
Epoch 8/100
108/108 [=====] - 19s 173ms/step - opt_accuracy: 0.9048 - sar_accuracy: 0.8105 - fus_accuracy: 0.9032 - opt_loss: 0.0488 - sar_loss: 0.1008 - fusion_loss: 0.0492 - loss: 0.1987 - val_opt_accuracy: 0.8563 - val_sar_accuracy: 0.8096 - val_fus_accuracy: 0.8560 - val_opt_loss: 0.1997 - val_sar_loss: 0.1421 - val_fusion_loss: 0.1977 - val_loss: 0.5396

Epoch 00008: val_loss did not improve from 0.34458
Epoch 9/100
108/108 [=====] - 19s 175ms/step - opt_accuracy: 0.9076 - sar_accuracy: 0.8132 - fus_accuracy: 0.9066 - opt_loss: 0.0468 - sar_loss: 0.0992 - fusion_loss: 0.0471 - loss: 0.1931 - val_opt_accuracy: 0.8605 - val_sar_accuracy: 0.8013 - val_fus_accuracy: 0.8595 - val_opt_loss: 0.1847 - val_sar_loss: 0.1401 - val_fusion_loss: 0.1834 - val_loss: 0.5083

Epoch 00009: val_loss did not improve from 0.34458
Epoch 10/100
108/108 [=====] - 19s 177ms/step - opt_accuracy: 0.9116 - sar_accuracy: 0.8201 - fus_accuracy: 0.9108 - opt_loss: 0.0432 - sar_loss: 0.0953 - fusion_loss: 0.0433 - loss: 0.1818 - val_opt_accuracy: 0.8588 - val_sar_accuracy: 0.8057 - val_fus_accuracy: 0.8583 - val_opt_loss: 0.1907 - val_sar_loss: 0.1376 - val_fusion_loss: 0.1908 - val_loss: 0.5190

Epoch 00010: val_loss did not improve from 0.34458
Epoch 11/100
108/108 [=====] - 19s 181ms/step - opt_accuracy: 0.9140 - sar_accuracy: 0.8182 - fus_accuracy: 0.9133 - opt_loss: 0.0411 - sar_loss: 0.0955 - fusion_loss: 0.0412 - loss: 0.1778 - val_opt_accuracy: 0.8606 - val_sar_accuracy: 0.8056 - val_fus_accuracy: 0.8602 - val_opt_loss: 0.1819 - val_sar_loss: 0.1263 - val_fusion_loss: 0.1808 - val_loss: 0.4890

Epoch 00011: val_loss did not improve from 0.34458

Epoch 00011: early stopping

time: 3

Model: "model_3_4"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| Total params: 1,406,327 | | |
| Trainable params: 1,406,313 | | |
| Non-trainable params: 14 | | |

Epoch 1/100

108/108 [=====] - 23s 192ms/step - opt_accuracy: 0.8351 - sar_accuracy: 0.7292 - fus_accuracy: 0.8026 - opt_loss: 0.0967 - sar_loss: 0.1423 - fusion_loss: 0.1115 - loss: 0.3506 - val_opt_accuracy: 0.8255 - val_sar_accuracy: 0.7676 - val_fus_accuracy: 0.8212 - val_opt_loss: 0.1136 - val_sar_loss: 0.1207 - val_fusion_loss: 0.1177 - val_loss: 0.3520

Epoch 00001: val_loss improved from inf to 0.35199, saving model to imgs/experiments/exp2/models\unet_3.h5

Epoch 2/100

108/108 [=====] - 20s 189ms/step - opt_accuracy: 0.8661 - sar_accuracy: 0.7651 - fus_accuracy: 0.8546 - opt_loss: 0.0783 - sar_loss: 0.1287 - fusion_loss: 0.0830 - loss: 0.2900 - val_opt_accuracy: 0.8382 - val_sar_accuracy: 0.7868 - val_fus_accuracy: 0.8340 - val_opt_loss: 0.1253 - val_sar_loss: 0.1190 - val_fusion_loss: 0.1238 - val_loss: 0.3681

Epoch 00002: val_loss did not improve from 0.35199

Epoch 3/100

108/108 [=====] - 22s 201ms/step - opt_accuracy: 0.8769 - sar_accuracy: 0.7786 - fus_accuracy: 0.8685 - opt_loss: 0.0715 - sar_loss: 0.1193 - fusion_loss: 0.0744 - loss: 0.2652 - val_opt_accuracy: 0.8438 - val_sar_accuracy: 0.7716 - val_fus_accuracy: 0.8403 - val_opt_loss: 0.1250 - val_sar_loss: 0.1317 - val_fusion_loss: 0.1241 - val_loss: 0.3808

Epoch 00003: val_loss did not improve from 0.35199

Epoch 4/100

108/108 [=====] - 22s 201ms/step - opt_accuracy: 0.8826 - sar_accuracy: 0.7725 - fus_accuracy: 0.8761 - opt_loss: 0.0679 - sar_loss: 0.1197 - fusion_loss: 0.0702 - loss: 0.2578 - val_opt_accuracy: 0.8561 - val_sar_accuracy: 0.7908 - val_fus_accuracy: 0.8498 - val_opt_loss: 0.1210 - val_sar_loss: 0.1273 - val_fusion_loss: 0.1224 - val_loss: 0.3707

Epoch 00004: val_loss did not improve from 0.35199

Epoch 5/100

108/108 [=====] - 21s 194ms/step - opt_accuracy: 0.8864 - sar_accuracy: 0.7809 - fus_accuracy: 0.8807 - opt_loss: 0.0647 - sar_loss: 0.1161 - fusion_loss: 0.0665 - loss: 0.2473 - val_opt_accuracy: 0.8498 - val_sar_accuracy: 0.7505 - val_fus_accuracy: 0.8438 - val_opt_loss: 0.1250 - val_sar_loss: 0.1276 - val_fusion_loss: 0.1203 - val_loss: 0.3728

Epoch 00005: val_loss did not improve from 0.35199

Epoch 6/100

108/108 [=====] - 21s 196ms/step - opt_accuracy: 0.8898 - sar_accuracy: 0.7817 - fus_accuracy: 0.8851 - opt_loss: 0.0625 - sar_loss: 0.1166 - fusion_loss: 0.0638 - loss: 0.2429 - val_opt_accuracy: 0.8565 - val_sar_accuracy: 0.8053 - val_fus_accuracy: 0.8526 - val_opt_loss: 0.1308 - val_sar_loss: 0.1413 - val_fusion_loss: 0.1308 - val_loss: 0.4028

Epoch 00006: val_loss did not improve from 0.35199

Epoch 7/100

108/108 [=====] - 21s 197ms/step - opt_accuracy: 0.8919 - sar_accuracy: 0.7873 - fus_accuracy: 0.8880 - opt_loss: 0.0609 - sar_loss: 0.1134 - fusion_loss: 0.0617 - loss: 0.2359 - val_opt_accuracy: 0.8521 - val_sar_accuracy: 0.7991 - val_fus_accuracy: 0.8460 - val_opt_loss: 0.1419 - val_sar_loss: 0.1691 - val_fusion_loss: 0.1439 - val_loss: 0.4550

Epoch 00007: val_loss did not improve from 0.35199

Epoch 8/100

108/108 [=====] - 22s 201ms/step - opt_accuracy: 0.8932 - sar_accuracy: 0.7830 - fus_accuracy: 0.8897 - opt_loss: 0.0595 - sar_loss: 0.1143 - fusion_loss: 0.0601 - loss: 0.2338 - val_opt_accuracy: 0.8540 - val_sar_accuracy: 0.7846 - val_fus_accuracy: 0.8511 - val_opt_loss: 0.1263 - val_sar_loss: 0.1331 - val_fusion_loss: 0.1268 - val_loss: 0.3862

Epoch 00008: val_loss did not improve from 0.35199

Epoch 9/100

108/108 [=====] - 22s 207ms/step - opt_accuracy: 0.8965 - sar_accuracy: 0.7850 - fus_accuracy: 0.8939 - opt_loss: 0.0572 - sar_loss: 0.1131 - fusion_loss: 0.0576 - loss: 0.2279 - val_opt_accuracy: 0.8527 - val_sar_accuracy: 0.7890 - val_fus_accuracy: 0.8500 - val_opt_loss: 0.1360 - val_sar_loss: 0.1360 - val_fusion_loss: 0.1353 - val_loss: 0.4073

Epoch 00009: val_loss did not improve from 0.35199

Epoch 10/100

108/108 [=====] - 22s 202ms/step - opt_accuracy: 0.8982 - sar_accuracy: 0.7906 - fus_accuracy: 0.8960 - opt_loss: 0.0558 - sar_loss: 0.1111 - fusion_loss: 0.0558 - loss: 0.2228 - val_opt_accuracy: 0.8597 - val_sar_accuracy: 0.8007 - val_fus_accuracy: 0.8561 - val_opt_loss: 0.1175 - val_sar_loss: 0.1487 - val_fusion_loss: 0.1213 - val_loss: 0.3875

Epoch 00010: val_loss did not improve from 0.35199

Epoch 11/100

108/108 [=====] - 22s 205ms/step - opt_accuracy: 0.9022 - sar_accuracy: 0.7888 - fus_accuracy: 0.9004 - opt_loss: 0.0516 - sar_loss: 0.1099 - fusion_loss: 0.0517 - loss: 0.2132 - val_opt_accuracy: 0.8536 - val_sar_accuracy: 0.7810 - val_fus_accuracy: 0.8509 - val_opt_loss: 0.1177 - val_sar_loss: 0.1216 - val_fusion_loss: 0.1164 - val_loss: 0.3557

Epoch 00011: val_loss did not improve from 0.35199

Epoch 00011: early stopping

time: 4

Model: "model_3_5"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |

Total params: 1,406,327
Trainable params: 1,406,313
Non-trainable params: 14

Epoch 1/100

108/108 [=====] - 25s 211ms/step - opt_accuracy: 0.8431 - sar_accuracy: 0.7396 - fus_accuracy: 0.8231 - opt_loss: 0.0921 - sar_loss: 0.1406 - fusion_loss: 0.0991 - loss: 0.3318 - val_opt_accuracy: 0.8426 - val_sar_accuracy: 0.7391 - val_fus_accuracy: 0.8349 - val_opt_loss: 0.1043 - val_sar_loss: 0.1263 - val_fusion_loss: 0.1097 - val_loss: 0.3403

Epoch 00001: val_loss improved from inf to 0.34031, saving model to imgs/experiments/exp2/models/unet_4.h5

Epoch 2/100

108/108 [=====] - 22s 208ms/step - opt_accuracy: 0.8746 - sar_accuracy: 0.7600 - fus_accuracy: 0.8659 - opt_loss: 0.0723 - sar_loss: 0.1307 - fusion_loss: 0.0752 - loss: 0.2782 - val_opt_accuracy: 0.8484 - val_sar_accuracy: 0.7554 - val_fus_accuracy: 0.8457 - val_opt_loss: 0.1225 - val_sar_loss: 0.1255 - val_fusion_loss: 0.1242 - val_loss: 0.3722

Epoch 00002: val_loss did not improve from 0.34031

Epoch 3/100

108/108 [=====] - 23s 211ms/step - opt_accuracy: 0.8826 - sar_accuracy: 0.7704 - fus_accuracy: 0.8780 - opt_loss: 0.0675 - sar_loss: 0.1276 - fusion_loss: 0.0690 - loss: 0.2641 - val_opt_accuracy: 0.8461 - val_sar_accuracy: 0.7938 - val_fus_accuracy: 0.8451 - val_opt_loss: 0.1346 - val_sar_loss: 0.1200 - val_fusion_loss: 0.1350 - val_loss: 0.3897

Epoch 00003: val_loss did not improve from 0.34031

Epoch 4/100

108/108 [=====] - 23s 213ms/step - opt_accuracy: 0.8887 - sar_accuracy: 0.7857 - fus_accuracy: 0.8854 - opt_loss: 0.0626 - sar_loss: 0.1205 - fusion_loss: 0.0638 - loss: 0.2470 - val_opt_accuracy: 0.8555 - val_sar_accuracy: 0.7789 - val_fus_accuracy: 0.8556 - val_opt_loss: 0.1245 - val_sar_loss: 0.1216 - val_fusion_loss: 0.1234 - val_loss: 0.3695

Epoch 00004: val_loss did not improve from 0.34031

Epoch 5/100

108/108 [=====] - 23s 215ms/step - opt_accuracy: 0.8912 - sar_accuracy: 0.7908 - fus_accuracy: 0.8893 - opt_loss: 0.0609 - sar_loss: 0.1159 - fusion_loss: 0.0617 - loss: 0.2384 - val_opt_accuracy: 0.8495 - val_sar_accuracy: 0.8031 - val_fus_accuracy: 0.8507 - val_opt_loss: 0.1450 - val_sar_loss: 0.1277 - val_fusion_loss: 0.1443 - val_loss: 0.4170

Epoch 00005: val_loss did not improve from 0.34031

Epoch 6/100

108/108 [=====] - 23s 217ms/step - opt_accuracy: 0.8963 - sar_accuracy: 0.7970 - fus_accuracy: 0.8952 - opt_loss: 0.0558 - sar_loss: 0.1106 - fusion_loss: 0.0561 - loss: 0.2225 - val_opt_accuracy: 0.8476 - val_sar_accuracy: 0.8079 - val_fus_accuracy: 0.8508 - val_opt_loss: 0.1414 - val_sar_loss: 0.1311 - val_fusion_loss: 0.1416 - val_loss: 0.4141

Epoch 00006: val_loss did not improve from 0.34031

Epoch 7/100

108/108 [=====] - 24s 220ms/step - opt_accuracy: 0.8976 - sar_accuracy: 0.7962 - fus_accuracy: 0.8967 - opt_loss: 0.0548 - sar_loss: 0.1116 - fusion_loss: 0.0549 - loss: 0.2213 - val_opt_accuracy: 0.8366 - val_sar_accuracy: 0.8091 - val_fus_accuracy: 0.8399 - val_opt_loss: 0.1654 - val_sar_loss: 0.1395 - val_fusion_loss: 0.1656 - val_loss: 0.4704

Epoch 00007: val_loss did not improve from 0.34031

Epoch 8/100

108/108 [=====] - 24s 221ms/step - opt_accuracy: 0.9005 - sar_accuracy: 0.7987 - fus_accuracy: 0.8998 - opt_loss: 0.0518 - sar_loss: 0.1085 - fusion_loss: 0.0519 - loss: 0.2123 - val_opt_accuracy: 0.8552 - val_sar_accuracy: 0.8

054 - val_fus_accuracy: 0.8543 - val_opt_loss: 0.1449 - val_sar_loss: 0.1408 - val_fusion_loss: 0.1490 - val_loss: 0.4346

Epoch 00008: val_loss did not improve from 0.34031

Epoch 9/100

108/108 [=====] - 24s 220ms/step - opt_accuracy: 0.9067 - sar_accuracy: 0.8107 - fus_accuracy: 0.9060 - opt_loss: 0.0468 - sar_loss: 0.1023 - fusion_loss: 0.0468 - loss: 0.1960 - val_opt_accuracy: 0.8609 - val_sar_accuracy: 0.8092 - val_fus_accuracy: 0.8601 - val_opt_loss: 0.1518 - val_sar_loss: 0.1426 - val_fusion_loss: 0.1531 - val_loss: 0.4474

Epoch 00009: val_loss did not improve from 0.34031

Epoch 10/100

108/108 [=====] - 24s 224ms/step - opt_accuracy: 0.9098 - sar_accuracy: 0.8109 - fus_accuracy: 0.9091 - opt_loss: 0.0440 - sar_loss: 0.1014 - fusion_loss: 0.0440 - loss: 0.1894 - val_opt_accuracy: 0.8638 - val_sar_accuracy: 0.8073 - val_fus_accuracy: 0.8627 - val_opt_loss: 0.1460 - val_sar_loss: 0.1315 - val_fusion_loss: 0.1473 - val_loss: 0.4248

Epoch 00010: val_loss did not improve from 0.34031

Epoch 11/100

108/108 [=====] - 24s 227ms/step - opt_accuracy: 0.9107 - sar_accuracy: 0.8143 - fus_accuracy: 0.9102 - opt_loss: 0.0444 - sar_loss: 0.1001 - fusion_loss: 0.0441 - loss: 0.1885 - val_opt_accuracy: 0.8633 - val_sar_accuracy: 0.7974 - val_fus_accuracy: 0.8629 - val_opt_loss: 0.1398 - val_sar_loss: 0.1196 - val_fusion_loss: 0.1398 - val_loss: 0.3992y: 0.9118

Epoch 00011: val_loss did not improve from 0.34031

Epoch 00011: early stopping

time: 5

Model: "model_3_6"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |

Total params: 1,406,327

Trainable params: 1,406,313

Non-trainable params: 14

Epoch 1/100

108/108 [=====] - 28s 236ms/step - opt_accuracy: 0.8269 - sar_accuracy: 0.7302 - fus_accuracy: 0.8011 - opt_loss: 0.0981 - sar_loss: 0.1423 - fusion_loss: 0.1113 - loss: 0.3516 - val_opt_accuracy: 0.8322 - val_sar_accuracy: 0.7571 - val_fus_accuracy: 0.8292 - val_opt_loss: 0.1149 - val_sar_loss: 0.1234 - val_fusion_loss: 0.1114 - val_loss: 0.3497

Epoch 00001: val_loss improved from inf to 0.34969, saving model to imgs/experiment s/exp2/models\unet_5.h5

Epoch 2/100

108/108 [=====] - 25s 230ms/step - opt_accuracy: 0.8651 - sar_accuracy: 0.7537 - fus_accuracy: 0.8530 - opt_loss: 0.0798 - sar_loss: 0.1328 - fusion_loss: 0.0849 - loss: 0.2976 - val_opt_accuracy: 0.8313 - val_sar_accuracy: 0.7614 - val_fus_accuracy: 0.8296 - val_opt_loss: 0.1558 - val_sar_loss: 0.1253 - val_fusion_loss: 0.1497 - val_loss: 0.4308

Epoch 00002: val_loss did not improve from 0.34969

Epoch 3/100

108/108 [=====] - 25s 235ms/step - opt_accuracy: 0.8754 - sar_accuracy: 0.7716 - fus_accuracy: 0.8698 - opt_loss: 0.0721 - sar_loss: 0.1248 - fusion_loss: 0.0751 - loss: 0.2720 - val_opt_accuracy: 0.8487 - val_sar_accuracy: 0.7694 - val_fus_accuracy: 0.8485 - val_opt_loss: 0.1186 - val_sar_loss: 0.1232 - val_fusion_loss: 0.1180 - val_loss: 0.3598

Epoch 00003: val_loss did not improve from 0.34969

Epoch 4/100

108/108 [=====] - 25s 236ms/step - opt_accuracy: 0.8844 - sar_accuracy: 0.7716 - fus_accuracy: 0.8802 - opt_loss: 0.0673 - sar_loss: 0.1235 - fusion_loss: 0.0694 - loss: 0.2602 - val_opt_accuracy: 0.8519 - val_sar_accuracy: 0.7897 - val_fus_accuracy: 0.8528 - val_opt_loss: 0.1006 - val_sar_loss: 0.1357 - val_fusion_loss: 0.1061 - val_loss: 0.3424

Epoch 00004: val_loss improved from 0.34969 to 0.34244, saving model to imgs/experiments/exp2/models/unet_5.h5

Epoch 5/100

108/108 [=====] - 26s 241ms/step - opt_accuracy: 0.8875 - sar_accuracy: 0.7831 - fus_accuracy: 0.8834 - opt_loss: 0.0640 - sar_loss: 0.1179 - fusion_loss: 0.0656 - loss: 0.2475 - val_opt_accuracy: 0.8567 - val_sar_accuracy: 0.7961 - val_fus_accuracy: 0.8566 - val_opt_loss: 0.1186 - val_sar_loss: 0.1453 - val_fusion_loss: 0.1226 - val_loss: 0.3864 - opt_accuracy: 0.8809 - opt_loss: 0.0663 - sar_ - ETA: 5s - opt_accuracy: 0.8870 - sar_accuracy: 0.7837 - fus_accuracy: 0.8826 - opt_loss: 0.0647 - sar_loss: - ETA: 1s - opt_accuracy: 0.8876 - sar_accuracy: 0.7832 - fus_accuracy: 0.8834 - opt_loss: 0.0639 - sar_loss: 0.1178 - fusion_loss: 0.0

Epoch 00005: val_loss did not improve from 0.34244

Epoch 6/100

108/108 [=====] - 26s 245ms/step - opt_accuracy: 0.8899 - sar_accuracy: 0.7837 - fus_accuracy: 0.8876 - opt_loss: 0.0617 - sar_loss: 0.1164 - fusion_loss: 0.0628 - loss: 0.2409 - val_opt_accuracy: 0.8517 - val_sar_accuracy: 0.7959 - val_fus_accuracy: 0.8528 - val_opt_loss: 0.1298 - val_sar_loss: 0.1404 - val_fusion_loss: 0.1339 - val_loss: 0.4042

Epoch 00006: val_loss did not improve from 0.34244

Epoch 7/100

108/108 [=====] - 27s 250ms/step - opt_accuracy: 0.8915 - sar_accuracy: 0.7893 - fus_accuracy: 0.8898 - opt_loss: 0.0595 - sar_loss: 0.1141 - fusion_loss: 0.0604 - loss: 0.2340 - val_opt_accuracy: 0.8527 - val_sar_accuracy: 0.7960 - val_fus_accuracy: 0.8526 - val_opt_loss: 0.1345 - val_sar_loss: 0.1377 - val_fusion_loss: 0.1362 - val_loss: 0.4084

Epoch 00007: val_loss did not improve from 0.34244

Epoch 8/100

108/108 [=====] - 27s 249ms/step - opt_accuracy: 0.8914 - sar_accuracy: 0.7713 - fus_accuracy: 0.8900 - opt_loss: 0.0586 - sar_loss: 0.1243 - fusion_loss: 0.0594 - loss: 0.2423 - val_opt_accuracy: 0.8491 - val_sar_accuracy: 0.7885 - val_fus_accuracy: 0.8503 - val_opt_loss: 0.1543 - val_sar_loss: 0.1483 - val_fusion_loss: 0.1579 - val_loss: 0.4605

Epoch 00008: val_loss did not improve from 0.34244

Epoch 9/100

108/108 [=====] - 27s 250ms/step - opt_accuracy: 0.8966 - sar_accuracy: 0.7932 - fus_accuracy: 0.8953 - opt_loss: 0.0549 - sar_loss: 0.1118 - fusion_loss: 0.0555 - loss: 0.2222 - val_opt_accuracy: 0.8514 - val_sar_accuracy: 0.7905 - val_fus_accuracy: 0.8516 - val_opt_loss: 0.1484 - val_sar_loss: 0.1344 - val_fusion_loss: 0.1486 - val_loss: 0.4314

Epoch 00009: val_loss did not improve from 0.34244

Epoch 10/100

108/108 [=====] - 27s 255ms/step - opt_accuracy: 0.8981 - sar_accuracy: 0.7882 - fus_accuracy: 0.8968 - opt_loss: 0.0533 - sar_loss: 0.1128 - f

usion_loss: 0.0537 - loss: 0.2198 - val_opt_accuracy: 0.8564 - val_sar_accuracy: 0.7921 - val_fus_accuracy: 0.8568 - val_opt_loss: 0.1508 - val_sar_loss: 0.1401 - val_fusion_loss: 0.1518 - val_loss: 0.4427

Epoch 00010: val_loss did not improve from 0.34244

Epoch 11/100

108/108 [=====] - 26s 245ms/step - opt_accuracy: 0.9056 - sar_accuracy: 0.7978 - fus_accuracy: 0.9043 - opt_loss: 0.0476 - sar_loss: 0.1078 - fusion_loss: 0.0481 - loss: 0.2035 - val_opt_accuracy: 0.8592 - val_sar_accuracy: 0.7974 - val_fus_accuracy: 0.8582 - val_opt_loss: 0.1424 - val_sar_loss: 0.1377 - val_fusion_loss: 0.1440 - val_loss: 0.4242

Epoch 00011: val_loss did not improve from 0.34244

Epoch 12/100

108/108 [=====] - 28s 257ms/step - opt_accuracy: 0.9042 - sar_accuracy: 0.8042 - fus_accuracy: 0.9033 - opt_loss: 0.0485 - sar_loss: 0.1052 - fusion_loss: 0.0488 - loss: 0.2024 - val_opt_accuracy: 0.8479 - val_sar_accuracy: 0.7984 - val_fus_accuracy: 0.8490 - val_opt_loss: 0.1717 - val_sar_loss: 0.1498 - val_fusion_loss: 0.1723 - val_loss: 0.4938

Epoch 00012: val_loss did not improve from 0.34244

Epoch 13/100

108/108 [=====] - 27s 255ms/step - opt_accuracy: 0.9086 - sar_accuracy: 0.8076 - fus_accuracy: 0.9079 - opt_loss: 0.0448 - sar_loss: 0.1026 - fusion_loss: 0.0449 - loss: 0.1923 - val_opt_accuracy: 0.8547 - val_sar_accuracy: 0.7944 - val_fus_accuracy: 0.8537 - val_opt_loss: 0.1665 - val_sar_loss: 0.1399 - val_fusion_loss: 0.1675 - val_loss: 0.4739

Epoch 00013: val_loss did not improve from 0.34244

Epoch 14/100

108/108 [=====] - 28s 257ms/step - opt_accuracy: 0.9048 - sar_accuracy: 0.8050 - fus_accuracy: 0.9042 - opt_loss: 0.0483 - sar_loss: 0.1043 - fusion_loss: 0.0483 - loss: 0.2009 - val_opt_accuracy: 0.8523 - val_sar_accuracy: 0.7991 - val_fus_accuracy: 0.8520 - val_opt_loss: 0.1688 - val_sar_loss: 0.1539 - val_fusion_loss: 0.1727 - val_loss: 0.49549034 - sar_accuracy: 0.8030 - fus_accuracy: 0.9028 - opt_loss: 0.0492 - sar_loss: 0.1053 - fu

Epoch 00014: val_loss did not improve from 0.34244

Epoch 00014: early stopping

time: 6

Model: "model_3_7"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |
| Total params: 1,406,327 | | |
| Trainable params: 1,406,313 | | |
| Non-trainable params: 14 | | |

Epoch 1/100

108/108 [=====] - 30s 263ms/step - opt_accuracy: 0.8310 - sar_accuracy: 0.7305 - fus_accuracy: 0.8152 - opt_loss: 0.0971 - sar_loss: 0.1407 - fusion_loss: 0.1063 - loss: 0.3441 - val_opt_accuracy: 0.8227 - val_sar_accuracy: 0.7363 - val_fus_accuracy: 0.8208 - val_opt_loss: 0.1233 - val_sar_loss: 0.1311 - val_fusion_loss: 0.1311 - val_loss: 0.4242

usion_loss: 0.1236 - val_loss: 0.3781

Epoch 00001: val_loss improved from inf to 0.37808, saving model to imgs/experiments/exp2/models\unet_6.h5

Epoch 2/100

108/108 [=====] - 28s 262ms/step - opt_accuracy: 0.8712 - sar_accuracy: 0.7514 - fus_accuracy: 0.8642 - opt_loss: 0.0751 - sar_loss: 0.1351 - fusion_loss: 0.0784 - loss: 0.2885 - val_opt_accuracy: 0.8399 - val_sar_accuracy: 0.7364 - val_fus_accuracy: 0.8392 - val_opt_loss: 0.1270 - val_sar_loss: 0.1277 - val_fusion_loss: 0.1225 - val_loss: 0.3772

Epoch 00002: val_loss improved from 0.37808 to 0.37724, saving model to imgs/experiments/exp2/models\unet_6.h5

Epoch 3/100

108/108 [=====] - 28s 262ms/step - opt_accuracy: 0.8805 - sar_accuracy: 0.7320 - fus_accuracy: 0.8782 - opt_loss: 0.0680 - sar_loss: 0.1380 - fusion_loss: 0.0692 - loss: 0.2752 - val_opt_accuracy: 0.8393 - val_sar_accuracy: 0.7425 - val_fus_accuracy: 0.8367 - val_opt_loss: 0.1520 - val_sar_loss: 0.1315 - val_fusion_loss: 0.1525 - val_loss: 0.43610681 - sar_loss: 0.1378 -

Epoch 00003: val_loss did not improve from 0.37724

Epoch 4/100

108/108 [=====] - 28s 261ms/step - opt_accuracy: 0.8844 - sar_accuracy: 0.7312 - fus_accuracy: 0.8824 - opt_loss: 0.0644 - sar_loss: 0.1406 - fusion_loss: 0.0652 - loss: 0.2702 - val_opt_accuracy: 0.8480 - val_sar_accuracy: 0.7450 - val_fus_accuracy: 0.8468 - val_opt_loss: 0.1273 - val_sar_loss: 0.1231 - val_fusion_loss: 0.1258 - val_loss: 0.3761

Epoch 00004: val_loss improved from 0.37724 to 0.37615, saving model to imgs/experiments/exp2/models\unet_6.h5

Epoch 5/100

108/108 [=====] - 29s 268ms/step - opt_accuracy: 0.8877 - sar_accuracy: 0.7406 - fus_accuracy: 0.8869 - opt_loss: 0.0621 - sar_loss: 0.1377 - fusion_loss: 0.0626 - loss: 0.2624 - val_opt_accuracy: 0.8455 - val_sar_accuracy: 0.7555 - val_fus_accuracy: 0.8449 - val_opt_loss: 0.1537 - val_sar_loss: 0.1210 - val_fusion_loss: 0.1528 - val_loss: 0.4276

Epoch 00005: val_loss did not improve from 0.37615

Epoch 6/100

108/108 [=====] - 29s 270ms/step - opt_accuracy: 0.8925 - sar_accuracy: 0.7413 - fus_accuracy: 0.8915 - opt_loss: 0.0585 - sar_loss: 0.1382 - fusion_loss: 0.0589 - loss: 0.2556 - val_opt_accuracy: 0.8573 - val_sar_accuracy: 0.7585 - val_fus_accuracy: 0.8556 - val_opt_loss: 0.1419 - val_sar_loss: 0.1232 - val_fusion_loss: 0.1417 - val_loss: 0.4068

Epoch 00006: val_loss did not improve from 0.37615

Epoch 7/100

108/108 [=====] - 29s 267ms/step - opt_accuracy: 0.8969 - sar_accuracy: 0.7478 - fus_accuracy: 0.8961 - opt_loss: 0.0549 - sar_loss: 0.1358 - fusion_loss: 0.0552 - loss: 0.2459 - val_opt_accuracy: 0.8623 - val_sar_accuracy: 0.7628 - val_fus_accuracy: 0.8607 - val_opt_loss: 0.1501 - val_sar_loss: 0.1203 - val_fusion_loss: 0.1508 - val_loss: 0.4212

Epoch 00007: val_loss did not improve from 0.37615

Epoch 8/100

108/108 [=====] - 30s 276ms/step - opt_accuracy: 0.8982 - sar_accuracy: 0.7521 - fus_accuracy: 0.8976 - opt_loss: 0.0544 - sar_loss: 0.1360 - fusion_loss: 0.0546 - loss: 0.2450 - val_opt_accuracy: 0.8590 - val_sar_accuracy: 0.7610 - val_fus_accuracy: 0.8583 - val_opt_loss: 0.1259 - val_sar_loss: 0.1157 - val_fusion_loss: 0.1260 - val_loss: 0.3675

Epoch 00008: val_loss improved from 0.37615 to 0.36747, saving model to imgs/experiments/exp2/models\unet_6.h5

Epoch 9/100

108/108 [=====] - 29s 272ms/step - opt_accuracy: 0.9053 - s

ar_accuracy: 0.7585 - fus_accuracy: 0.9049 - opt_loss: 0.0481 - sar_loss: 0.1344 - fusion_loss: 0.0482 - loss: 0.2307 - val_opt_accuracy: 0.8617 - val_sar_accuracy: 0.7719 - val_fus_accuracy: 0.8606 - val_opt_loss: 0.1507 - val_sar_loss: 0.1186 - val_fusion_loss: 0.1519 - val_loss: 0.4211

Epoch 00009: val_loss did not improve from 0.36747

Epoch 10/100

108/108 [=====] - 30s 279ms/step - opt_accuracy: 0.9065 - sar_accuracy: 0.7597 - fus_accuracy: 0.9060 - opt_loss: 0.0469 - sar_loss: 0.1331 - fusion_loss: 0.0471 - loss: 0.2271 - val_opt_accuracy: 0.8532 - val_sar_accuracy: 0.7664 - val_fus_accuracy: 0.8515 - val_opt_loss: 0.1795 - val_sar_loss: 0.1207 - val_fusion_loss: 0.1809 - val_loss: 0.4811

Epoch 00010: val_loss did not improve from 0.36747

Epoch 11/100

108/108 [=====] - 30s 283ms/step - opt_accuracy: 0.9098 - sar_accuracy: 0.7566 - fus_accuracy: 0.9094 - opt_loss: 0.0437 - sar_loss: 0.1330 - fusion_loss: 0.0439 - loss: 0.2207 - val_opt_accuracy: 0.8554 - val_sar_accuracy: 0.7532 - val_fus_accuracy: 0.8543 - val_opt_loss: 0.1898 - val_sar_loss: 0.1225 - val_fusion_loss: 0.1901 - val_loss: 0.5024

Epoch 00011: val_loss did not improve from 0.36747

Epoch 12/100

108/108 [=====] - 30s 282ms/step - opt_accuracy: 0.9115 - sar_accuracy: 0.7541 - fus_accuracy: 0.9111 - opt_loss: 0.0426 - sar_loss: 0.1345 - fusion_loss: 0.0428 - loss: 0.2198 - val_opt_accuracy: 0.8592 - val_sar_accuracy: 0.7694 - val_fus_accuracy: 0.8585 - val_opt_loss: 0.1973 - val_sar_loss: 0.1194 - val_fusion_loss: 0.1969 - val_loss: 0.5136

Epoch 00012: val_loss did not improve from 0.36747

Epoch 13/100

108/108 [=====] - 30s 282ms/step - opt_accuracy: 0.9161 - sar_accuracy: 0.7587 - fus_accuracy: 0.9159 - opt_loss: 0.0393 - sar_loss: 0.1338 - fusion_loss: 0.0394 - loss: 0.2126 - val_opt_accuracy: 0.8533 - val_sar_accuracy: 0.7528 - val_fus_accuracy: 0.8528 - val_opt_loss: 0.2067 - val_sar_loss: 0.1213 - val_fusion_loss: 0.2062 - val_loss: 0.5343

Epoch 00013: val_loss did not improve from 0.36747

Epoch 14/100

108/108 [=====] - 30s 282ms/step - opt_accuracy: 0.9182 - sar_accuracy: 0.7614 - fus_accuracy: 0.9181 - opt_loss: 0.0373 - sar_loss: 0.1324 - fusion_loss: 0.0373 - loss: 0.2070 - val_opt_accuracy: 0.8548 - val_sar_accuracy: 0.7707 - val_fus_accuracy: 0.8531 - val_opt_loss: 0.2120 - val_sar_loss: 0.1193 - val_fusion_loss: 0.2123 - val_loss: 0.5436

Epoch 00014: val_loss did not improve from 0.36747

Epoch 15/100

108/108 [=====] - 31s 288ms/step - opt_accuracy: 0.9184 - sar_accuracy: 0.7665 - fus_accuracy: 0.9184 - opt_loss: 0.0378 - sar_loss: 0.1324 - fusion_loss: 0.0378 - loss: 0.2080 - val_opt_accuracy: 0.8560 - val_sar_accuracy: 0.7762 - val_fus_accuracy: 0.8542 - val_opt_loss: 0.2198 - val_sar_loss: 0.1182 - val_fusion_loss: 0.2204 - val_loss: 0.5584

Epoch 00015: val_loss did not improve from 0.36747

Epoch 16/100

108/108 [=====] - 31s 291ms/step - opt_accuracy: 0.9211 - sar_accuracy: 0.7607 - fus_accuracy: 0.9208 - opt_loss: 0.0355 - sar_loss: 0.1328 - fusion_loss: 0.0356 - loss: 0.2039 - val_opt_accuracy: 0.8573 - val_sar_accuracy: 0.7750 - val_fus_accuracy: 0.8563 - val_opt_loss: 0.2157 - val_sar_loss: 0.1162 - val_fusion_loss: 0.2160 - val_loss: 0.5478

Epoch 00016: val_loss did not improve from 0.36747

Epoch 17/100

108/108 [=====] - 31s 292ms/step - opt_accuracy: 0.9184 - sar_accuracy: 0.7636 - fus_accuracy: 0.9183 - opt_loss: 0.0379 - sar_loss: 0.1330 - fusion_loss: 0.0379 - loss: 0.2039 - val_opt_accuracy: 0.8573 - val_sar_accuracy: 0.7750 - val_fus_accuracy: 0.8563 - val_opt_loss: 0.2157 - val_sar_loss: 0.1162 - val_fusion_loss: 0.2160 - val_loss: 0.5478

usion_loss: 0.0380 - loss: 0.2090 - val_opt_accuracy: 0.8591 - val_sar_accuracy: 0.7669 - val_fus_accuracy: 0.8589 - val_opt_loss: 0.1707 - val_sar_loss: 0.1188 - val_fusion_loss: 0.1705 - val_loss: 0.4600

Epoch 00017: val_loss did not improve from 0.36747

Epoch 18/100

108/108 [=====] - 31s 289ms/step - opt_accuracy: 0.9194 - sar_accuracy: 0.7677 - fus_accuracy: 0.9193 - opt_loss: 0.0368 - sar_loss: 0.1309 - fusion_loss: 0.0369 - loss: 0.2047 - val_opt_accuracy: 0.8600 - val_sar_accuracy: 0.7758 - val_fus_accuracy: 0.8598 - val_opt_loss: 0.1916 - val_sar_loss: 0.1173 - val_fusion_loss: 0.1904 - val_loss: 0.4993

Epoch 00018: val_loss did not improve from 0.36747

Epoch 00018: early stopping

time: 7

Model: "model_3_8"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |

Total params: 1,406,327

Trainable params: 1,406,313

Non-trainable params: 14

Epoch 1/100

108/108 [=====] - 35s 300ms/step - opt_accuracy: 0.8324 - sar_accuracy: 0.7350 - fus_accuracy: 0.8054 - opt_loss: 0.0988 - sar_loss: 0.1421 - fusion_loss: 0.1146 - loss: 0.3556 - val_opt_accuracy: 0.8486 - val_sar_accuracy: 0.7631 - val_fus_accuracy: 0.8315 - val_opt_loss: 0.1050 - val_sar_loss: 0.1184 - val_fusion_loss: 0.1130 - val_loss: 0.3364

Epoch 00001: val_loss improved from inf to 0.33642, saving model to imgs/experiments/exp2/models\unet_7.h5

Epoch 2/100

108/108 [=====] - 31s 290ms/step - opt_accuracy: 0.8676 - sar_accuracy: 0.7520 - fus_accuracy: 0.8522 - opt_loss: 0.0783 - sar_loss: 0.1329 - fusion_loss: 0.0862 - loss: 0.2974 - val_opt_accuracy: 0.8442 - val_sar_accuracy: 0.7713 - val_fus_accuracy: 0.8399 - val_opt_loss: 0.1180 - val_sar_loss: 0.1276 - val_fusion_loss: 0.1197 - val_loss: 0.3654

Epoch 00002: val_loss did not improve from 0.33642

Epoch 3/100

108/108 [=====] - 32s 293ms/step - opt_accuracy: 0.8769 - sar_accuracy: 0.7719 - fus_accuracy: 0.8688 - opt_loss: 0.0713 - sar_loss: 0.1241 - fusion_loss: 0.0755 - loss: 0.2709 - val_opt_accuracy: 0.8493 - val_sar_accuracy: 0.7927 - val_fus_accuracy: 0.8476 - val_opt_loss: 0.1124 - val_sar_loss: 0.1404 - val_fusion_loss: 0.1202 - val_loss: 0.3730

Epoch 00003: val_loss did not improve from 0.33642

Epoch 4/100

108/108 [=====] - 32s 295ms/step - opt_accuracy: 0.8807 - sar_accuracy: 0.7738 - fus_accuracy: 0.8770 - opt_loss: 0.0673 - sar_loss: 0.1216 - fusion_loss: 0.0695 - loss: 0.2584 - val_opt_accuracy: 0.8407 - val_sar_accuracy: 0.7902 - val_fus_accuracy: 0.8397 - val_opt_loss: 0.1457 - val_sar_loss: 0.1216 - val_fusion_loss: 0.1216 - val_loss: 0.3730

usion_loss: 0.1444 - val_loss: 0.4117

Epoch 00004: val_loss did not improve from 0.33642

Epoch 5/100

108/108 [=====] - 33s 306ms/step - opt_accuracy: 0.8867 - sar_accuracy: 0.7823 - fus_accuracy: 0.8835 - opt_loss: 0.0629 - sar_loss: 0.1175 - fusion_loss: 0.0644 - loss: 0.2449 - val_opt_accuracy: 0.8533 - val_sar_accuracy: 0.7881 - val_fus_accuracy: 0.8529 - val_opt_loss: 0.1022 - val_sar_loss: 0.1298 - val_fusion_loss: 0.1054 - val_loss: 0.3375

Epoch 00005: val_loss did not improve from 0.33642

Epoch 6/100

108/108 [=====] - 33s 309ms/step - opt_accuracy: 0.8892 - sar_accuracy: 0.7913 - fus_accuracy: 0.8873 - opt_loss: 0.0612 - sar_loss: 0.1144 - fusion_loss: 0.0618 - loss: 0.2373 - val_opt_accuracy: 0.8516 - val_sar_accuracy: 0.7911 - val_fus_accuracy: 0.8521 - val_opt_loss: 0.1214 - val_sar_loss: 0.1308 - val_fusion_loss: 0.1245 - val_loss: 0.3767

Epoch 00006: val_loss did not improve from 0.33642

Epoch 7/100

108/108 [=====] - 34s 315ms/step - opt_accuracy: 0.8931 - sar_accuracy: 0.7913 - fus_accuracy: 0.8911 - opt_loss: 0.0578 - sar_loss: 0.1135 - fusion_loss: 0.0584 - loss: 0.2297 - val_opt_accuracy: 0.8613 - val_sar_accuracy: 0.8085 - val_fus_accuracy: 0.8601 - val_opt_loss: 0.1103 - val_sar_loss: 0.1614 - val_fusion_loss: 0.1229 - val_loss: 0.3946

Epoch 00007: val_loss did not improve from 0.33642

Epoch 8/100

108/108 [=====] - 34s 313ms/step - opt_accuracy: 0.8953 - sar_accuracy: 0.7949 - fus_accuracy: 0.8938 - opt_loss: 0.0556 - sar_loss: 0.1118 - fusion_loss: 0.0560 - loss: 0.2234 - val_opt_accuracy: 0.8473 - val_sar_accuracy: 0.8052 - val_fus_accuracy: 0.8481 - val_opt_loss: 0.1554 - val_sar_loss: 0.1436 - val_fusion_loss: 0.1593 - val_loss: 0.4584

Epoch 00008: val_loss did not improve from 0.33642

Epoch 9/100

108/108 [=====] - 34s 320ms/step - opt_accuracy: 0.8973 - sar_accuracy: 0.7966 - fus_accuracy: 0.8958 - opt_loss: 0.0540 - sar_loss: 0.1115 - fusion_loss: 0.0543 - loss: 0.2198 - val_opt_accuracy: 0.8557 - val_sar_accuracy: 0.8085 - val_fus_accuracy: 0.8551 - val_opt_loss: 0.1412 - val_sar_loss: 0.1483 - val_fusion_loss: 0.1460 - val_loss: 0.4356

Epoch 00009: val_loss did not improve from 0.33642

Epoch 10/100

108/108 [=====] - 35s 321ms/step - opt_accuracy: 0.9033 - sar_accuracy: 0.8011 - fus_accuracy: 0.9019 - opt_loss: 0.0492 - sar_loss: 0.1094 - fusion_loss: 0.0497 - loss: 0.2083 - val_opt_accuracy: 0.8569 - val_sar_accuracy: 0.8080 - val_fus_accuracy: 0.8561 - val_opt_loss: 0.1493 - val_sar_loss: 0.1626 - val_fusion_loss: 0.1559 - val_loss: 0.4678

Epoch 00010: val_loss did not improve from 0.33642

Epoch 11/100

108/108 [=====] - 35s 327ms/step - opt_accuracy: 0.9043 - sar_accuracy: 0.8019 - fus_accuracy: 0.9033 - opt_loss: 0.0487 - sar_loss: 0.1079 - fusion_loss: 0.0488 - loss: 0.2054 - val_opt_accuracy: 0.8610 - val_sar_accuracy: 0.8059 - val_fus_accuracy: 0.8596 - val_opt_loss: 0.1505 - val_sar_loss: 0.1569 - val_fusion_loss: 0.1544 - val_loss: 0.4618

Epoch 00011: val_loss did not improve from 0.33642

Epoch 00011: early stopping

time: 8

Model: "model_3_9"

| Layer (type) | Output Shape | Param # |
|--------------|--------------|---------|
| ===== | | |

| | | |
|-----------------------------|----------|--------|
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |
| Total params: 1,406,327 | | |
| Trainable params: 1,406,313 | | |
| Non-trainable params: 14 | | |

Epoch 1/100

108/108 [=====] - 38s 334ms/step - opt_accuracy: 0.8279 - sar_accuracy: 0.7406 - fus_accuracy: 0.8154 - opt_loss: 0.0997 - sar_loss: 0.1380 - fusion_loss: 0.1069 - loss: 0.3446 - val_opt_accuracy: 0.8485 - val_sar_accuracy: 0.7410 - val_fus_accuracy: 0.8383 - val_opt_loss: 0.0955 - val_sar_loss: 0.1233 - val_fusion_loss: 0.0985 - val_loss: 0.3173

Epoch 00001: val_loss improved from inf to 0.31725, saving model to imgs/experiments/exp2/models/unet_8.h5

Epoch 2/100

108/108 [=====] - 35s 330ms/step - opt_accuracy: 0.8707 - sar_accuracy: 0.7624 - fus_accuracy: 0.8606 - opt_loss: 0.0764 - sar_loss: 0.1265 - fusion_loss: 0.0797 - loss: 0.2827 - val_opt_accuracy: 0.8474 - val_sar_accuracy: 0.7531 - val_fus_accuracy: 0.8388 - val_opt_loss: 0.1109 - val_sar_loss: 0.1245 - val_fusion_loss: 0.1148 - val_loss: 0.3503

Epoch 00002: val_loss did not improve from 0.31725

Epoch 3/100

108/108 [=====] - 36s 334ms/step - opt_accuracy: 0.8810 - sar_accuracy: 0.7738 - fus_accuracy: 0.8760 - opt_loss: 0.0693 - sar_loss: 0.1200 - fusion_loss: 0.0709 - loss: 0.2602 - val_opt_accuracy: 0.8413 - val_sar_accuracy: 0.7782 - val_fus_accuracy: 0.8387 - val_opt_loss: 0.1446 - val_sar_loss: 0.1212 - val_fusion_loss: 0.1477 - val_loss: 0.4136

Epoch 00003: val_loss did not improve from 0.31725

Epoch 4/100

108/108 [=====] - 36s 334ms/step - opt_accuracy: 0.8843 - sar_accuracy: 0.7716 - fus_accuracy: 0.8801 - opt_loss: 0.0666 - sar_loss: 0.1208 - fusion_loss: 0.0676 - loss: 0.2549 - val_opt_accuracy: 0.8477 - val_sar_accuracy: 0.7666 - val_fus_accuracy: 0.8442 - val_opt_loss: 0.1447 - val_sar_loss: 0.1235 - val_fusion_loss: 0.1404 - val_loss: 0.4086

Epoch 00004: val_loss did not improve from 0.31725

Epoch 5/100

108/108 [=====] - 35s 330ms/step - opt_accuracy: 0.8879 - sar_accuracy: 0.7775 - fus_accuracy: 0.8845 - opt_loss: 0.0637 - sar_loss: 0.1172 - fusion_loss: 0.0645 - loss: 0.2453 - val_opt_accuracy: 0.8532 - val_sar_accuracy: 0.7975 - val_fus_accuracy: 0.8481 - val_opt_loss: 0.1362 - val_sar_loss: 0.1666 - val_fusion_loss: 0.1460 - val_loss: 0.4488

Epoch 00005: val_loss did not improve from 0.31725

Epoch 6/100

108/108 [=====] - 36s 337ms/step - opt_accuracy: 0.8922 - sar_accuracy: 0.7821 - fus_accuracy: 0.8891 - opt_loss: 0.0607 - sar_loss: 0.1134 - fusion_loss: 0.0612 - loss: 0.2353 - val_opt_accuracy: 0.8536 - val_sar_accuracy: 0.7823 - val_fus_accuracy: 0.8522 - val_opt_loss: 0.1240 - val_sar_loss: 0.1216 - val_fusion_loss: 0.1248 - val_loss: 0.3703

Epoch 00006: val_loss did not improve from 0.31725

Epoch 7/100

108/108 [=====] - 36s 339ms/step - opt_accuracy: 0.8938 - sar_accuracy: 0.7927 - fus_accuracy: 0.8916 - opt_loss: 0.0576 - sar_loss: 0.1078 - fusion_loss: 0.0576 - loss: 0.2230 - val_opt_accuracy: 0.8552 - val_sar_accuracy: 0.7986 - val_fus_accuracy: 0.8517 - val_opt_loss: 0.1561 - val_sar_loss: 0.1603 - val_fusion_loss: 0.1633 - val_loss: 0.4797

Epoch 00007: val_loss did not improve from 0.31725

Epoch 8/100

108/108 [=====] - 37s 343ms/step - opt_accuracy: 0.9003 - sar_accuracy: 0.8003 - fus_accuracy: 0.8984 - opt_loss: 0.0523 - sar_loss: 0.1052 - fusion_loss: 0.0523 - loss: 0.2099 - val_opt_accuracy: 0.8511 - val_sar_accuracy: 0.7879 - val_fus_accuracy: 0.8501 - val_opt_loss: 0.1485 - val_sar_loss: 0.1328 - val_fusion_loss: 0.1485 - val_loss: 0.4299

Epoch 00008: val_loss did not improve from 0.31725

Epoch 9/100

108/108 [=====] - 36s 338ms/step - opt_accuracy: 0.9024 - sar_accuracy: 0.8011 - fus_accuracy: 0.9010 - opt_loss: 0.0509 - sar_loss: 0.1057 - fusion_loss: 0.0509 - loss: 0.2074 - val_opt_accuracy: 0.8567 - val_sar_accuracy: 0.7977 - val_fus_accuracy: 0.8555 - val_opt_loss: 0.1278 - val_sar_loss: 0.1323 - val_fusion_loss: 0.1289 - val_loss: 0.3889

Epoch 00009: val_loss did not improve from 0.31725

Epoch 10/100

108/108 [=====] - 37s 343ms/step - opt_accuracy: 0.9031 - sar_accuracy: 0.8105 - fus_accuracy: 0.9021 - opt_loss: 0.0492 - sar_loss: 0.1000 - fusion_loss: 0.0490 - loss: 0.1981 - val_opt_accuracy: 0.8427 - val_sar_accuracy: 0.7880 - val_fus_accuracy: 0.8424 - val_opt_loss: 0.1722 - val_sar_loss: 0.1362 - val_fusion_loss: 0.1707 - val_loss: 0.4790

Epoch 00010: val_loss did not improve from 0.31725

Epoch 11/100

108/108 [=====] - 39s 360ms/step - opt_accuracy: 0.9029 - sar_accuracy: 0.8119 - fus_accuracy: 0.9023 - opt_loss: 0.0499 - sar_loss: 0.1007 - fusion_loss: 0.0494 - loss: 0.2001 - val_opt_accuracy: 0.8441 - val_sar_accuracy: 0.7982 - val_fus_accuracy: 0.8407 - val_opt_loss: 0.1818 - val_sar_loss: 0.1509 - val_fusion_loss: 0.1833 - val_loss: 0.5159

Epoch 00011: val_loss did not improve from 0.31725

Epoch 00011: early stopping

time: 9

Model: "model_3_10"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |

Total params: 1,406,327

Trainable params: 1,406,313

Non-trainable params: 14

Epoch 1/100

108/108 [=====] - 40s 352ms/step - opt_accuracy: 0.8302 - sar_accuracy: 0.7424 - fus_accuracy: 0.7948 - opt_loss: 0.0996 - sar_loss: 0.1415 - f

usion_loss: 0.1128 - loss: 0.3539 - val_opt_accuracy: 0.8443 - val_sar_accuracy: 0.7653 - val_fus_accuracy: 0.8276 - val_opt_loss: 0.1088 - val_sar_loss: 0.1179 - val_fusion_loss: 0.1154 - val_loss: 0.3421

Epoch 00001: val_loss improved from inf to 0.34209, saving model to imgs/experiments/exp2/models\unet_9.h5

Epoch 2/100

108/108 [=====] - 37s 348ms/step - opt_accuracy: 0.8699 - sar_accuracy: 0.7602 - fus_accuracy: 0.8572 - opt_loss: 0.0768 - sar_loss: 0.1339 - fusion_loss: 0.0815 - loss: 0.2922 - val_opt_accuracy: 0.8504 - val_sar_accuracy: 0.7682 - val_fus_accuracy: 0.8455 - val_opt_loss: 0.1131 - val_sar_loss: 0.1190 - val_fusion_loss: 0.1136 - val_loss: 0.3457

Epoch 00002: val_loss did not improve from 0.34209

Epoch 3/100

108/108 [=====] - 38s 358ms/step - opt_accuracy: 0.8771 - sar_accuracy: 0.7615 - fus_accuracy: 0.8722 - opt_loss: 0.0712 - sar_loss: 0.1325 - fusion_loss: 0.0732 - loss: 0.2770 - val_opt_accuracy: 0.8511 - val_sar_accuracy: 0.7718 - val_fus_accuracy: 0.8480 - val_opt_loss: 0.1116 - val_sar_loss: 0.1288 - val_fusion_loss: 0.1145 - val_loss: 0.3549

Epoch 00003: val_loss did not improve from 0.34209

Epoch 4/100

108/108 [=====] - 39s 360ms/step - opt_accuracy: 0.8826 - sar_accuracy: 0.7551 - fus_accuracy: 0.8792 - opt_loss: 0.0659 - sar_loss: 0.1339 - fusion_loss: 0.0673 - loss: 0.2671 - val_opt_accuracy: 0.8503 - val_sar_accuracy: 0.7526 - val_fus_accuracy: 0.8496 - val_opt_loss: 0.1354 - val_sar_loss: 0.1263 - val_fusion_loss: 0.1349 - val_loss: 0.3965

Epoch 00004: val_loss did not improve from 0.34209

Epoch 5/100

108/108 [=====] - 38s 356ms/step - opt_accuracy: 0.8873 - sar_accuracy: 0.7509 - fus_accuracy: 0.8854 - opt_loss: 0.0622 - sar_loss: 0.1340 - fusion_loss: 0.0630 - loss: 0.2591 - val_opt_accuracy: 0.8514 - val_sar_accuracy: 0.7572 - val_fus_accuracy: 0.8482 - val_opt_loss: 0.1320 - val_sar_loss: 0.1240 - val_fusion_loss: 0.1313 - val_loss: 0.3872

Epoch 00005: val_loss did not improve from 0.34209

Epoch 6/100

108/108 [=====] - 39s 365ms/step - opt_accuracy: 0.8924 - sar_accuracy: 0.7397 - fus_accuracy: 0.8908 - opt_loss: 0.0577 - sar_loss: 0.1354 - fusion_loss: 0.0584 - loss: 0.2515 - val_opt_accuracy: 0.8566 - val_sar_accuracy: 0.7526 - val_fus_accuracy: 0.8553 - val_opt_loss: 0.1331 - val_sar_loss: 0.1254 - val_fusion_loss: 0.1305 - val_loss: 0.3890

Epoch 00006: val_loss did not improve from 0.34209

Epoch 7/100

108/108 [=====] - 39s 364ms/step - opt_accuracy: 0.8954 - sar_accuracy: 0.7475 - fus_accuracy: 0.8941 - opt_loss: 0.0555 - sar_loss: 0.1347 - fusion_loss: 0.0559 - loss: 0.2461 - val_opt_accuracy: 0.8541 - val_sar_accuracy: 0.7539 - val_fus_accuracy: 0.8532 - val_opt_loss: 0.1698 - val_sar_loss: 0.1238 - val_fusion_loss: 0.1711 - val_loss: 0.4647

Epoch 00007: val_loss did not improve from 0.34209

Epoch 8/100

108/108 [=====] - 40s 369ms/step - opt_accuracy: 0.8948 - sar_accuracy: 0.7444 - fus_accuracy: 0.8930 - opt_loss: 0.0550 - sar_loss: 0.1354 - fusion_loss: 0.0555 - loss: 0.2460 - val_opt_accuracy: 0.8619 - val_sar_accuracy: 0.7573 - val_fus_accuracy: 0.8615 - val_opt_loss: 0.1544 - val_sar_loss: 0.1211 - val_fusion_loss: 0.1570 - val_loss: 0.4326

Epoch 00008: val_loss did not improve from 0.34209

Epoch 9/100

108/108 [=====] - 39s 367ms/step - opt_accuracy: 0.8982 - sar_accuracy: 0.7382 - fus_accuracy: 0.8967 - opt_loss: 0.0513 - sar_loss: 0.1363 - f

usion_loss: 0.0517 - loss: 0.2393 - val_opt_accuracy: 0.8567 - val_sar_accuracy: 0.7448 - val_fus_accuracy: 0.8553 - val_opt_loss: 0.1813 - val_sar_loss: 0.1214 - val_fusion_loss: 0.1823 - val_loss: 0.4850

Epoch 00009: val_loss did not improve from 0.34209

Epoch 10/100

108/108 [=====] - 39s 366ms/step - opt_accuracy: 0.9002 - sar_accuracy: 0.7335 - fus_accuracy: 0.8987 - opt_loss: 0.0510 - sar_loss: 0.1393 - fusion_loss: 0.0516 - loss: 0.2419 - val_opt_accuracy: 0.8577 - val_sar_accuracy: 0.7456 - val_fus_accuracy: 0.8569 - val_opt_loss: 0.1727 - val_sar_loss: 0.1216 - val_fusion_loss: 0.1738 - val_loss: 0.4681

Epoch 00010: val_loss did not improve from 0.34209

Epoch 11/100

108/108 [=====] - 41s 378ms/step - opt_accuracy: 0.9066 - sar_accuracy: 0.7384 - fus_accuracy: 0.9060 - opt_loss: 0.0463 - sar_loss: 0.1383 - fusion_loss: 0.0464 - loss: 0.2310 - val_opt_accuracy: 0.8542 - val_sar_accuracy: 0.7497 - val_fus_accuracy: 0.8532 - val_opt_loss: 0.1671 - val_sar_loss: 0.1201 - val_fusion_loss: 0.1678 - val_loss: 0.4550

Epoch 00011: val_loss did not improve from 0.34209

Epoch 00011: early stopping

time: 10

Model: "model_3_11"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |
| Total params: 1,406,327 | | |
| Trainable params: 1,406,313 | | |
| Non-trainable params: 14 | | |

Epoch 1/100

108/108 [=====] - 46s 405ms/step - opt_accuracy: 0.8288 - sar_accuracy: 0.7440 - fus_accuracy: 0.8148 - opt_loss: 0.0979 - sar_loss: 0.1391 - fusion_loss: 0.1027 - loss: 0.3397 - val_opt_accuracy: 0.8475 - val_sar_accuracy: 0.7594 - val_fus_accuracy: 0.8381 - val_opt_loss: 0.1011 - val_sar_loss: 0.1214 - val_fusion_loss: 0.0990 - val_loss: 0.3215

Epoch 00001: val_loss improved from inf to 0.32146, saving model to imgs/experiments/exp2/models/unet_10.h5

Epoch 2/100

108/108 [=====] - 42s 387ms/step - opt_accuracy: 0.8718 - sar_accuracy: 0.7594 - fus_accuracy: 0.8611 - opt_loss: 0.0740 - sar_loss: 0.1333 - fusion_loss: 0.0768 - loss: 0.2841 - val_opt_accuracy: 0.8458 - val_sar_accuracy: 0.7737 - val_fus_accuracy: 0.8397 - val_opt_loss: 0.1111 - val_sar_loss: 0.1196 - val_fusion_loss: 0.1112 - val_loss: 0.3419

Epoch 00002: val_loss did not improve from 0.32146

Epoch 3/100

108/108 [=====] - 41s 385ms/step - opt_accuracy: 0.8816 - sar_accuracy: 0.7683 - fus_accuracy: 0.8744 - opt_loss: 0.0685 - sar_loss: 0.1299 - fusion_loss: 0.0705 - loss: 0.2689 - val_opt_accuracy: 0.8496 - val_sar_accuracy: 0.7750 - val_fus_accuracy: 0.8463 - val_opt_loss: 0.1203 - val_sar_loss: 0.1235 - val_fusion_loss: 0.1203 - val_loss: 0.3419

usion_loss: 0.1180 - val_loss: 0.3619

Epoch 00003: val_loss did not improve from 0.32146

Epoch 4/100

108/108 [=====] - 42s 395ms/step - opt_accuracy: 0.8856 - sar_accuracy: 0.7819 - fus_accuracy: 0.8808 - opt_loss: 0.0649 - sar_loss: 0.1216 - fusion_loss: 0.0666 - loss: 0.2531 - val_opt_accuracy: 0.8370 - val_sar_accuracy: 0.7732 - val_fus_accuracy: 0.8363 - val_opt_loss: 0.1575 - val_sar_loss: 0.1235 - val_fusion_loss: 0.1486 - val_loss: 0.4296

Epoch 00004: val_loss did not improve from 0.32146

Epoch 5/100

108/108 [=====] - 42s 395ms/step - opt_accuracy: 0.8889 - sar_accuracy: 0.7914 - fus_accuracy: 0.8866 - opt_loss: 0.0620 - sar_loss: 0.1168 - fusion_loss: 0.0628 - loss: 0.2416 - val_opt_accuracy: 0.8484 - val_sar_accuracy: 0.7965 - val_fus_accuracy: 0.8503 - val_opt_loss: 0.1386 - val_sar_loss: 0.1286 - val_fusion_loss: 0.1370 - val_loss: 0.4042

Epoch 00005: val_loss did not improve from 0.32146

Epoch 6/100

108/108 [=====] - 42s 393ms/step - opt_accuracy: 0.8927 - sar_accuracy: 0.7928 - fus_accuracy: 0.8912 - opt_loss: 0.0586 - sar_loss: 0.1135 - fusion_loss: 0.0590 - loss: 0.2311 - val_opt_accuracy: 0.8521 - val_sar_accuracy: 0.8046 - val_fus_accuracy: 0.8532 - val_opt_loss: 0.1656 - val_sar_loss: 0.1294 - val_fusion_loss: 0.1641 - val_loss: 0.4592

Epoch 00006: val_loss did not improve from 0.32146

Epoch 7/100

108/108 [=====] - 42s 389ms/step - opt_accuracy: 0.8950 - sar_accuracy: 0.7829 - fus_accuracy: 0.8937 - opt_loss: 0.0569 - sar_loss: 0.1164 - fusion_loss: 0.0573 - loss: 0.2305 - val_opt_accuracy: 0.8626 - val_sar_accuracy: 0.7841 - val_fus_accuracy: 0.8626 - val_opt_loss: 0.1321 - val_sar_loss: 0.1234 - val_fusion_loss: 0.1291 - val_loss: 0.3846

Epoch 00007: val_loss did not improve from 0.32146

Epoch 8/100

108/108 [=====] - 43s 403ms/step - opt_accuracy: 0.8971 - sar_accuracy: 0.7974 - fus_accuracy: 0.8963 - opt_loss: 0.0555 - sar_loss: 0.1111 - fusion_loss: 0.0555 - loss: 0.2222 - val_opt_accuracy: 0.8607 - val_sar_accuracy: 0.8058 - val_fus_accuracy: 0.8605 - val_opt_loss: 0.1692 - val_sar_loss: 0.1481 - val_fusion_loss: 0.1706 - val_loss: 0.4879

Epoch 00008: val_loss did not improve from 0.32146

Epoch 9/100

108/108 [=====] - 44s 407ms/step - opt_accuracy: 0.9044 - sar_accuracy: 0.8070 - fus_accuracy: 0.9038 - opt_loss: 0.0487 - sar_loss: 0.1052 - fusion_loss: 0.0488 - loss: 0.2027 - val_opt_accuracy: 0.8628 - val_sar_accuracy: 0.8019 - val_fus_accuracy: 0.8624 - val_opt_loss: 0.1484 - val_sar_loss: 0.1466 - val_fusion_loss: 0.1520 - val_loss: 0.4470

Epoch 00009: val_loss did not improve from 0.32146

Epoch 10/100

108/108 [=====] - 45s 421ms/step - opt_accuracy: 0.9062 - sar_accuracy: 0.8105 - fus_accuracy: 0.9057 - opt_loss: 0.0477 - sar_loss: 0.1029 - fusion_loss: 0.0477 - loss: 0.1983 - val_opt_accuracy: 0.8628 - val_sar_accuracy: 0.8076 - val_fus_accuracy: 0.8610 - val_opt_loss: 0.1604 - val_sar_loss: 0.1670 - val_fusion_loss: 0.1671 - val_loss: 0.4946

Epoch 00010: val_loss did not improve from 0.32146

Epoch 11/100

108/108 [=====] - 43s 402ms/step - opt_accuracy: 0.9108 - sar_accuracy: 0.8135 - fus_accuracy: 0.9105 - opt_loss: 0.0441 - sar_loss: 0.1010 - fusion_loss: 0.0439 - loss: 0.1890 - val_opt_accuracy: 0.8647 - val_sar_accuracy: 0.7894 - val_fus_accuracy: 0.8633 - val_opt_loss: 0.1546 - val_sar_loss: 0.1425 - val_fusion_loss: 0.1530 - val_loss: 0.4501

Epoch 00011: val_loss did not improve from 0.32146
 Epoch 00011: early stopping
 time: 11
 Model: "model_3_12"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |

=====
 Total params: 1,406,327
 Trainable params: 1,406,313
 Non-trainable params: 14

Epoch 1/100

108/108 [=====] - 47s 415ms/step - opt_accuracy: 0.8247 - sar_accuracy: 0.7249 - fus_accuracy: 0.8143 - opt_loss: 0.0992 - sar_loss: 0.1402 - fusion_loss: 0.1059 - loss: 0.3453 - val_opt_accuracy: 0.8414 - val_sar_accuracy: 0.7532 - val_fus_accuracy: 0.8369 - val_opt_loss: 0.0998 - val_sar_loss: 0.1234 - val_fusion_loss: 0.1030 - val_loss: 0.3262

Epoch 00001: val_loss improved from inf to 0.32620, saving model to imgs/experiments/exp2/models/unet_11.h5

Epoch 2/100

108/108 [=====] - 43s 399ms/step - opt_accuracy: 0.8672 - sar_accuracy: 0.7452 - fus_accuracy: 0.8578 - opt_loss: 0.0771 - sar_loss: 0.1354 - fusion_loss: 0.0802 - loss: 0.2927 - val_opt_accuracy: 0.8458 - val_sar_accuracy: 0.7546 - val_fus_accuracy: 0.8408 - val_opt_loss: 0.1158 - val_sar_loss: 0.1183 - val_fusion_loss: 0.1109 - val_loss: 0.3450

Epoch 00002: val_loss did not improve from 0.32620

Epoch 3/100

108/108 [=====] - 44s 414ms/step - opt_accuracy: 0.8770 - sar_accuracy: 0.7600 - fus_accuracy: 0.8710 - opt_loss: 0.0701 - sar_loss: 0.1288 - fusion_loss: 0.0719 - loss: 0.2708 - val_opt_accuracy: 0.8511 - val_sar_accuracy: 0.7706 - val_fus_accuracy: 0.8471 - val_opt_loss: 0.1499 - val_sar_loss: 0.1222 - val_fusion_loss: 0.1438 - val_loss: 0.4159

Epoch 00003: val_loss did not improve from 0.32620

Epoch 4/100

108/108 [=====] - 44s 408ms/step - opt_accuracy: 0.8826 - sar_accuracy: 0.7771 - fus_accuracy: 0.8790 - opt_loss: 0.0661 - sar_loss: 0.1213 - fusion_loss: 0.0671 - loss: 0.2546 - val_opt_accuracy: 0.8355 - val_sar_accuracy: 0.7676 - val_fus_accuracy: 0.8369 - val_opt_loss: 0.1526 - val_sar_loss: 0.1242 - val_fusion_loss: 0.1385 - val_loss: 0.4153

Epoch 00004: val_loss did not improve from 0.32620

Epoch 5/100

108/108 [=====] - 43s 401ms/step - opt_accuracy: 0.8855 - sar_accuracy: 0.7822 - fus_accuracy: 0.8830 - opt_loss: 0.0642 - sar_loss: 0.1174 - fusion_loss: 0.0648 - loss: 0.2464 - val_opt_accuracy: 0.8510 - val_sar_accuracy: 0.7914 - val_fus_accuracy: 0.8511 - val_opt_loss: 0.1335 - val_sar_loss: 0.1218 - val_fusion_loss: 0.1264 - val_loss: 0.3818

Epoch 00005: val_loss did not improve from 0.32620

Epoch 6/100

108/108 [=====] - 45s 421ms/step - opt_accuracy: 0.8912 - sar_accuracy: 0.7876 - fus_accuracy: 0.8891 - opt_loss: 0.0593 - sar_loss: 0.1127 - fusion_loss: 0.0598 - loss: 0.2318 - val_opt_accuracy: 0.8497 - val_sar_accuracy: 0.7841 - val_fus_accuracy: 0.8496 - val_opt_loss: 0.1512 - val_sar_loss: 0.1256 - val_fusion_loss: 0.1433 - val_loss: 0.4201

Epoch 00006: val_loss did not improve from 0.32620

Epoch 7/100

108/108 [=====] - 45s 422ms/step - opt_accuracy: 0.8949 - sar_accuracy: 0.7730 - fus_accuracy: 0.8929 - opt_loss: 0.0560 - sar_loss: 0.1212 - fusion_loss: 0.0566 - loss: 0.2338 - val_opt_accuracy: 0.8481 - val_sar_accuracy: 0.7632 - val_fus_accuracy: 0.8477 - val_opt_loss: 0.1433 - val_sar_loss: 0.1210 - val_fusion_loss: 0.1353 - val_loss: 0.3996

Epoch 00007: val_loss did not improve from 0.32620

Epoch 8/100

108/108 [=====] - 46s 429ms/step - opt_accuracy: 0.8988 - sar_accuracy: 0.7814 - fus_accuracy: 0.8974 - opt_loss: 0.0527 - sar_loss: 0.1165 - fusion_loss: 0.0530 - loss: 0.2222 - val_opt_accuracy: 0.8558 - val_sar_accuracy: 0.7930 - val_fus_accuracy: 0.8553 - val_opt_loss: 0.1440 - val_sar_loss: 0.1275 - val_fusion_loss: 0.1389 - val_loss: 0.4104

Epoch 00008: val_loss did not improve from 0.32620

Epoch 9/100

108/108 [=====] - 46s 429ms/step - opt_accuracy: 0.9014 - sar_accuracy: 0.7840 - fus_accuracy: 0.9000 - opt_loss: 0.0502 - sar_loss: 0.1149 - fusion_loss: 0.0506 - loss: 0.2157 - val_opt_accuracy: 0.8513 - val_sar_accuracy: 0.7854 - val_fus_accuracy: 0.8515 - val_opt_loss: 0.1590 - val_sar_loss: 0.1288 - val_fusion_loss: 0.1553 - val_loss: 0.4432

Epoch 00009: val_loss did not improve from 0.32620

Epoch 10/100

108/108 [=====] - 45s 424ms/step - opt_accuracy: 0.9058 - sar_accuracy: 0.7922 - fus_accuracy: 0.9046 - opt_loss: 0.0465 - sar_loss: 0.1092 - fusion_loss: 0.0469 - loss: 0.2026 - val_opt_accuracy: 0.8605 - val_sar_accuracy: 0.7959 - val_fus_accuracy: 0.8601 - val_opt_loss: 0.1567 - val_sar_loss: 0.1311 - val_fusion_loss: 0.1498 - val_loss: 0.4376

Epoch 00010: val_loss did not improve from 0.32620

Epoch 11/100

108/108 [=====] - 46s 429ms/step - opt_accuracy: 0.9074 - sar_accuracy: 0.7954 - fus_accuracy: 0.9064 - opt_loss: 0.0459 - sar_loss: 0.1080 - fusion_loss: 0.0461 - loss: 0.2000 - val_opt_accuracy: 0.8622 - val_sar_accuracy: 0.7963 - val_fus_accuracy: 0.8616 - val_opt_loss: 0.1722 - val_sar_loss: 0.1594 - val_fusion_loss: 0.1705 - val_loss: 0.5022

Epoch 00011: val_loss did not improve from 0.32620

Epoch 00011: early stopping

time: 12

Model: "model_3_13"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |

=====

Total params: 1,406,327
Trainable params: 1,406,313
Non-trainable params: 14

Epoch 1/100

108/108 [=====] - 49s 435ms/step - opt_accuracy: 0.8399 - sar_accuracy: 0.7408 - fus_accuracy: 0.8268 - opt_loss: 0.0932 - sar_loss: 0.1393 - fusion_loss: 0.1006 - loss: 0.3330 - val_opt_accuracy: 0.8483 - val_sar_accuracy: 0.7652 - val_fus_accuracy: 0.8431 - val_opt_loss: 0.0937 - val_sar_loss: 0.1191 - val_fusion_loss: 0.0986 - val_loss: 0.3114

Epoch 00001: val_loss improved from inf to 0.31137, saving model to imgs/experiments/exp2/models/unet_12.h5

Epoch 2/100

108/108 [=====] - 48s 448ms/step - opt_accuracy: 0.8730 - sar_accuracy: 0.7607 - fus_accuracy: 0.8662 - opt_loss: 0.0732 - sar_loss: 0.1327 - fusion_loss: 0.0769 - loss: 0.2829 - val_opt_accuracy: 0.8527 - val_sar_accuracy: 0.7421 - val_fus_accuracy: 0.8461 - val_opt_loss: 0.0964 - val_sar_loss: 0.1207 - val_fusion_loss: 0.0983 - val_loss: 0.3154

Epoch 00002: val_loss did not improve from 0.31137

Epoch 3/100

108/108 [=====] - 46s 432ms/step - opt_accuracy: 0.8786 - sar_accuracy: 0.7664 - fus_accuracy: 0.8739 - opt_loss: 0.0706 - sar_loss: 0.1301 - fusion_loss: 0.0728 - loss: 0.2734 - val_opt_accuracy: 0.8509 - val_sar_accuracy: 0.7679 - val_fus_accuracy: 0.8516 - val_opt_loss: 0.1310 - val_sar_loss: 0.1229 - val_fusion_loss: 0.1271 - val_loss: 0.3810

Epoch 00003: val_loss did not improve from 0.31137

Epoch 4/100

108/108 [=====] - 47s 442ms/step - opt_accuracy: 0.8843 - sar_accuracy: 0.7643 - fus_accuracy: 0.8813 - opt_loss: 0.0661 - sar_loss: 0.1307 - fusion_loss: 0.0672 - loss: 0.2640 - val_opt_accuracy: 0.8549 - val_sar_accuracy: 0.7800 - val_fus_accuracy: 0.8513 - val_opt_loss: 0.1186 - val_sar_loss: 0.1258 - val_fusion_loss: 0.1201 - val_loss: 0.3645

Epoch 00004: val_loss did not improve from 0.31137

Epoch 5/100

108/108 [=====] - 47s 439ms/step - opt_accuracy: 0.8897 - sar_accuracy: 0.7732 - fus_accuracy: 0.8867 - opt_loss: 0.0627 - sar_loss: 0.1248 - fusion_loss: 0.0636 - loss: 0.2511 - val_opt_accuracy: 0.8503 - val_sar_accuracy: 0.7328 - val_fus_accuracy: 0.8493 - val_opt_loss: 0.1432 - val_sar_loss: 0.1310 - val_fusion_loss: 0.1422 - val_loss: 0.4164

Epoch 00005: val_loss did not improve from 0.31137

Epoch 6/100

108/108 [=====] - 47s 439ms/step - opt_accuracy: 0.8923 - sar_accuracy: 0.7678 - fus_accuracy: 0.8901 - opt_loss: 0.0606 - sar_loss: 0.1278 - fusion_loss: 0.0611 - loss: 0.2494 - val_opt_accuracy: 0.8553 - val_sar_accuracy: 0.7937 - val_fus_accuracy: 0.8550 - val_opt_loss: 0.1311 - val_sar_loss: 0.1249 - val_fusion_loss: 0.1330 - val_loss: 0.3889

Epoch 00006: val_loss did not improve from 0.31137

Epoch 7/100

108/108 [=====] - 48s 448ms/step - opt_accuracy: 0.8925 - sar_accuracy: 0.7728 - fus_accuracy: 0.8906 - opt_loss: 0.0585 - sar_loss: 0.1233 - fusion_loss: 0.0589 - loss: 0.2407 - val_opt_accuracy: 0.8525 - val_sar_accuracy: 0.7723 - val_fus_accuracy: 0.8523 - val_opt_loss: 0.1207 - val_sar_loss: 0.1196 - val_fusion_loss: 0.1222 - val_loss: 0.3625

Epoch 00007: val_loss did not improve from 0.31137

Epoch 8/100

108/108 [=====] - 48s 450ms/step - opt_accuracy: 0.8979 - sar_accuracy: 0.7715 - fus_accuracy: 0.8966 - opt_loss: 0.0544 - sar_loss: 0.1234 - f

usion_loss: 0.0546 - loss: 0.2324 - val_opt_accuracy: 0.8385 - val_sar_accuracy: 0.7764 - val_fus_accuracy: 0.8386 - val_opt_loss: 0.1664 - val_sar_loss: 0.1265 - val_fusion_loss: 0.1650 - val_loss: 0.4579

Epoch 00008: val_loss did not improve from 0.31137

Epoch 9/100

108/108 [=====] - 48s 451ms/step - opt_accuracy: 0.9034 - sar_accuracy: 0.7871 - fus_accuracy: 0.9019 - opt_loss: 0.0495 - sar_loss: 0.1138 - fusion_loss: 0.0497 - loss: 0.2130 - val_opt_accuracy: 0.8576 - val_sar_accuracy: 0.7941 - val_fus_accuracy: 0.8570 - val_opt_loss: 0.1406 - val_sar_loss: 0.1304 - val_fusion_loss: 0.1425 - val_loss: 0.4135

Epoch 00009: val_loss did not improve from 0.31137

Epoch 10/100

108/108 [=====] - 49s 457ms/step - opt_accuracy: 0.9066 - sar_accuracy: 0.7863 - fus_accuracy: 0.9054 - opt_loss: 0.0469 - sar_loss: 0.1150 - fusion_loss: 0.0471 - loss: 0.2091 - val_opt_accuracy: 0.8519 - val_sar_accuracy: 0.7995 - val_fus_accuracy: 0.8542 - val_opt_loss: 0.1405 - val_sar_loss: 0.1570 - val_fusion_loss: 0.1499 - val_loss: 0.4474

Epoch 00010: val_loss did not improve from 0.31137

Epoch 11/100

108/108 [=====] - 50s 463ms/step - opt_accuracy: 0.9082 - sar_accuracy: 0.7824 - fus_accuracy: 0.9071 - opt_loss: 0.0453 - sar_loss: 0.1184 - fusion_loss: 0.0455 - loss: 0.2092 - val_opt_accuracy: 0.8596 - val_sar_accuracy: 0.8013 - val_fus_accuracy: 0.8582 - val_opt_loss: 0.1492 - val_sar_loss: 0.1431 - val_fusion_loss: 0.1549 - val_loss: 0.4472

Epoch 00011: val_loss did not improve from 0.31137

Epoch 00011: early stopping

time: 13

Model: "model_3_14"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |

Total params: 1,406,327

Trainable params: 1,406,313

Non-trainable params: 14

Epoch 1/100

108/108 [=====] - 54s 477ms/step - opt_accuracy: 0.8251 - sar_accuracy: 0.7276 - fus_accuracy: 0.8099 - opt_loss: 0.0985 - sar_loss: 0.1428 - fusion_loss: 0.1065 - loss: 0.3478 - val_opt_accuracy: 0.8472 - val_sar_accuracy: 0.7645 - val_fus_accuracy: 0.8303 - val_opt_loss: 0.0931 - val_sar_loss: 0.1192 - val_fusion_loss: 0.0964 - val_loss: 0.3088

Epoch 00001: val_loss improved from inf to 0.30877, saving model to imgs/experiments/exp2/models/unet_13.h5

Epoch 2/100

108/108 [=====] - 48s 449ms/step - opt_accuracy: 0.8691 - sar_accuracy: 0.7606 - fus_accuracy: 0.8577 - opt_loss: 0.0763 - sar_loss: 0.1305 - fusion_loss: 0.0788 - loss: 0.2856 - val_opt_accuracy: 0.8407 - val_sar_accuracy: 0.7645 - val_fus_accuracy: 0.8384 - val_opt_loss: 0.1156 - val_sar_loss: 0.1222 - val_fusion_loss: 0.1156 - val_loss: 0.3088

usion_loss: 0.1074 - val_loss: 0.3452

Epoch 00002: val_loss did not improve from 0.30877

Epoch 3/100

108/108 [=====] - 48s 448ms/step - opt_accuracy: 0.8791 - sar_accuracy: 0.7716 - fus_accuracy: 0.8736 - opt_loss: 0.0703 - sar_loss: 0.1270 - fusion_loss: 0.0719 - loss: 0.2692 - val_opt_accuracy: 0.8497 - val_sar_accuracy: 0.7975 - val_fus_accuracy: 0.8468 - val_opt_loss: 0.1105 - val_sar_loss: 0.1286 - val_fusion_loss: 0.1107 - val_loss: 0.3498

Epoch 00003: val_loss did not improve from 0.30877

Epoch 4/100

108/108 [=====] - 49s 454ms/step - opt_accuracy: 0.8836 - sar_accuracy: 0.7655 - fus_accuracy: 0.8801 - opt_loss: 0.0665 - sar_loss: 0.1259 - fusion_loss: 0.0679 - loss: 0.2603 - val_opt_accuracy: 0.8528 - val_sar_accuracy: 0.7719 - val_fus_accuracy: 0.8493 - val_opt_loss: 0.1134 - val_sar_loss: 0.1312 - val_fusion_loss: 0.1144 - val_loss: 0.3590

Epoch 00004: val_loss did not improve from 0.30877

Epoch 5/100

108/108 [=====] - 48s 451ms/step - opt_accuracy: 0.8885 - sar_accuracy: 0.7762 - fus_accuracy: 0.8859 - opt_loss: 0.0622 - sar_loss: 0.1236 - fusion_loss: 0.0634 - loss: 0.2492 - val_opt_accuracy: 0.8447 - val_sar_accuracy: 0.7817 - val_fus_accuracy: 0.8415 - val_opt_loss: 0.1418 - val_sar_loss: 0.1203 - val_fusion_loss: 0.1385 - val_loss: 0.4006

Epoch 00005: val_loss did not improve from 0.30877

Epoch 6/100

108/108 [=====] - 49s 457ms/step - opt_accuracy: 0.8923 - sar_accuracy: 0.7834 - fus_accuracy: 0.8902 - opt_loss: 0.0594 - sar_loss: 0.1184 - fusion_loss: 0.0604 - loss: 0.2382 - val_opt_accuracy: 0.8470 - val_sar_accuracy: 0.7815 - val_fus_accuracy: 0.8444 - val_opt_loss: 0.1403 - val_sar_loss: 0.1302 - val_fusion_loss: 0.1386 - val_loss: 0.4091

Epoch 00006: val_loss did not improve from 0.30877

Epoch 7/100

108/108 [=====] - 49s 457ms/step - opt_accuracy: 0.8955 - sar_accuracy: 0.7848 - fus_accuracy: 0.8934 - opt_loss: 0.0567 - sar_loss: 0.1164 - fusion_loss: 0.0577 - loss: 0.2308 - val_opt_accuracy: 0.8530 - val_sar_accuracy: 0.7977 - val_fus_accuracy: 0.8509 - val_opt_loss: 0.1708 - val_sar_loss: 0.1377 - val_fusion_loss: 0.1691 - val_loss: 0.4775

Epoch 00007: val_loss did not improve from 0.30877

Epoch 8/100

108/108 [=====] - 51s 470ms/step - opt_accuracy: 0.8987 - sar_accuracy: 0.7905 - fus_accuracy: 0.8968 - opt_loss: 0.0536 - sar_loss: 0.1136 - fusion_loss: 0.0545 - loss: 0.2217 - val_opt_accuracy: 0.8589 - val_sar_accuracy: 0.7912 - val_fus_accuracy: 0.8559 - val_opt_loss: 0.1423 - val_sar_loss: 0.1430 - val_fusion_loss: 0.1423 - val_loss: 0.4276

Epoch 00008: val_loss did not improve from 0.30877

Epoch 9/100

108/108 [=====] - 49s 458ms/step - opt_accuracy: 0.9013 - sar_accuracy: 0.7900 - fus_accuracy: 0.8997 - opt_loss: 0.0509 - sar_loss: 0.1139 - fusion_loss: 0.0519 - loss: 0.2168 - val_opt_accuracy: 0.8596 - val_sar_accuracy: 0.7954 - val_fus_accuracy: 0.8585 - val_opt_loss: 0.1565 - val_sar_loss: 0.1276 - val_fusion_loss: 0.1546 - val_loss: 0.4386

Epoch 00009: val_loss did not improve from 0.30877

Epoch 10/100

108/108 [=====] - 48s 449ms/step - opt_accuracy: 0.9019 - sar_accuracy: 0.7843 - fus_accuracy: 0.9001 - opt_loss: 0.0506 - sar_loss: 0.1154 - fusion_loss: 0.0515 - loss: 0.2175 - val_opt_accuracy: 0.8564 - val_sar_accuracy: 0.7563 - val_fus_accuracy: 0.8505 - val_opt_loss: 0.1298 - val_sar_loss: 0.1251 - val_fusion_loss: 0.1295 - val_loss: 0.3844

Epoch 00010: val_loss did not improve from 0.30877

Epoch 11/100

108/108 [=====] - 51s 471ms/step - opt_accuracy: 0.8995 - sar_accuracy: 0.7865 - fus_accuracy: 0.8984 - opt_loss: 0.0515 - sar_loss: 0.1152 - fusion_loss: 0.0522 - loss: 0.2190 - val_opt_accuracy: 0.8622 - val_sar_accuracy: 0.8038 - val_fus_accuracy: 0.8614 - val_opt_loss: 0.1418 - val_sar_loss: 0.1447 - val_fusion_loss: 0.1429 - val_loss: 0.4294

Epoch 00011: val_loss did not improve from 0.30877

Epoch 00011: early stopping

time: 14

Model: "model_3_15"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |
| Total params: 1,406,327 | | |
| Trainable params: 1,406,313 | | |
| Non-trainable params: 14 | | |

Epoch 1/100

108/108 [=====] - 53s 467ms/step - opt_accuracy: 0.8330 - sar_accuracy: 0.7422 - fus_accuracy: 0.8106 - opt_loss: 0.0983 - sar_loss: 0.1434 - fusion_loss: 0.1083 - loss: 0.3500 - val_opt_accuracy: 0.8480 - val_sar_accuracy: 0.7759 - val_fus_accuracy: 0.8340 - val_opt_loss: 0.1035 - val_sar_loss: 0.1189 - val_fusion_loss: 0.1057 - val_loss: 0.3281

Epoch 00001: val_loss improved from inf to 0.32813, saving model to imgs/experiments/exp2/models/unet_14.h5

Epoch 2/100

108/108 [=====] - 50s 469ms/step - opt_accuracy: 0.8684 - sar_accuracy: 0.7389 - fus_accuracy: 0.8591 - opt_loss: 0.0769 - sar_loss: 0.1385 - fusion_loss: 0.0803 - loss: 0.2957 - val_opt_accuracy: 0.8538 - val_sar_accuracy: 0.7463 - val_fus_accuracy: 0.8492 - val_opt_loss: 0.1082 - val_sar_loss: 0.1237 - val_fusion_loss: 0.1063 - val_loss: 0.3382

Epoch 00002: val_loss did not improve from 0.32813

Epoch 3/100

108/108 [=====] - 52s 485ms/step - opt_accuracy: 0.8791 - sar_accuracy: 0.7525 - fus_accuracy: 0.8735 - opt_loss: 0.0698 - sar_loss: 0.1354 - fusion_loss: 0.0719 - loss: 0.2771 - val_opt_accuracy: 0.8520 - val_sar_accuracy: 0.7701 - val_fus_accuracy: 0.8468 - val_opt_loss: 0.1185 - val_sar_loss: 0.1222 - val_fusion_loss: 0.1169 - val_loss: 0.3575

Epoch 00003: val_loss did not improve from 0.32813

Epoch 4/100

108/108 [=====] - 53s 492ms/step - opt_accuracy: 0.8825 - sar_accuracy: 0.7612 - fus_accuracy: 0.8781 - opt_loss: 0.0670 - sar_loss: 0.1320 - fusion_loss: 0.0684 - loss: 0.2674 - val_opt_accuracy: 0.8523 - val_sar_accuracy: 0.7789 - val_fus_accuracy: 0.8500 - val_opt_loss: 0.1342 - val_sar_loss: 0.1211 - val_fusion_loss: 0.1331 - val_loss: 0.3883

Epoch 00004: val_loss did not improve from 0.32813

Epoch 5/100

108/108 [=====] - 53s 490ms/step - opt_accuracy: 0.8878 - sar_accuracy: 0.7619 - fus_accuracy: 0.8841 - opt_loss: 0.0623 - sar_loss: 0.1291 - fusion_loss: 0.0635 - loss: 0.2549 - val_opt_accuracy: 0.8383 - val_sar_accuracy: 0.7378 - val_fus_accuracy: 0.8311 - val_opt_loss: 0.1618 - val_sar_loss: 0.1241 - val_fusion_loss: 0.1603 - val_loss: 0.4461

Epoch 00005: val_loss did not improve from 0.32813

Epoch 6/100

108/108 [=====] - 53s 492ms/step - opt_accuracy: 0.8923 - sar_accuracy: 0.7519 - fus_accuracy: 0.8886 - opt_loss: 0.0592 - sar_loss: 0.1316 - fusion_loss: 0.0603 - loss: 0.2511 - val_opt_accuracy: 0.8539 - val_sar_accuracy: 0.7661 - val_fus_accuracy: 0.8513 - val_opt_loss: 0.1492 - val_sar_loss: 0.1214 - val_fusion_loss: 0.1451 - val_loss: 0.4157

Epoch 00006: val_loss did not improve from 0.32813

Epoch 7/100

108/108 [=====] - 53s 493ms/step - opt_accuracy: 0.8935 - sar_accuracy: 0.7525 - fus_accuracy: 0.8903 - opt_loss: 0.0581 - sar_loss: 0.1299 - fusion_loss: 0.0590 - loss: 0.2471 - val_opt_accuracy: 0.8522 - val_sar_accuracy: 0.7699 - val_fus_accuracy: 0.8485 - val_opt_loss: 0.1567 - val_sar_loss: 0.1243 - val_fusion_loss: 0.1557 - val_loss: 0.4367

Epoch 00007: val_loss did not improve from 0.32813

Epoch 8/100

108/108 [=====] - 52s 482ms/step - opt_accuracy: 0.8968 - sar_accuracy: 0.7406 - fus_accuracy: 0.8950 - opt_loss: 0.0550 - sar_loss: 0.1351 - fusion_loss: 0.0557 - loss: 0.2458 - val_opt_accuracy: 0.8577 - val_sar_accuracy: 0.7425 - val_fus_accuracy: 0.8567 - val_opt_loss: 0.1678 - val_sar_loss: 0.1237 - val_fusion_loss: 0.1683 - val_loss: 0.4598

Epoch 00008: val_loss did not improve from 0.32813

Epoch 9/100

108/108 [=====] - 53s 489ms/step - opt_accuracy: 0.9026 - sar_accuracy: 0.7366 - fus_accuracy: 0.9020 - opt_loss: 0.0499 - sar_loss: 0.1385 - fusion_loss: 0.0502 - loss: 0.2386 - val_opt_accuracy: 0.8612 - val_sar_accuracy: 0.7473 - val_fus_accuracy: 0.8606 - val_opt_loss: 0.1672 - val_sar_loss: 0.1214 - val_fusion_loss: 0.1683 - val_loss: 0.4569

Epoch 00009: val_loss did not improve from 0.32813

Epoch 10/100

108/108 [=====] - 54s 499ms/step - opt_accuracy: 0.9040 - sar_accuracy: 0.7369 - fus_accuracy: 0.9036 - opt_loss: 0.0486 - sar_loss: 0.1390 - fusion_loss: 0.0487 - loss: 0.2363 - val_opt_accuracy: 0.8609 - val_sar_accuracy: 0.7474 - val_fus_accuracy: 0.8605 - val_opt_loss: 0.1710 - val_sar_loss: 0.1218 - val_fusion_loss: 0.1714 - val_loss: 0.4642

Epoch 00010: val_loss did not improve from 0.32813

Epoch 11/100

108/108 [=====] - 54s 504ms/step - opt_accuracy: 0.9081 - sar_accuracy: 0.7392 - fus_accuracy: 0.9077 - opt_loss: 0.0457 - sar_loss: 0.1377 - fusion_loss: 0.0458 - loss: 0.2291 - val_opt_accuracy: 0.8647 - val_sar_accuracy: 0.7501 - val_fus_accuracy: 0.8645 - val_opt_loss: 0.1632 - val_sar_loss: 0.1203 - val_fusion_loss: 0.1630 - val_loss: 0.4465

Epoch 00011: val_loss did not improve from 0.32813

Epoch 00011: early stopping

time: 15

Model: "model_3_16"

| Layer (type) | Output Shape | Param # |
|----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| ===== | | |
| sar_encoder (UNET_Encoder) | multiple | 536288 |

| | | |
|-----------------------------|----------|--------|
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |

=====

Total params: 1,406,327

Trainable params: 1,406,313

Non-trainable params: 14

Epoch 1/100

108/108 [=====] - 60s 537ms/step - opt_accuracy: 0.8349 - sar_accuracy: 0.7303 - fus_accuracy: 0.8118 - opt_loss: 0.0938 - sar_loss: 0.1414 - fusion_loss: 0.1067 - loss: 0.3419 - val_opt_accuracy: 0.8478 - val_sar_accuracy: 0.7629 - val_fus_accuracy: 0.8397 - val_opt_loss: 0.1044 - val_sar_loss: 0.1186 - val_fusion_loss: 0.1136 - val_loss: 0.3367

Epoch 00001: val_loss improved from inf to 0.33668, saving model to imgs/experiments/exp2/models/unet_15.h5

Epoch 2/100

108/108 [=====] - 55s 507ms/step - opt_accuracy: 0.8694 - sar_accuracy: 0.7500 - fus_accuracy: 0.8587 - opt_loss: 0.0741 - sar_loss: 0.1344 - fusion_loss: 0.0783 - loss: 0.2868 - val_opt_accuracy: 0.8451 - val_sar_accuracy: 0.7464 - val_fus_accuracy: 0.8389 - val_opt_loss: 0.1116 - val_sar_loss: 0.1248 - val_fusion_loss: 0.1137 - val_loss: 0.3501

Epoch 00002: val_loss did not improve from 0.33668

Epoch 3/100

108/108 [=====] - 54s 503ms/step - opt_accuracy: 0.8784 - sar_accuracy: 0.7605 - fus_accuracy: 0.8722 - opt_loss: 0.0692 - sar_loss: 0.1323 - fusion_loss: 0.0720 - loss: 0.2735 - val_opt_accuracy: 0.8467 - val_sar_accuracy: 0.7381 - val_fus_accuracy: 0.8437 - val_opt_loss: 0.1110 - val_sar_loss: 0.1287 - val_fusion_loss: 0.1116 - val_loss: 0.3512

Epoch 00003: val_loss did not improve from 0.33668

Epoch 4/100

108/108 [=====] - 54s 505ms/step - opt_accuracy: 0.8822 - sar_accuracy: 0.7610 - fus_accuracy: 0.8787 - opt_loss: 0.0662 - sar_loss: 0.1328 - fusion_loss: 0.0680 - loss: 0.2669 - val_opt_accuracy: 0.8413 - val_sar_accuracy: 0.7861 - val_fus_accuracy: 0.8398 - val_opt_loss: 0.1353 - val_sar_loss: 0.1216 - val_fusion_loss: 0.1353 - val_loss: 0.3922

Epoch 00004: val_loss did not improve from 0.33668

Epoch 5/100

108/108 [=====] - 53s 492ms/step - opt_accuracy: 0.8863 - sar_accuracy: 0.7850 - fus_accuracy: 0.8838 - opt_loss: 0.0623 - sar_loss: 0.1230 - fusion_loss: 0.0635 - loss: 0.2488 - val_opt_accuracy: 0.8453 - val_sar_accuracy: 0.7975 - val_fus_accuracy: 0.8463 - val_opt_loss: 0.1198 - val_sar_loss: 0.1274 - val_fusion_loss: 0.1215 - val_loss: 0.3688

Epoch 00005: val_loss did not improve from 0.33668

Epoch 6/100

108/108 [=====] - 53s 495ms/step - opt_accuracy: 0.8871 - sar_accuracy: 0.7794 - fus_accuracy: 0.8856 - opt_loss: 0.0625 - sar_loss: 0.1263 - fusion_loss: 0.0633 - loss: 0.2520 - val_opt_accuracy: 0.8544 - val_sar_accuracy: 0.7971 - val_fus_accuracy: 0.8547 - val_opt_loss: 0.1149 - val_sar_loss: 0.1208 - val_fusion_loss: 0.1153 - val_loss: 0.3510

Epoch 00006: val_loss did not improve from 0.33668

Epoch 7/100

108/108 [=====] - 55s 508ms/step - opt_accuracy: 0.8910 - sar_accuracy: 0.7946 - fus_accuracy: 0.8898 - opt_loss: 0.0579 - sar_loss: 0.1158 - fusion_loss: 0.0579 - loss: 0.2488 - val_opt_accuracy: 0.8544 - val_sar_accuracy: 0.7971 - val_fus_accuracy: 0.8547 - val_opt_loss: 0.1149 - val_sar_loss: 0.1208 - val_fusion_loss: 0.1153 - val_loss: 0.3510

usion_loss: 0.0584 - loss: 0.2321 - val_opt_accuracy: 0.8454 - val_sar_accuracy: 0.7929 - val_fus_accuracy: 0.8473 - val_opt_loss: 0.1527 - val_sar_loss: 0.1332 - val_fusion_loss: 0.1533 - val_loss: 0.4392

Epoch 00007: val_loss did not improve from 0.33668

Epoch 8/100

108/108 [=====] - 54s 507ms/step - opt_accuracy: 0.8951 - sar_accuracy: 0.7631 - fus_accuracy: 0.8936 - opt_loss: 0.0548 - sar_loss: 0.1245 - fusion_loss: 0.0554 - loss: 0.2347 - val_opt_accuracy: 0.8452 - val_sar_accuracy: 0.7455 - val_fus_accuracy: 0.8467 - val_opt_loss: 0.1594 - val_sar_loss: 0.1254 - val_fusion_loss: 0.1589 - val_loss: 0.4437

Epoch 00008: val_loss did not improve from 0.33668

Epoch 9/100

108/108 [=====] - 55s 509ms/step - opt_accuracy: 0.9006 - sar_accuracy: 0.7483 - fus_accuracy: 0.8991 - opt_loss: 0.0508 - sar_loss: 0.1306 - fusion_loss: 0.0512 - loss: 0.2326 - val_opt_accuracy: 0.8467 - val_sar_accuracy: 0.7679 - val_fus_accuracy: 0.8479 - val_opt_loss: 0.1574 - val_sar_loss: 0.1225 - val_fusion_loss: 0.1582 - val_loss: 0.4381

Epoch 00009: val_loss did not improve from 0.33668

Epoch 10/100

108/108 [=====] - 58s 540ms/step - opt_accuracy: 0.9014 - sar_accuracy: 0.7620 - fus_accuracy: 0.9001 - opt_loss: 0.0489 - sar_loss: 0.1264 - fusion_loss: 0.0493 - loss: 0.2245 - val_opt_accuracy: 0.8577 - val_sar_accuracy: 0.7861 - val_fus_accuracy: 0.8581 - val_opt_loss: 0.1657 - val_sar_loss: 0.1260 - val_fusion_loss: 0.1673 - val_loss: 0.4589

Epoch 00010: val_loss did not improve from 0.33668

Epoch 11/100

108/108 [=====] - 57s 532ms/step - opt_accuracy: 0.9053 - sar_accuracy: 0.7690 - fus_accuracy: 0.9039 - opt_loss: 0.0466 - sar_loss: 0.1243 - fusion_loss: 0.0469 - loss: 0.2177 - val_opt_accuracy: 0.8553 - val_sar_accuracy: 0.7765 - val_fus_accuracy: 0.8559 - val_opt_loss: 0.1483 - val_sar_loss: 0.1584 - val_fusion_loss: 0.1537 - val_loss: 0.4605

Epoch 00011: val_loss did not improve from 0.33668

Epoch 00011: early stopping

time: 16

Model: "model_3_17"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |
| Total params: 1,406,327 | | |
| Trainable params: 1,406,313 | | |
| Non-trainable params: 14 | | |

Epoch 1/100

108/108 [=====] - 61s 548ms/step - opt_accuracy: 0.8349 - sar_accuracy: 0.7393 - fus_accuracy: 0.8161 - opt_loss: 0.0956 - sar_loss: 0.1390 - fusion_loss: 0.1027 - loss: 0.3374 - val_opt_accuracy: 0.8392 - val_sar_accuracy: 0.7659 - val_fus_accuracy: 0.8279 - val_opt_loss: 0.0995 - val_sar_loss: 0.1204 - val_fusion_loss: 0.1063 - val_loss: 0.3261

Epoch 00001: val_loss improved from inf to 0.32612, saving model to imgs/experiment
s/exp2/models\unet_16.h5

Epoch 2/100

108/108 [=====] - 59s 547ms/step - opt_accuracy: 0.8736 - s
ar_accuracy: 0.7517 - fus_accuracy: 0.8623 - opt_loss: 0.0764 - sar_loss: 0.1344 - f
usion_loss: 0.0799 - loss: 0.2907 - val_opt_accuracy: 0.8490 - val_sar_accuracy: 0.7
712 - val_fus_accuracy: 0.8424 - val_opt_loss: 0.1090 - val_sar_loss: 0.1194 - val_f
usion_loss: 0.1113 - val_loss: 0.3397

Epoch 00002: val_loss did not improve from 0.32612

Epoch 3/100

108/108 [=====] - 59s 546ms/step - opt_accuracy: 0.8822 - s
ar_accuracy: 0.7558 - fus_accuracy: 0.8765 - opt_loss: 0.0695 - sar_loss: 0.1334 - f
usion_loss: 0.0716 - loss: 0.2745 - val_opt_accuracy: 0.8334 - val_sar_accuracy: 0.7
623 - val_fus_accuracy: 0.8334 - val_opt_loss: 0.1265 - val_sar_loss: 0.1208 - val_f
usion_loss: 0.1263 - val_loss: 0.3737

Epoch 00003: val_loss did not improve from 0.32612

Epoch 4/100

108/108 [=====] - 59s 552ms/step - opt_accuracy: 0.8858 - s
ar_accuracy: 0.7646 - fus_accuracy: 0.8828 - opt_loss: 0.0664 - sar_loss: 0.1321 - f
usion_loss: 0.0674 - loss: 0.2659 - val_opt_accuracy: 0.8413 - val_sar_accuracy: 0.7
774 - val_fus_accuracy: 0.8398 - val_opt_loss: 0.1333 - val_sar_loss: 0.1235 - val_f
usion_loss: 0.1337 - val_loss: 0.3905

Epoch 00004: val_loss did not improve from 0.32612

Epoch 5/100

108/108 [=====] - 59s 553ms/step - opt_accuracy: 0.8916 - s
ar_accuracy: 0.7738 - fus_accuracy: 0.8890 - opt_loss: 0.0614 - sar_loss: 0.1246 - f
usion_loss: 0.0623 - loss: 0.2483 - val_opt_accuracy: 0.8568 - val_sar_accuracy: 0.7
673 - val_fus_accuracy: 0.8546 - val_opt_loss: 0.1239 - val_sar_loss: 0.1280 - val_f
usion_loss: 0.1244 - val_loss: 0.3763

Epoch 00005: val_loss did not improve from 0.32612

Epoch 6/100

108/108 [=====] - 60s 557ms/step - opt_accuracy: 0.8927 - s
ar_accuracy: 0.7764 - fus_accuracy: 0.8904 - opt_loss: 0.0602 - sar_loss: 0.1193 - f
usion_loss: 0.0607 - loss: 0.2402 - val_opt_accuracy: 0.8331 - val_sar_accuracy: 0.7
785 - val_fus_accuracy: 0.8343 - val_opt_loss: 0.1628 - val_sar_loss: 0.1309 - val_f
usion_loss: 0.1636 - val_loss: 0.4574

Epoch 00006: val_loss did not improve from 0.32612

Epoch 7/100

108/108 [=====] - 60s 561ms/step - opt_accuracy: 0.8943 - s
ar_accuracy: 0.7815 - fus_accuracy: 0.8921 - opt_loss: 0.0588 - sar_loss: 0.1177 - f
usion_loss: 0.0592 - loss: 0.2357 - val_opt_accuracy: 0.8556 - val_sar_accuracy: 0.7
984 - val_fus_accuracy: 0.8567 - val_opt_loss: 0.1464 - val_sar_loss: 0.1289 - val_f
usion_loss: 0.1471 - val_loss: 0.4224

Epoch 00007: val_loss did not improve from 0.32612

Epoch 8/100

108/108 [=====] - 60s 562ms/step - opt_accuracy: 0.8981 - s
ar_accuracy: 0.7871 - fus_accuracy: 0.8965 - opt_loss: 0.0551 - sar_loss: 0.1143 - f
usion_loss: 0.0553 - loss: 0.2247 - val_opt_accuracy: 0.8591 - val_sar_accuracy: 0.7
962 - val_fus_accuracy: 0.8583 - val_opt_loss: 0.1443 - val_sar_loss: 0.1468 - val_f
usion_loss: 0.1482 - val_loss: 0.4394

Epoch 00008: val_loss did not improve from 0.32612

Epoch 9/100

108/108 [=====] - 62s 580ms/step - opt_accuracy: 0.9017 - s
ar_accuracy: 0.7962 - fus_accuracy: 0.9003 - opt_loss: 0.0524 - sar_loss: 0.1105 - f
usion_loss: 0.0524 - loss: 0.2153 - val_opt_accuracy: 0.8537 - val_sar_accuracy: 0.8
052 - val_fus_accuracy: 0.8529 - val_opt_loss: 0.1785 - val_sar_loss: 0.1610 - val_f
usion_loss: 0.1823 - val_loss: 0.5219

Epoch 00009: val_loss did not improve from 0.32612

Epoch 10/100

108/108 [=====] - 61s 565ms/step - opt_accuracy: 0.9023 - sar_accuracy: 0.7989 - fus_accuracy: 0.9011 - opt_loss: 0.0518 - sar_loss: 0.1088 - fusion_loss: 0.0517 - loss: 0.2122 - val_opt_accuracy: 0.8580 - val_sar_accuracy: 0.7728 - val_fus_accuracy: 0.8573 - val_opt_loss: 0.1737 - val_sar_loss: 0.1328 - val_fusion_loss: 0.1703 - val_loss: 0.4768

Epoch 00010: val_loss did not improve from 0.32612

Epoch 11/100

108/108 [=====] - 58s 543ms/step - opt_accuracy: 0.9069 - sar_accuracy: 0.7977 - fus_accuracy: 0.9057 - opt_loss: 0.0481 - sar_loss: 0.1075 - fusion_loss: 0.0481 - loss: 0.2036 - val_opt_accuracy: 0.8543 - val_sar_accuracy: 0.7919 - val_fus_accuracy: 0.8534 - val_opt_loss: 0.1395 - val_sar_loss: 0.1529 - val_fusion_loss: 0.1425 - val_loss: 0.4349

Epoch 00011: val_loss did not improve from 0.32612

Epoch 00011: early stopping

time: 17

Model: "model_3_18"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |
| Total params: 1,406,327 | | |
| Trainable params: 1,406,313 | | |
| Non-trainable params: 14 | | |

Epoch 1/100

108/108 [=====] - 67s 599ms/step - opt_accuracy: 0.8177 - sar_accuracy: 0.7276 - fus_accuracy: 0.8027 - opt_loss: 0.1031 - sar_loss: 0.1426 - fusion_loss: 0.1121 - loss: 0.3577 - val_opt_accuracy: 0.8310 - val_sar_accuracy: 0.7607 - val_fus_accuracy: 0.8340 - val_opt_loss: 0.0987 - val_sar_loss: 0.1178 - val_fusion_loss: 0.1012 - val_loss: 0.3176

Epoch 00001: val_loss improved from inf to 0.31764, saving model to imgs/experiments/exp2/models/unet_17.h5

Epoch 2/100

108/108 [=====] - 79s 735ms/step - opt_accuracy: 0.8631 - sar_accuracy: 0.7530 - fus_accuracy: 0.8530 - opt_loss: 0.0796 - sar_loss: 0.1334 - fusion_loss: 0.0832 - loss: 0.2962 - val_opt_accuracy: 0.8389 - val_sar_accuracy: 0.7669 - val_fus_accuracy: 0.8333 - val_opt_loss: 0.1121 - val_sar_loss: 0.1195 - val_fusion_loss: 0.1099 - val_loss: 0.3416

Epoch 00002: val_loss did not improve from 0.31764

Epoch 3/100

108/108 [=====] - 64s 600ms/step - opt_accuracy: 0.8750 - sar_accuracy: 0.7686 - fus_accuracy: 0.8669 - opt_loss: 0.0724 - sar_loss: 0.1249 - fusion_loss: 0.0749 - loss: 0.2722 - val_opt_accuracy: 0.8424 - val_sar_accuracy: 0.7856 - val_fus_accuracy: 0.8385 - val_opt_loss: 0.1519 - val_sar_loss: 0.1304 - val_fusion_loss: 0.1457 - val_loss: 0.4281

Epoch 00003: val_loss did not improve from 0.31764

Epoch 4/100

108/108 [=====] - 64s 593ms/step - opt_accuracy: 0.8808 - sar_accuracy: 0.7739 - fus_accuracy: 0.8761 - opt_loss: 0.0681 - sar_loss: 0.1198 - fusion_loss: 0.0694 - loss: 0.2572 - val_opt_accuracy: 0.8575 - val_sar_accuracy: 0.7859 - val_fus_accuracy: 0.8503 - val_opt_loss: 0.1208 - val_sar_loss: 0.1292 - val_fusion_loss: 0.1199 - val_loss: 0.3699

Epoch 00004: val_loss did not improve from 0.31764

Epoch 5/100

108/108 [=====] - 64s 594ms/step - opt_accuracy: 0.8815 - sar_accuracy: 0.7793 - fus_accuracy: 0.8785 - opt_loss: 0.0659 - sar_loss: 0.1166 - fusion_loss: 0.0667 - loss: 0.2492 - val_opt_accuracy: 0.8583 - val_sar_accuracy: 0.7876 - val_fus_accuracy: 0.8539 - val_opt_loss: 0.1201 - val_sar_loss: 0.1349 - val_fusion_loss: 0.1214 - val_loss: 0.3764

Epoch 00005: val_loss did not improve from 0.31764

Epoch 6/100

108/108 [=====] - 63s 589ms/step - opt_accuracy: 0.8868 - sar_accuracy: 0.7832 - fus_accuracy: 0.8840 - opt_loss: 0.0626 - sar_loss: 0.1142 - fusion_loss: 0.0633 - loss: 0.2401 - val_opt_accuracy: 0.8537 - val_sar_accuracy: 0.7963 - val_fus_accuracy: 0.8531 - val_opt_loss: 0.1323 - val_sar_loss: 0.1381 - val_fusion_loss: 0.1319 - val_loss: 0.4023

Epoch 00006: val_loss did not improve from 0.31764

Epoch 7/100

108/108 [=====] - 63s 588ms/step - opt_accuracy: 0.8913 - sar_accuracy: 0.7866 - fus_accuracy: 0.8888 - opt_loss: 0.0598 - sar_loss: 0.1119 - fusion_loss: 0.0605 - loss: 0.2321 - val_opt_accuracy: 0.8521 - val_sar_accuracy: 0.7902 - val_fus_accuracy: 0.8504 - val_opt_loss: 0.1413 - val_sar_loss: 0.1261 - val_fusion_loss: 0.1390 - val_loss: 0.4064

Epoch 00007: val_loss did not improve from 0.31764

Epoch 8/100

108/108 [=====] - 64s 595ms/step - opt_accuracy: 0.8918 - sar_accuracy: 0.7739 - fus_accuracy: 0.8892 - opt_loss: 0.0579 - sar_loss: 0.1163 - fusion_loss: 0.0586 - loss: 0.2329 - val_opt_accuracy: 0.8570 - val_sar_accuracy: 0.7913 - val_fus_accuracy: 0.8550 - val_opt_loss: 0.1574 - val_sar_loss: 0.1417 - val_fusion_loss: 0.1561 - val_loss: 0.4553

Epoch 00008: val_loss did not improve from 0.31764

Epoch 9/100

108/108 [=====] - 64s 598ms/step - opt_accuracy: 0.8956 - sar_accuracy: 0.7810 - fus_accuracy: 0.8931 - opt_loss: 0.0556 - sar_loss: 0.1120 - fusion_loss: 0.0562 - loss: 0.2238 - val_opt_accuracy: 0.8535 - val_sar_accuracy: 0.7831 - val_fus_accuracy: 0.8516 - val_opt_loss: 0.1483 - val_sar_loss: 0.1543 - val_fusion_loss: 0.1450 - val_loss: 0.4476

Epoch 00009: val_loss did not improve from 0.31764

Epoch 10/100

108/108 [=====] - 66s 612ms/step - opt_accuracy: 0.9034 - sar_accuracy: 0.7904 - fus_accuracy: 0.9016 - opt_loss: 0.0498 - sar_loss: 0.1073 - fusion_loss: 0.0505 - loss: 0.2076 - val_opt_accuracy: 0.8562 - val_sar_accuracy: 0.7624 - val_fus_accuracy: 0.8535 - val_opt_loss: 0.1695 - val_sar_loss: 0.1240 - val_fusion_loss: 0.1649 - val_loss: 0.4584

Epoch 00010: val_loss did not improve from 0.31764

Epoch 11/100

108/108 [=====] - 69s 639ms/step - opt_accuracy: 0.9054 - sar_accuracy: 0.7883 - fus_accuracy: 0.9036 - opt_loss: 0.0488 - sar_loss: 0.1086 - fusion_loss: 0.0496 - loss: 0.2070 - val_opt_accuracy: 0.8629 - val_sar_accuracy: 0.7895 - val_fus_accuracy: 0.8614 - val_opt_loss: 0.1693 - val_sar_loss: 0.1364 - val_fusion_loss: 0.1682 - val_loss: 0.4740

Epoch 00011: val_loss did not improve from 0.31764

Epoch 00011: early stopping

time: 18
Model: "model_3_19"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |

=====
Total params: 1,406,327
Trainable params: 1,406,313
Non-trainable params: 14

Epoch 1/100

108/108 [=====] - 71s 634ms/step - opt_accuracy: 0.8305 - sar_accuracy: 0.7293 - fus_accuracy: 0.8222 - opt_loss: 0.0963 - sar_loss: 0.1429 - fusion_loss: 0.1057 - loss: 0.3449 - val_opt_accuracy: 0.8435 - val_sar_accuracy: 0.7359 - val_fus_accuracy: 0.8394 - val_opt_loss: 0.1169 - val_sar_loss: 0.1260 - val_fusion_loss: 0.1150 - val_loss: 0.3579

Epoch 00001: val_loss improved from inf to 0.35793, saving model to imgs/experiments/exp2/models/unet_18.h5

Epoch 2/100

108/108 [=====] - 66s 615ms/step - opt_accuracy: 0.8728 - sar_accuracy: 0.7519 - fus_accuracy: 0.8649 - opt_loss: 0.0747 - sar_loss: 0.1347 - fusion_loss: 0.0782 - loss: 0.2876 - val_opt_accuracy: 0.8295 - val_sar_accuracy: 0.7534 - val_fus_accuracy: 0.8227 - val_opt_loss: 0.1191 - val_sar_loss: 0.1226 - val_fusion_loss: 0.1205 - val_loss: 0.3622

Epoch 00002: val_loss did not improve from 0.35793

Epoch 3/100

108/108 [=====] - 68s 634ms/step - opt_accuracy: 0.8815 - sar_accuracy: 0.7484 - fus_accuracy: 0.8756 - opt_loss: 0.0689 - sar_loss: 0.1329 - fusion_loss: 0.0710 - loss: 0.2728 - val_opt_accuracy: 0.8408 - val_sar_accuracy: 0.7755 - val_fus_accuracy: 0.8360 - val_opt_loss: 0.1451 - val_sar_loss: 0.1193 - val_fusion_loss: 0.1457 - val_loss: 0.4101

Epoch 00003: val_loss did not improve from 0.35793

Epoch 4/100

108/108 [=====] - 70s 649ms/step - opt_accuracy: 0.8849 - sar_accuracy: 0.7796 - fus_accuracy: 0.8798 - opt_loss: 0.0654 - sar_loss: 0.1221 - fusion_loss: 0.0670 - loss: 0.2545 - val_opt_accuracy: 0.8492 - val_sar_accuracy: 0.8038 - val_fus_accuracy: 0.8462 - val_opt_loss: 0.1483 - val_sar_loss: 0.1274 - val_fusion_loss: 0.1479 - val_loss: 0.4236

Epoch 00004: val_loss did not improve from 0.35793

Epoch 5/100

108/108 [=====] - 71s 665ms/step - opt_accuracy: 0.8877 - sar_accuracy: 0.7807 - fus_accuracy: 0.8841 - opt_loss: 0.0631 - sar_loss: 0.1197 - fusion_loss: 0.0642 - loss: 0.2469 - val_opt_accuracy: 0.8503 - val_sar_accuracy: 0.7895 - val_fus_accuracy: 0.8500 - val_opt_loss: 0.1474 - val_sar_loss: 0.1236 - val_fusion_loss: 0.1473 - val_loss: 0.4184

Epoch 00005: val_loss did not improve from 0.35793

Epoch 6/100

108/108 [=====] - 72s 670ms/step - opt_accuracy: 0.8901 - sar_accuracy: 0.7775 - fus_accuracy: 0.8874 - opt_loss: 0.0611 - sar_loss: 0.1198 - fusion_loss: 0.0611 - loss: 0.2469 - val_opt_accuracy: 0.8503 - val_sar_accuracy: 0.7895 - val_fus_accuracy: 0.8500 - val_opt_loss: 0.1474 - val_sar_loss: 0.1236 - val_fusion_loss: 0.1473 - val_loss: 0.4184

usion_loss: 0.0618 - loss: 0.2427 - val_opt_accuracy: 0.8479 - val_sar_accuracy: 0.7880 - val_fus_accuracy: 0.8480 - val_opt_loss: 0.1462 - val_sar_loss: 0.1256 - val_fusion_loss: 0.1467 - val_loss: 0.4185

Epoch 00006: val_loss did not improve from 0.35793

Epoch 7/100

108/108 [=====] - 72s 670ms/step - opt_accuracy: 0.8926 - sar_accuracy: 0.7753 - fus_accuracy: 0.8901 - opt_loss: 0.0584 - sar_loss: 0.1205 - fusion_loss: 0.0589 - loss: 0.2378 - val_opt_accuracy: 0.8467 - val_sar_accuracy: 0.7908 - val_fus_accuracy: 0.8466 - val_opt_loss: 0.1471 - val_sar_loss: 0.1310 - val_fusion_loss: 0.1479 - val_loss: 0.4260

Epoch 00007: val_loss did not improve from 0.35793

Epoch 8/100

108/108 [=====] - 74s 690ms/step - opt_accuracy: 0.8957 - sar_accuracy: 0.7774 - fus_accuracy: 0.8937 - opt_loss: 0.0552 - sar_loss: 0.1201 - fusion_loss: 0.0556 - loss: 0.2309 - val_opt_accuracy: 0.8545 - val_sar_accuracy: 0.7915 - val_fus_accuracy: 0.8545 - val_opt_loss: 0.1469 - val_sar_loss: 0.1374 - val_fusion_loss: 0.1489 - val_loss: 0.4332

Epoch 00008: val_loss did not improve from 0.35793

Epoch 9/100

108/108 [=====] - 73s 682ms/step - opt_accuracy: 0.8966 - sar_accuracy: 0.7752 - fus_accuracy: 0.8944 - opt_loss: 0.0545 - sar_loss: 0.1203 - fusion_loss: 0.0548 - loss: 0.2295 - val_opt_accuracy: 0.8561 - val_sar_accuracy: 0.7969 - val_fus_accuracy: 0.8563 - val_opt_loss: 0.1577 - val_sar_loss: 0.1388 - val_fusion_loss: 0.1604 - val_loss: 0.4569

Epoch 00009: val_loss did not improve from 0.35793

Epoch 10/100

108/108 [=====] - 74s 688ms/step - opt_accuracy: 0.8986 - sar_accuracy: 0.7849 - fus_accuracy: 0.8971 - opt_loss: 0.0529 - sar_loss: 0.1166 - fusion_loss: 0.0530 - loss: 0.2225 - val_opt_accuracy: 0.8527 - val_sar_accuracy: 0.7881 - val_fus_accuracy: 0.8536 - val_opt_loss: 0.1392 - val_sar_loss: 0.1372 - val_fusion_loss: 0.1425 - val_loss: 0.4189

Epoch 00010: val_loss did not improve from 0.35793

Epoch 11/100

108/108 [=====] - 73s 679ms/step - opt_accuracy: 0.9056 - sar_accuracy: 0.7774 - fus_accuracy: 0.9040 - opt_loss: 0.0471 - sar_loss: 0.1196 - fusion_loss: 0.0472 - loss: 0.2138 - val_opt_accuracy: 0.8603 - val_sar_accuracy: 0.7861 - val_fus_accuracy: 0.8599 - val_opt_loss: 0.1448 - val_sar_loss: 0.1362 - val_fusion_loss: 0.1474 - val_loss: 0.4284

Epoch 00011: val_loss did not improve from 0.35793

Epoch 00011: early stopping

time: 19

Model: "model_3_20"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |
| Total params: 1,406,327 | | |
| Trainable params: 1,406,313 | | |

Non-trainable params: 14

Epoch 1/100

108/108 [=====] - 78s 696ms/step - opt_accuracy: 0.8190 - sar_accuracy: 0.7289 - fus_accuracy: 0.7884 - opt_loss: 0.1042 - sar_loss: 0.1400 - fusion_loss: 0.1143 - loss: 0.3586 - val_opt_accuracy: 0.8355 - val_sar_accuracy: 0.7373 - val_fus_accuracy: 0.8269 - val_opt_loss: 0.1063 - val_sar_loss: 0.1282 - val_fusion_loss: 0.1084 - val_loss: 0.3429

Epoch 00001: val_loss improved from inf to 0.34290, saving model to imgs/experiments/exp2/models\unet_19.h5

Epoch 2/100

108/108 [=====] - 74s 685ms/step - opt_accuracy: 0.8602 - sar_accuracy: 0.7529 - fus_accuracy: 0.8483 - opt_loss: 0.0824 - sar_loss: 0.1295 - fusion_loss: 0.0861 - loss: 0.2979 - val_opt_accuracy: 0.8484 - val_sar_accuracy: 0.7527 - val_fus_accuracy: 0.8388 - val_opt_loss: 0.0963 - val_sar_loss: 0.1218 - val_fusion_loss: 0.1019 - val_loss: 0.3200

Epoch 00002: val_loss improved from 0.34290 to 0.31995, saving model to imgs/experiments/exp2/models\unet_19.h5

Epoch 3/100

108/108 [=====] - 73s 684ms/step - opt_accuracy: 0.8713 - sar_accuracy: 0.7614 - fus_accuracy: 0.8650 - opt_loss: 0.0745 - sar_loss: 0.1243 - fusion_loss: 0.0768 - loss: 0.2756 - val_opt_accuracy: 0.8468 - val_sar_accuracy: 0.7692 - val_fus_accuracy: 0.8460 - val_opt_loss: 0.1145 - val_sar_loss: 0.1233 - val_fusion_loss: 0.1143 - val_loss: 0.3522

Epoch 00003: val_loss did not improve from 0.31995

Epoch 4/100

108/108 [=====] - 72s 667ms/step - opt_accuracy: 0.8784 - sar_accuracy: 0.7709 - fus_accuracy: 0.8736 - opt_loss: 0.0694 - sar_loss: 0.1198 - fusion_loss: 0.0709 - loss: 0.2601 - val_opt_accuracy: 0.8403 - val_sar_accuracy: 0.7795 - val_fus_accuracy: 0.8404 - val_opt_loss: 0.1348 - val_sar_loss: 0.1242 - val_fusion_loss: 0.1320 - val_loss: 0.3909

Epoch 00004: val_loss did not improve from 0.31995

Epoch 5/100

108/108 [=====] - 73s 682ms/step - opt_accuracy: 0.8834 - sar_accuracy: 0.7788 - fus_accuracy: 0.8804 - opt_loss: 0.0664 - sar_loss: 0.1166 - fusion_loss: 0.0673 - loss: 0.2503 - val_opt_accuracy: 0.8507 - val_sar_accuracy: 0.7822 - val_fus_accuracy: 0.8501 - val_opt_loss: 0.1453 - val_sar_loss: 0.1359 - val_fusion_loss: 0.1422 - val_loss: 0.4234

Epoch 00005: val_loss did not improve from 0.31995

Epoch 6/100

108/108 [=====] - 74s 688ms/step - opt_accuracy: 0.8861 - sar_accuracy: 0.7825 - fus_accuracy: 0.8838 - opt_loss: 0.0643 - sar_loss: 0.1140 - fusion_loss: 0.0646 - loss: 0.2429 - val_opt_accuracy: 0.8533 - val_sar_accuracy: 0.7904 - val_fus_accuracy: 0.8528 - val_opt_loss: 0.1228 - val_sar_loss: 0.1332 - val_fusion_loss: 0.1249 - val_loss: 0.3808

Epoch 00006: val_loss did not improve from 0.31995

Epoch 7/100

108/108 [=====] - 74s 687ms/step - opt_accuracy: 0.8880 - sar_accuracy: 0.7913 - fus_accuracy: 0.8867 - opt_loss: 0.0613 - sar_loss: 0.1102 - fusion_loss: 0.0613 - loss: 0.2328 - val_opt_accuracy: 0.8494 - val_sar_accuracy: 0.7792 - val_fus_accuracy: 0.8499 - val_opt_loss: 0.1201 - val_sar_loss: 0.1247 - val_fusion_loss: 0.1201 - val_loss: 0.3648

Epoch 00007: val_loss did not improve from 0.31995

Epoch 8/100

108/108 [=====] - 74s 688ms/step - opt_accuracy: 0.8909 - sar_accuracy: 0.7794 - fus_accuracy: 0.8899 - opt_loss: 0.0590 - sar_loss: 0.1156 - fusion_loss: 0.0590 - loss: 0.2336 - val_opt_accuracy: 0.8474 - val_sar_accuracy: 0.7694 - val_fus_accuracy: 0.8475 - val_opt_loss: 0.1535 - val_sar_loss: 0.1241 - val_fusion_loss: 0.1241 - val_loss: 0.3648

usion_loss: 0.1525 - val_loss: 0.4301

Epoch 00008: val_loss did not improve from 0.31995

Epoch 9/100

108/108 [=====] - 76s 711ms/step - opt_accuracy: 0.8946 - sar_accuracy: 0.7905 - fus_accuracy: 0.8936 - opt_loss: 0.0566 - sar_loss: 0.1105 - fusion_loss: 0.0564 - loss: 0.2235 - val_opt_accuracy: 0.8494 - val_sar_accuracy: 0.7876 - val_fus_accuracy: 0.8486 - val_opt_loss: 0.1400 - val_sar_loss: 0.1305 - val_fusion_loss: 0.1407 - val_loss: 0.4113

Epoch 00009: val_loss did not improve from 0.31995

Epoch 10/100

108/108 [=====] - 76s 710ms/step - opt_accuracy: 0.8948 - sar_accuracy: 0.7987 - fus_accuracy: 0.8938 - opt_loss: 0.0551 - sar_loss: 0.1050 - fusion_loss: 0.0548 - loss: 0.2149 - val_opt_accuracy: 0.8580 - val_sar_accuracy: 0.8019 - val_fus_accuracy: 0.8571 - val_opt_loss: 0.1285 - val_sar_loss: 0.1524 - val_fusion_loss: 0.1348 - val_loss: 0.4157

Epoch 00010: val_loss did not improve from 0.31995

Epoch 11/100

108/108 [=====] - 76s 707ms/step - opt_accuracy: 0.8989 - sar_accuracy: 0.8034 - fus_accuracy: 0.8978 - opt_loss: 0.0524 - sar_loss: 0.1028 - fusion_loss: 0.0524 - loss: 0.2076 - val_opt_accuracy: 0.8561 - val_sar_accuracy: 0.7998 - val_fus_accuracy: 0.8547 - val_opt_loss: 0.1428 - val_sar_loss: 0.1426 - val_fusion_loss: 0.1450 - val_loss: 0.4304

Epoch 00011: val_loss did not improve from 0.31995

Epoch 12/100

108/108 [=====] - 75s 701ms/step - opt_accuracy: 0.8997 - sar_accuracy: 0.8080 - fus_accuracy: 0.8990 - opt_loss: 0.0514 - sar_loss: 0.1004 - fusion_loss: 0.0512 - loss: 0.2030 - val_opt_accuracy: 0.8493 - val_sar_accuracy: 0.8020 - val_fus_accuracy: 0.8495 - val_opt_loss: 0.1457 - val_sar_loss: 0.1363 - val_fusion_loss: 0.1470 - val_loss: 0.4290

Epoch 00012: val_loss did not improve from 0.31995

Epoch 00012: early stopping

time: 20

Model: "model_3_21"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |

Total params: 1,406,327

Trainable params: 1,406,313

Non-trainable params: 14

Epoch 1/100

108/108 [=====] - 76s 667ms/step - opt_accuracy: 0.8370 - sar_accuracy: 0.7288 - fus_accuracy: 0.8264 - opt_loss: 0.0968 - sar_loss: 0.1421 - fusion_loss: 0.1054 - loss: 0.3443 - val_opt_accuracy: 0.8365 - val_sar_accuracy: 0.7576 - val_fus_accuracy: 0.8330 - val_opt_loss: 0.1099 - val_sar_loss: 0.1205 - val_fusion_loss: 0.1096 - val_loss: 0.3400

Epoch 00001: val_loss improved from inf to 0.33998, saving model to imgs/experiment

s/exp2/models\unet_20.h5

Epoch 2/100

108/108 [=====] - 74s 690ms/step - opt_accuracy: 0.8710 - sar_accuracy: 0.7524 - fus_accuracy: 0.8622 - opt_loss: 0.0757 - sar_loss: 0.1296 - fusion_loss: 0.0793 - loss: 0.2846 - val_opt_accuracy: 0.8467 - val_sar_accuracy: 0.7733 - val_fus_accuracy: 0.8453 - val_opt_loss: 0.1224 - val_sar_loss: 0.1216 - val_fusion_loss: 0.1208 - val_loss: 0.3649

Epoch 00002: val_loss did not improve from 0.33998

Epoch 3/100

108/108 [=====] - 74s 690ms/step - opt_accuracy: 0.8822 - sar_accuracy: 0.7372 - fus_accuracy: 0.8776 - opt_loss: 0.0676 - sar_loss: 0.1368 - fusion_loss: 0.0694 - loss: 0.2738 - val_opt_accuracy: 0.8559 - val_sar_accuracy: 0.7348 - val_fus_accuracy: 0.8544 - val_opt_loss: 0.1104 - val_sar_loss: 0.1271 - val_fusion_loss: 0.1065 - val_loss: 0.3440

Epoch 00003: val_loss did not improve from 0.33998

Epoch 4/100

108/108 [=====] - 75s 701ms/step - opt_accuracy: 0.8879 - sar_accuracy: 0.7294 - fus_accuracy: 0.8858 - opt_loss: 0.0628 - sar_loss: 0.1393 - fusion_loss: 0.0634 - loss: 0.2656 - val_opt_accuracy: 0.8531 - val_sar_accuracy: 0.7351 - val_fus_accuracy: 0.8521 - val_opt_loss: 0.1211 - val_sar_loss: 0.1253 - val_fusion_loss: 0.1182 - val_loss: 0.3645

Epoch 00004: val_loss did not improve from 0.33998

Epoch 5/100

108/108 [=====] - 75s 696ms/step - opt_accuracy: 0.8891 - sar_accuracy: 0.7311 - fus_accuracy: 0.8880 - opt_loss: 0.0608 - sar_loss: 0.1407 - fusion_loss: 0.0612 - loss: 0.2627 - val_opt_accuracy: 0.8585 - val_sar_accuracy: 0.7417 - val_fus_accuracy: 0.8581 - val_opt_loss: 0.1159 - val_sar_loss: 0.1231 - val_fusion_loss: 0.1146 - val_loss: 0.3535

Epoch 00005: val_loss did not improve from 0.33998

Epoch 6/100

108/108 [=====] - 73s 680ms/step - opt_accuracy: 0.8967 - sar_accuracy: 0.7352 - fus_accuracy: 0.8955 - opt_loss: 0.0555 - sar_loss: 0.1390 - fusion_loss: 0.0558 - loss: 0.2503 - val_opt_accuracy: 0.8622 - val_sar_accuracy: 0.7462 - val_fus_accuracy: 0.8612 - val_opt_loss: 0.1289 - val_sar_loss: 0.1223 - val_fusion_loss: 0.1278 - val_loss: 0.3790

Epoch 00006: val_loss did not improve from 0.33998

Epoch 7/100

108/108 [=====] - 74s 691ms/step - opt_accuracy: 0.8981 - sar_accuracy: 0.7374 - fus_accuracy: 0.8976 - opt_loss: 0.0541 - sar_loss: 0.1384 - fusion_loss: 0.0543 - loss: 0.2467 - val_opt_accuracy: 0.8526 - val_sar_accuracy: 0.7497 - val_fus_accuracy: 0.8522 - val_opt_loss: 0.1460 - val_sar_loss: 0.1211 - val_fusion_loss: 0.1457 - val_loss: 0.4127

Epoch 00007: val_loss did not improve from 0.33998

Epoch 8/100

108/108 [=====] - 72s 673ms/step - opt_accuracy: 0.9003 - sar_accuracy: 0.7392 - fus_accuracy: 0.9001 - opt_loss: 0.0516 - sar_loss: 0.1379 - fusion_loss: 0.0518 - loss: 0.2413 - val_opt_accuracy: 0.8534 - val_sar_accuracy: 0.7509 - val_fus_accuracy: 0.8529 - val_opt_loss: 0.1506 - val_sar_loss: 0.1201 - val_fusion_loss: 0.1503 - val_loss: 0.4210

Epoch 00008: val_loss did not improve from 0.33998

Epoch 9/100

108/108 [=====] - 78s 723ms/step - opt_accuracy: 0.9054 - sar_accuracy: 0.7408 - fus_accuracy: 0.9052 - opt_loss: 0.0473 - sar_loss: 0.1378 - fusion_loss: 0.0475 - loss: 0.2325 - val_opt_accuracy: 0.8632 - val_sar_accuracy: 0.7517 - val_fus_accuracy: 0.8635 - val_opt_loss: 0.1445 - val_sar_loss: 0.1211 - val_fusion_loss: 0.1439 - val_loss: 0.4096

Epoch 00009: val_loss did not improve from 0.33998

Epoch 10/100

108/108 [=====] - 77s 720ms/step - opt_accuracy: 0.9088 - sar_accuracy: 0.7414 - fus_accuracy: 0.9088 - opt_loss: 0.0451 - sar_loss: 0.1385 - fusion_loss: 0.0452 - loss: 0.2287 - val_opt_accuracy: 0.8557 - val_sar_accuracy: 0.7519 - val_fus_accuracy: 0.8553 - val_opt_loss: 0.1527 - val_sar_loss: 0.1200 - val_fusion_loss: 0.1526 - val_loss: 0.4252

Epoch 00010: val_loss did not improve from 0.33998

Epoch 11/100

108/108 [=====] - 79s 732ms/step - opt_accuracy: 0.9114 - sar_accuracy: 0.7428 - fus_accuracy: 0.9113 - opt_loss: 0.0426 - sar_loss: 0.1378 - fusion_loss: 0.0426 - loss: 0.2230 - val_opt_accuracy: 0.8565 - val_sar_accuracy: 0.7541 - val_fus_accuracy: 0.8558 - val_opt_loss: 0.1503 - val_sar_loss: 0.1165 - val_fusion_loss: 0.1501 - val_loss: 0.4169

Epoch 00011: val_loss did not improve from 0.33998

Epoch 00011: early stopping

time: 21

Model: "model_3_22"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |

Total params: 1,406,327

Trainable params: 1,406,313

Non-trainable params: 14

Epoch 1/100

108/108 [=====] - 97s 870ms/step - opt_accuracy: 0.8253 - sar_accuracy: 0.7386 - fus_accuracy: 0.8033 - opt_loss: 0.0992 - sar_loss: 0.1413 - fusion_loss: 0.1071 - loss: 0.3475 - val_opt_accuracy: 0.8338 - val_sar_accuracy: 0.7635 - val_fus_accuracy: 0.8237 - val_opt_loss: 0.1068 - val_sar_loss: 0.1212 - val_fusion_loss: 0.1082 - val_loss: 0.3363

Epoch 00001: val_loss improved from inf to 0.33625, saving model to imgs/experiments/exp2/models/unet_21.h5

Epoch 2/100

108/108 [=====] - 80s 748ms/step - opt_accuracy: 0.8650 - sar_accuracy: 0.7633 - fus_accuracy: 0.8585 - opt_loss: 0.0772 - sar_loss: 0.1317 - fusion_loss: 0.0793 - loss: 0.2882 - val_opt_accuracy: 0.8440 - val_sar_accuracy: 0.7870 - val_fus_accuracy: 0.8364 - val_opt_loss: 0.1071 - val_sar_loss: 0.1226 - val_fusion_loss: 0.1116 - val_loss: 0.3413

Epoch 00002: val_loss did not improve from 0.33625

Epoch 3/100

108/108 [=====] - 82s 763ms/step - opt_accuracy: 0.8792 - sar_accuracy: 0.7613 - fus_accuracy: 0.8736 - opt_loss: 0.0694 - sar_loss: 0.1310 - fusion_loss: 0.0709 - loss: 0.2713 - val_opt_accuracy: 0.8577 - val_sar_accuracy: 0.7729 - val_fus_accuracy: 0.8524 - val_opt_loss: 0.1194 - val_sar_loss: 0.1240 - val_fusion_loss: 0.1200 - val_loss: 0.3634

Epoch 00003: val_loss did not improve from 0.33625

Epoch 4/100

108/108 [=====] - 83s 776ms/step - opt_accuracy: 0.8850 - s

ar_accuracy: 0.7672 - fus_accuracy: 0.8813 - opt_loss: 0.0660 - sar_loss: 0.1286 - fusion_loss: 0.0673 - loss: 0.2619 - val_opt_accuracy: 0.8538 - val_sar_accuracy: 0.7838 - val_fus_accuracy: 0.8502 - val_opt_loss: 0.1224 - val_sar_loss: 0.1261 - val_fusion_loss: 0.1262 - val_loss: 0.3747

Epoch 00004: val_loss did not improve from 0.33625

Epoch 5/100

108/108 [=====] - 87s 808ms/step - opt_accuracy: 0.8894 - sar_accuracy: 0.7690 - fus_accuracy: 0.8854 - opt_loss: 0.0631 - sar_loss: 0.1266 - fusion_loss: 0.0642 - loss: 0.2540 - val_opt_accuracy: 0.8478 - val_sar_accuracy: 0.7840 - val_fus_accuracy: 0.8439 - val_opt_loss: 0.1303 - val_sar_loss: 0.1278 - val_fusion_loss: 0.1330 - val_loss: 0.3911

Epoch 00005: val_loss did not improve from 0.33625

Epoch 6/100

108/108 [=====] - 83s 777ms/step - opt_accuracy: 0.8926 - sar_accuracy: 0.7785 - fus_accuracy: 0.8901 - opt_loss: 0.0603 - sar_loss: 0.1205 - fusion_loss: 0.0611 - loss: 0.2418 - val_opt_accuracy: 0.8573 - val_sar_accuracy: 0.7935 - val_fus_accuracy: 0.8534 - val_opt_loss: 0.1345 - val_sar_loss: 0.1400 - val_fusion_loss: 0.1382 - val_loss: 0.4127

Epoch 00006: val_loss did not improve from 0.33625

Epoch 7/100

108/108 [=====] - 91s 843ms/step - opt_accuracy: 0.8933 - sar_accuracy: 0.7736 - fus_accuracy: 0.8910 - opt_loss: 0.0594 - sar_loss: 0.1220 - fusion_loss: 0.0600 - loss: 0.2414 - val_opt_accuracy: 0.8590 - val_sar_accuracy: 0.7874 - val_fus_accuracy: 0.8566 - val_opt_loss: 0.1212 - val_sar_loss: 0.1259 - val_fusion_loss: 0.1240 - val_loss: 0.3711

Epoch 00007: val_loss did not improve from 0.33625

Epoch 8/100

108/108 [=====] - 88s 822ms/step - opt_accuracy: 0.8973 - sar_accuracy: 0.7644 - fus_accuracy: 0.8958 - opt_loss: 0.0562 - sar_loss: 0.1272 - fusion_loss: 0.0568 - loss: 0.2402 - val_opt_accuracy: 0.8540 - val_sar_accuracy: 0.7785 - val_fus_accuracy: 0.8525 - val_opt_loss: 0.1424 - val_sar_loss: 0.1448 - val_fusion_loss: 0.1464 - val_loss: 0.4335

Epoch 00008: val_loss did not improve from 0.33625

Epoch 9/100

108/108 [=====] - 88s 822ms/step - opt_accuracy: 0.8958 - sar_accuracy: 0.7688 - fus_accuracy: 0.8945 - opt_loss: 0.0578 - sar_loss: 0.1250 - fusion_loss: 0.0581 - loss: 0.2410 - val_opt_accuracy: 0.8592 - val_sar_accuracy: 0.7743 - val_fus_accuracy: 0.8579 - val_opt_loss: 0.1293 - val_sar_loss: 0.1451 - val_fusion_loss: 0.1347 - val_loss: 0.4091

Epoch 00009: val_loss did not improve from 0.33625

Epoch 10/100

108/108 [=====] - 87s 812ms/step - opt_accuracy: 0.9012 - sar_accuracy: 0.7862 - fus_accuracy: 0.9003 - opt_loss: 0.0518 - sar_loss: 0.1161 - fusion_loss: 0.0521 - loss: 0.2201 - val_opt_accuracy: 0.8632 - val_sar_accuracy: 0.8029 - val_fus_accuracy: 0.8623 - val_opt_loss: 0.1289 - val_sar_loss: 0.1408 - val_fusion_loss: 0.1341 - val_loss: 0.4037

Epoch 00010: val_loss did not improve from 0.33625

Epoch 11/100

108/108 [=====] - 87s 815ms/step - opt_accuracy: 0.9045 - sar_accuracy: 0.7906 - fus_accuracy: 0.9037 - opt_loss: 0.0490 - sar_loss: 0.1144 - fusion_loss: 0.0493 - loss: 0.2127 - val_opt_accuracy: 0.8572 - val_sar_accuracy: 0.8080 - val_fus_accuracy: 0.8562 - val_opt_loss: 0.1202 - val_sar_loss: 0.1369 - val_fusion_loss: 0.1257 - val_loss: 0.3828

Epoch 00011: val_loss did not improve from 0.33625

Epoch 00011: early stopping

time: 22

Model: "model_3_23"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| Total params: 1,406,327 | | |
| Trainable params: 1,406,313 | | |
| Non-trainable params: 14 | | |

Epoch 1/100

108/108 [=====] - 94s 838ms/step - opt_accuracy: 0.8261 - sar_accuracy: 0.7369 - fus_accuracy: 0.8220 - opt_loss: 0.0976 - sar_loss: 0.1421 - fusion_loss: 0.1026 - loss: 0.3422 - val_opt_accuracy: 0.8350 - val_sar_accuracy: 0.7587 - val_fus_accuracy: 0.8370 - val_opt_loss: 0.1165 - val_sar_loss: 0.1230 - val_fusion_loss: 0.1114 - val_loss: 0.3509

Epoch 00001: val_loss improved from inf to 0.35093, saving model to imgs/experiments/exp2/models/unet_22.h5

Epoch 2/100

108/108 [=====] - 89s 829ms/step - opt_accuracy: 0.8688 - sar_accuracy: 0.7623 - fus_accuracy: 0.8648 - opt_loss: 0.0776 - sar_loss: 0.1289 - fusion_loss: 0.0795 - loss: 0.2859 - val_opt_accuracy: 0.8413 - val_sar_accuracy: 0.7562 - val_fus_accuracy: 0.8381 - val_opt_loss: 0.1212 - val_sar_loss: 0.1236 - val_fusion_loss: 0.1164 - val_loss: 0.3612

Epoch 00002: val_loss did not improve from 0.35093

Epoch 3/100

108/108 [=====] - 88s 823ms/step - opt_accuracy: 0.8804 - sar_accuracy: 0.7781 - fus_accuracy: 0.8766 - opt_loss: 0.0717 - sar_loss: 0.1234 - fusion_loss: 0.0732 - loss: 0.2682 - val_opt_accuracy: 0.8510 - val_sar_accuracy: 0.7986 - val_fus_accuracy: 0.8493 - val_opt_loss: 0.1224 - val_sar_loss: 0.1261 - val_fusion_loss: 0.1194 - val_loss: 0.3679

Epoch 00003: val_loss did not improve from 0.35093

Epoch 4/100

108/108 [=====] - 89s 830ms/step - opt_accuracy: 0.8852 - sar_accuracy: 0.7868 - fus_accuracy: 0.8826 - opt_loss: 0.0661 - sar_loss: 0.1178 - fusion_loss: 0.0674 - loss: 0.2513 - val_opt_accuracy: 0.8560 - val_sar_accuracy: 0.7845 - val_fus_accuracy: 0.8560 - val_opt_loss: 0.1207 - val_sar_loss: 0.1205 - val_fusion_loss: 0.1157 - val_loss: 0.3569

Epoch 00004: val_loss did not improve from 0.35093

Epoch 5/100

108/108 [=====] - 91s 852ms/step - opt_accuracy: 0.8880 - sar_accuracy: 0.7835 - fus_accuracy: 0.8858 - opt_loss: 0.0638 - sar_loss: 0.1173 - fusion_loss: 0.0647 - loss: 0.2458 - val_opt_accuracy: 0.8524 - val_sar_accuracy: 0.7805 - val_fus_accuracy: 0.8518 - val_opt_loss: 0.1624 - val_sar_loss: 0.1249 - val_fusion_loss: 0.1540 - val_loss: 0.4414

Epoch 00005: val_loss did not improve from 0.35093

Epoch 6/100

108/108 [=====] - 93s 864ms/step - opt_accuracy: 0.8939 - sar_accuracy: 0.7946 - fus_accuracy: 0.8916 - opt_loss: 0.0592 - sar_loss: 0.1115 - fusion_loss: 0.0603 - loss: 0.2310 - val_opt_accuracy: 0.8571 - val_sar_accuracy: 0.8019 - val_fus_accuracy: 0.8535 - val_opt_loss: 0.1321 - val_sar_loss: 0.1453 - val_fusion_loss: 0.1540 - val_loss: 0.4414

usion_loss: 0.1352 - val_loss: 0.4126

Epoch 00006: val_loss did not improve from 0.35093

Epoch 7/100

108/108 [=====] - 93s 869ms/step - opt_accuracy: 0.8957 - sar_accuracy: 0.7944 - fus_accuracy: 0.8933 - opt_loss: 0.0574 - sar_loss: 0.1105 - fusion_loss: 0.0584 - loss: 0.2263 - val_opt_accuracy: 0.8604 - val_sar_accuracy: 0.8004 - val_fus_accuracy: 0.8571 - val_opt_loss: 0.1482 - val_sar_loss: 0.1404 - val_fusion_loss: 0.1463 - val_loss: 0.4349

Epoch 00007: val_loss did not improve from 0.35093

Epoch 8/100

108/108 [=====] - 98s 914ms/step - opt_accuracy: 0.8990 - sar_accuracy: 0.7868 - fus_accuracy: 0.8965 - opt_loss: 0.0546 - sar_loss: 0.1158 - fusion_loss: 0.0556 - loss: 0.2261 - val_opt_accuracy: 0.8583 - val_sar_accuracy: 0.7977 - val_fus_accuracy: 0.8561 - val_opt_loss: 0.1317 - val_sar_loss: 0.1167 - val_fusion_loss: 0.1278 - val_loss: 0.3762

Epoch 00008: val_loss did not improve from 0.35093

Epoch 9/100

108/108 [=====] - 91s 852ms/step - opt_accuracy: 0.9023 - sar_accuracy: 0.7707 - fus_accuracy: 0.9005 - opt_loss: 0.0520 - sar_loss: 0.1240 - fusion_loss: 0.0527 - loss: 0.2287 - val_opt_accuracy: 0.8602 - val_sar_accuracy: 0.7923 - val_fus_accuracy: 0.8580 - val_opt_loss: 0.1673 - val_sar_loss: 0.1301 - val_fusion_loss: 0.1672 - val_loss: 0.4646

Epoch 00009: val_loss did not improve from 0.35093

Epoch 10/100

108/108 [=====] - 96s 892ms/step - opt_accuracy: 0.9064 - sar_accuracy: 0.7806 - fus_accuracy: 0.9050 - opt_loss: 0.0488 - sar_loss: 0.1199 - fusion_loss: 0.0494 - loss: 0.2180 - val_opt_accuracy: 0.8601 - val_sar_accuracy: 0.7760 - val_fus_accuracy: 0.8592 - val_opt_loss: 0.1707 - val_sar_loss: 0.1277 - val_fusion_loss: 0.1699 - val_loss: 0.4682

Epoch 00010: val_loss did not improve from 0.35093

Epoch 11/100

108/108 [=====] - 94s 879ms/step - opt_accuracy: 0.9095 - sar_accuracy: 0.7783 - fus_accuracy: 0.9084 - opt_loss: 0.0461 - sar_loss: 0.1203 - fusion_loss: 0.0466 - loss: 0.2130 - val_opt_accuracy: 0.8610 - val_sar_accuracy: 0.7766 - val_fus_accuracy: 0.8599 - val_opt_loss: 0.1419 - val_sar_loss: 0.1321 - val_fusion_loss: 0.1423 - val_loss: 0.4164

Epoch 00011: val_loss did not improve from 0.35093

Epoch 00011: early stopping

time: 23

Model: "model_3_24"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |
| Total params: 1,406,327 | | |
| Trainable params: 1,406,313 | | |
| Non-trainable params: 14 | | |

Epoch 1/100

108/108 [=====] - 102s 903ms/step - opt_accuracy: 0.8326 - sar_accuracy: 0.7305 - fus_accuracy: 0.8094 - opt_loss: 0.0981 - sar_loss: 0.1430 - fusion_loss: 0.1070 - loss: 0.3481 - val_opt_accuracy: 0.8460 - val_sar_accuracy: 0.7648 - val_fus_accuracy: 0.8283 - val_opt_loss: 0.1013 - val_sar_loss: 0.1225 - val_fusion_loss: 0.1064 - val_loss: 0.3303

Epoch 00001: val_loss improved from inf to 0.33029, saving model to imgs/experiments/exp2/models/unet_23.h5

Epoch 2/100

108/108 [=====] - 96s 890ms/step - opt_accuracy: 0.8679 - sar_accuracy: 0.7607 - fus_accuracy: 0.8581 - opt_loss: 0.0792 - sar_loss: 0.1271 - fusion_loss: 0.0820 - loss: 0.2883 - val_opt_accuracy: 0.8480 - val_sar_accuracy: 0.7605 - val_fus_accuracy: 0.8455 - val_opt_loss: 0.1233 - val_sar_loss: 0.1244 - val_fusion_loss: 0.1170 - val_loss: 0.3648

Epoch 00002: val_loss did not improve from 0.33029

Epoch 3/100

108/108 [=====] - 116s 1s/step - opt_accuracy: 0.8795 - sar_accuracy: 0.7720 - fus_accuracy: 0.8741 - opt_loss: 0.0710 - sar_loss: 0.1214 - fusion_loss: 0.0728 - loss: 0.2652 - val_opt_accuracy: 0.8473 - val_sar_accuracy: 0.7861 - val_fus_accuracy: 0.8460 - val_opt_loss: 0.1350 - val_sar_loss: 0.1304 - val_fusion_loss: 0.1347 - val_loss: 0.4001

Epoch 00003: val_loss did not improve from 0.33029

Epoch 4/100

108/108 [=====] - 97s 904ms/step - opt_accuracy: 0.8868 - sar_accuracy: 0.7802 - fus_accuracy: 0.8823 - opt_loss: 0.0649 - sar_loss: 0.1169 - fusion_loss: 0.0663 - loss: 0.2480 - val_opt_accuracy: 0.8412 - val_sar_accuracy: 0.7886 - val_fus_accuracy: 0.8415 - val_opt_loss: 0.1362 - val_sar_loss: 0.1357 - val_fusion_loss: 0.1371 - val_loss: 0.4091

Epoch 00004: val_loss did not improve from 0.33029

Epoch 5/100

108/108 [=====] - 99s 925ms/step - opt_accuracy: 0.8907 - sar_accuracy: 0.7906 - fus_accuracy: 0.8881 - opt_loss: 0.0613 - sar_loss: 0.1101 - fusion_loss: 0.0618 - loss: 0.2332 - val_opt_accuracy: 0.8511 - val_sar_accuracy: 0.7889 - val_fus_accuracy: 0.8516 - val_opt_loss: 0.1215 - val_sar_loss: 0.1423 - val_fusion_loss: 0.1241 - val_loss: 0.3879

Epoch 00005: val_loss did not improve from 0.33029

Epoch 6/100

108/108 [=====] - 97s 902ms/step - opt_accuracy: 0.8965 - sar_accuracy: 0.7948 - fus_accuracy: 0.8949 - opt_loss: 0.0561 - sar_loss: 0.1089 - fusion_loss: 0.0564 - loss: 0.2214 - val_opt_accuracy: 0.8416 - val_sar_accuracy: 0.8049 - val_fus_accuracy: 0.8437 - val_opt_loss: 0.1399 - val_sar_loss: 0.1703 - val_fusion_loss: 0.1506 - val_loss: 0.4608

Epoch 00006: val_loss did not improve from 0.33029

Epoch 7/100

108/108 [=====] - 108s 1s/step - opt_accuracy: 0.8991 - sar_accuracy: 0.8004 - fus_accuracy: 0.8979 - opt_loss: 0.0530 - sar_loss: 0.1062 - fusion_loss: 0.0530 - loss: 0.2122 - val_opt_accuracy: 0.8558 - val_sar_accuracy: 0.7551 - val_fus_accuracy: 0.8537 - val_opt_loss: 0.1308 - val_sar_loss: 0.1419 - val_fusion_loss: 0.1296 - val_loss: 0.4022

Epoch 00007: val_loss did not improve from 0.33029

Epoch 8/100

108/108 [=====] - 101s 943ms/step - opt_accuracy: 0.9005 - sar_accuracy: 0.8019 - fus_accuracy: 0.8996 - opt_loss: 0.0515 - sar_loss: 0.1045 - fusion_loss: 0.0513 - loss: 0.2073 - val_opt_accuracy: 0.8533 - val_sar_accuracy: 0.8056 - val_fus_accuracy: 0.8531 - val_opt_loss: 0.1527 - val_sar_loss: 0.1430 - val_fusion_loss: 0.1557 - val_loss: 0.4514

Epoch 00008: val_loss did not improve from 0.33029

Epoch 9/100

108/108 [=====] - 101s 940ms/step - opt_accuracy: 0.9037 - sar_accuracy: 0.8047 - fus_accuracy: 0.9031 - opt_loss: 0.0485 - sar_loss: 0.1034 - fusion_loss: 0.0481 - loss: 0.2000 - val_opt_accuracy: 0.8525 - val_sar_accuracy: 0.8079 - val_fus_accuracy: 0.8530 - val_opt_loss: 0.1581 - val_sar_loss: 0.1746 - val_fusion_loss: 0.1666 - val_loss: 0.4993

Epoch 00009: val_loss did not improve from 0.33029

Epoch 10/100

108/108 [=====] - 101s 943ms/step - opt_accuracy: 0.9097 - sar_accuracy: 0.8157 - fus_accuracy: 0.9090 - opt_loss: 0.0442 - sar_loss: 0.0963 - fusion_loss: 0.0438 - loss: 0.1843 - val_opt_accuracy: 0.8558 - val_sar_accuracy: 0.8022 - val_fus_accuracy: 0.8555 - val_opt_loss: 0.1331 - val_sar_loss: 0.1476 - val_fusion_loss: 0.1384 - val_loss: 0.4191

Epoch 00010: val_loss did not improve from 0.33029

Epoch 11/100

108/108 [=====] - 99s 923ms/step - opt_accuracy: 0.9052 - sar_accuracy: 0.8106 - fus_accuracy: 0.9049 - opt_loss: 0.0467 - sar_loss: 0.1001 - fusion_loss: 0.0460 - loss: 0.1927 - val_opt_accuracy: 0.8555 - val_sar_accuracy: 0.8081 - val_fus_accuracy: 0.8550 - val_opt_loss: 0.1290 - val_sar_loss: 0.1464 - val_fusion_loss: 0.1352 - val_loss: 0.4106

Epoch 00011: val_loss did not improve from 0.33029

Epoch 00011: early stopping

time: 24

Model: "model_3_25"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |
| Total params: 1,406,327 | | |
| Trainable params: 1,406,313 | | |
| Non-trainable params: 14 | | |

Epoch 1/100

108/108 [=====] - 110s 988ms/step - opt_accuracy: 0.8409 - sar_accuracy: 0.7436 - fus_accuracy: 0.8241 - opt_loss: 0.0978 - sar_loss: 0.1392 - fusion_loss: 0.1023 - loss: 0.3394 - val_opt_accuracy: 0.8478 - val_sar_accuracy: 0.7674 - val_fus_accuracy: 0.8409 - val_opt_loss: 0.0992 - val_sar_loss: 0.1208 - val_fusion_loss: 0.0991 - val_loss: 0.3191

Epoch 00001: val_loss improved from inf to 0.31907, saving model to imgs/experiments/exp2/models/unet_24.h5

Epoch 2/100

108/108 [=====] - 102s 949ms/step - opt_accuracy: 0.8717 - sar_accuracy: 0.7618 - fus_accuracy: 0.8667 - opt_loss: 0.0774 - sar_loss: 0.1307 - fusion_loss: 0.0796 - loss: 0.2877 - val_opt_accuracy: 0.8382 - val_sar_accuracy: 0.7668 - val_fus_accuracy: 0.8317 - val_opt_loss: 0.1188 - val_sar_loss: 0.1246 - val_fusion_loss: 0.1156 - val_loss: 0.3591

Epoch 00002: val_loss did not improve from 0.31907

Epoch 3/100

108/108 [=====] - 103s 956ms/step - opt_accuracy: 0.8819 -

sar_accuracy: 0.7803 - fus_accuracy: 0.8782 - opt_loss: 0.0691 - sar_loss: 0.1203 - fusion_loss: 0.0706 - loss: 0.2600 - val_opt_accuracy: 0.8393 - val_sar_accuracy: 0.7920 - val_fus_accuracy: 0.8388 - val_opt_loss: 0.1366 - val_sar_loss: 0.1218 - val_fusion_loss: 0.1324 - val_loss: 0.3908

Epoch 00003: val_loss did not improve from 0.31907

Epoch 4/100

108/108 [=====] - 102s 946ms/step - opt_accuracy: 0.8879 - sar_accuracy: 0.7848 - fus_accuracy: 0.8857 - opt_loss: 0.0651 - sar_loss: 0.1176 - fusion_loss: 0.0659 - loss: 0.2486 - val_opt_accuracy: 0.8481 - val_sar_accuracy: 0.7965 - val_fus_accuracy: 0.8475 - val_opt_loss: 0.1045 - val_sar_loss: 0.1180 - val_fusion_loss: 0.1050 - val_loss: 0.3276

Epoch 00004: val_loss did not improve from 0.31907

Epoch 5/100

108/108 [=====] - 102s 947ms/step - opt_accuracy: 0.8920 - sar_accuracy: 0.7869 - fus_accuracy: 0.8905 - opt_loss: 0.0617 - sar_loss: 0.1146 - fusion_loss: 0.0622 - loss: 0.2384 - val_opt_accuracy: 0.8616 - val_sar_accuracy: 0.7930 - val_fus_accuracy: 0.8593 - val_opt_loss: 0.1026 - val_sar_loss: 0.1282 - val_fusion_loss: 0.1054 - val_loss: 0.3362

Epoch 00005: val_loss did not improve from 0.31907

Epoch 6/100

108/108 [=====] - 103s 964ms/step - opt_accuracy: 0.8902 - sar_accuracy: 0.7854 - fus_accuracy: 0.8892 - opt_loss: 0.0615 - sar_loss: 0.1149 - fusion_loss: 0.0616 - loss: 0.2380 - val_opt_accuracy: 0.8575 - val_sar_accuracy: 0.8030 - val_fus_accuracy: 0.8573 - val_opt_loss: 0.1053 - val_sar_loss: 0.1299 - val_fusion_loss: 0.1082 - val_loss: 0.3435

Epoch 00006: val_loss did not improve from 0.31907

Epoch 7/100

108/108 [=====] - 107s 994ms/step - opt_accuracy: 0.8970 - sar_accuracy: 0.7964 - fus_accuracy: 0.8961 - opt_loss: 0.0561 - sar_loss: 0.1100 - fusion_loss: 0.0562 - loss: 0.2223 - val_opt_accuracy: 0.8608 - val_sar_accuracy: 0.7945 - val_fus_accuracy: 0.8601 - val_opt_loss: 0.1544 - val_sar_loss: 0.1194 - val_fusion_loss: 0.1534 - val_loss: 0.4272

Epoch 00007: val_loss did not improve from 0.31907

Epoch 8/100

108/108 [=====] - 107s 998ms/step - opt_accuracy: 0.9006 - sar_accuracy: 0.8000 - fus_accuracy: 0.8997 - opt_loss: 0.0528 - sar_loss: 0.1080 - fusion_loss: 0.0528 - loss: 0.2137 - val_opt_accuracy: 0.8578 - val_sar_accuracy: 0.8072 - val_fus_accuracy: 0.8562 - val_opt_loss: 0.1400 - val_sar_loss: 0.1406 - val_fusion_loss: 0.1444 - val_loss: 0.4250

Epoch 00008: val_loss did not improve from 0.31907

Epoch 9/100

108/108 [=====] - 108s 1s/step - opt_accuracy: 0.9050 - sar_accuracy: 0.8020 - fus_accuracy: 0.9040 - opt_loss: 0.0496 - sar_loss: 0.1068 - fusion_loss: 0.0497 - loss: 0.2062 - val_opt_accuracy: 0.8635 - val_sar_accuracy: 0.7887 - val_fus_accuracy: 0.8618 - val_opt_loss: 0.1569 - val_sar_loss: 0.1551 - val_fusion_loss: 0.1625 - val_loss: 0.4745

Epoch 00009: val_loss did not improve from 0.31907

Epoch 10/100

108/108 [=====] - 107s 1000ms/step - opt_accuracy: 0.9069 - sar_accuracy: 0.8051 - fus_accuracy: 0.9060 - opt_loss: 0.0480 - sar_loss: 0.1041 - fusion_loss: 0.0480 - loss: 0.2001 - val_opt_accuracy: 0.8599 - val_sar_accuracy: 0.8012 - val_fus_accuracy: 0.8587 - val_opt_loss: 0.1282 - val_sar_loss: 0.1519 - val_fusion_loss: 0.1352 - val_loss: 0.4152

Epoch 00010: val_loss did not improve from 0.31907

Epoch 11/100

108/108 [=====] - 105s 976ms/step - opt_accuracy: 0.9098 - sar_accuracy: 0.8083 - fus_accuracy: 0.9090 - opt_loss: 0.0456 - sar_loss: 0.1026 -

fusion_loss: 0.0454 - loss: 0.1937 - val_opt_accuracy: 0.8465 - val_sar_accuracy: 0.7915 - val_fus_accuracy: 0.8432 - val_opt_loss: 0.1627 - val_sar_loss: 0.1233 - val_fusion_loss: 0.1631 - val_loss: 0.4491

Epoch 00011: val_loss did not improve from 0.31907

Epoch 00011: early stopping

time: 25

Model: "model_3_26"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |

Total params: 1,406,327

Trainable params: 1,406,313

Non-trainable params: 14

Epoch 1/100

108/108 [=====] - 110s 983ms/step - opt_accuracy: 0.8262 - sar_accuracy: 0.7414 - fus_accuracy: 0.8116 - opt_loss: 0.0995 - sar_loss: 0.1393 - fusion_loss: 0.1079 - loss: 0.3467 - val_opt_accuracy: 0.8384 - val_sar_accuracy: 0.7844 - val_fus_accuracy: 0.8186 - val_opt_loss: 0.1020 - val_sar_loss: 0.1203 - val_fusion_loss: 0.1103 - val_loss: 0.3326

Epoch 00001: val_loss improved from inf to 0.33262, saving model to imgs/experiments/exp2/models/unet_25.h5

Epoch 2/100

108/108 [=====] - 104s 970ms/step - opt_accuracy: 0.8694 - sar_accuracy: 0.7671 - fus_accuracy: 0.8590 - opt_loss: 0.0764 - sar_loss: 0.1285 - fusion_loss: 0.0799 - loss: 0.2848 - val_opt_accuracy: 0.8448 - val_sar_accuracy: 0.7794 - val_fus_accuracy: 0.8392 - val_opt_loss: 0.1432 - val_sar_loss: 0.1229 - val_fusion_loss: 0.1447 - val_loss: 0.4108

Epoch 00002: val_loss did not improve from 0.33262

Epoch 3/100

108/108 [=====] - 102s 949ms/step - opt_accuracy: 0.8824 - sar_accuracy: 0.7883 - fus_accuracy: 0.8755 - opt_loss: 0.0677 - sar_loss: 0.1150 - fusion_loss: 0.0698 - loss: 0.2525 - val_opt_accuracy: 0.8479 - val_sar_accuracy: 0.7977 - val_fus_accuracy: 0.8455 - val_opt_loss: 0.1742 - val_sar_loss: 0.1323 - val_fusion_loss: 0.1727 - val_loss: 0.4791

Epoch 00003: val_loss did not improve from 0.33262

Epoch 4/100

108/108 [=====] - 102s 953ms/step - opt_accuracy: 0.8866 - sar_accuracy: 0.7960 - fus_accuracy: 0.8824 - opt_loss: 0.0648 - sar_loss: 0.1107 - fusion_loss: 0.0659 - loss: 0.2414 - val_opt_accuracy: 0.8505 - val_sar_accuracy: 0.8036 - val_fus_accuracy: 0.8492 - val_opt_loss: 0.1469 - val_sar_loss: 0.1356 - val_fusion_loss: 0.1486 - val_loss: 0.4311

Epoch 00004: val_loss did not improve from 0.33262

Epoch 5/100

108/108 [=====] - 104s 967ms/step - opt_accuracy: 0.8907 - sar_accuracy: 0.8041 - fus_accuracy: 0.8875 - opt_loss: 0.0611 - sar_loss: 0.1060 - fusion_loss: 0.0615 - loss: 0.2286 - val_opt_accuracy: 0.8439 - val_sar_accuracy: 0.7960 - val_fus_accuracy: 0.8422 - val_opt_loss: 0.1529 - val_sar_loss: 0.1340 - val_fusion_loss: 0.1529 - val_loss: 0.4311

fusion_loss: 0.1559 - val_loss: 0.4428

Epoch 00005: val_loss did not improve from 0.33262

Epoch 6/100

108/108 [=====] - 104s 973ms/step - opt_accuracy: 0.8923 - sar_accuracy: 0.8052 - fus_accuracy: 0.8903 - opt_loss: 0.0595 - sar_loss: 0.1055 - fusion_loss: 0.0595 - loss: 0.2245 - val_opt_accuracy: 0.8536 - val_sar_accuracy: 0.8018 - val_fus_accuracy: 0.8500 - val_opt_loss: 0.1465 - val_sar_loss: 0.1330 - val_fusion_loss: 0.1503 - val_loss: 0.4298

Epoch 00006: val_loss did not improve from 0.33262

Epoch 7/100

108/108 [=====] - 104s 966ms/step - opt_accuracy: 0.8953 - sar_accuracy: 0.8055 - fus_accuracy: 0.8932 - opt_loss: 0.0567 - sar_loss: 0.1036 - fusion_loss: 0.0568 - loss: 0.2171 - val_opt_accuracy: 0.8498 - val_sar_accuracy: 0.7976 - val_fus_accuracy: 0.8478 - val_opt_loss: 0.1752 - val_sar_loss: 0.1324 - val_fusion_loss: 0.1777 - val_loss: 0.4853

Epoch 00007: val_loss did not improve from 0.33262

Epoch 8/100

108/108 [=====] - 111s 1s/step - opt_accuracy: 0.8996 - sar_accuracy: 0.8118 - fus_accuracy: 0.8981 - opt_loss: 0.0536 - sar_loss: 0.1005 - fusion_loss: 0.0535 - loss: 0.2077 - val_opt_accuracy: 0.8550 - val_sar_accuracy: 0.8120 - val_fus_accuracy: 0.8539 - val_opt_loss: 0.1526 - val_sar_loss: 0.1572 - val_fusion_loss: 0.1646 - val_loss: 0.4744

Epoch 00008: val_loss did not improve from 0.33262

Epoch 9/100

108/108 [=====] - 104s 967ms/step - opt_accuracy: 0.9003 - sar_accuracy: 0.8154 - fus_accuracy: 0.8994 - opt_loss: 0.0534 - sar_loss: 0.0976 - fusion_loss: 0.0528 - loss: 0.2037 - val_opt_accuracy: 0.8436 - val_sar_accuracy: 0.8027 - val_fus_accuracy: 0.8452 - val_opt_loss: 0.1601 - val_sar_loss: 0.1430 - val_fusion_loss: 0.1625 - val_loss: 0.4657

Epoch 00009: val_loss did not improve from 0.33262

Epoch 10/100

108/108 [=====] - 100s 934ms/step - opt_accuracy: 0.9021 - sar_accuracy: 0.8186 - fus_accuracy: 0.9015 - opt_loss: 0.0511 - sar_loss: 0.0964 - fusion_loss: 0.0504 - loss: 0.1979 - val_opt_accuracy: 0.8598 - val_sar_accuracy: 0.8065 - val_fus_accuracy: 0.8579 - val_opt_loss: 0.1631 - val_sar_loss: 0.1603 - val_fusion_loss: 0.1672 - val_loss: 0.4906

Epoch 00010: val_loss did not improve from 0.33262

Epoch 11/100

108/108 [=====] - 103s 957ms/step - opt_accuracy: 0.9100 - sar_accuracy: 0.8265 - fus_accuracy: 0.9093 - opt_loss: 0.0453 - sar_loss: 0.0902 - fusion_loss: 0.0448 - loss: 0.1803 - val_opt_accuracy: 0.8624 - val_sar_accuracy: 0.8090 - val_fus_accuracy: 0.8607 - val_opt_loss: 0.1336 - val_sar_loss: 0.1466 - val_fusion_loss: 0.1405 - val_loss: 0.4207

Epoch 00011: val_loss did not improve from 0.33262

Epoch 00011: early stopping

time: 26

Model: "model_3_27"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |

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sar_classifier (Classifier)  multiple 195
=====
fus_classifier (Classifier)  multiple 195
=====
Total params: 1,406,327
Trainable params: 1,406,313
Non-trainable params: 14
=====
Epoch 1/100
108/108 [=====] - 107s 959ms/step - opt_accuracy: 0.8228 -
sar_accuracy: 0.7321 - fus_accuracy: 0.7935 - opt_loss: 0.1013 - sar_loss: 0.1431 -
fusion_loss: 0.1109 - loss: 0.3553 - val_opt_accuracy: 0.8418 - val_sar_accuracy: 0.
7684 - val_fus_accuracy: 0.8323 - val_opt_loss: 0.1030 - val_sar_loss: 0.1244 - val_
fusion_loss: 0.1064 - val_loss: 0.3338

Epoch 00001: val_loss improved from inf to 0.33385, saving model to imgs/experiment
s/exp2/models\unet_26.h5
Epoch 2/100
108/108 [=====] - 107s 1s/step - opt_accuracy: 0.8642 - sar
_accuracy: 0.7675 - fus_accuracy: 0.8518 - opt_loss: 0.0784 - sar_loss: 0.1285 - fus
ion_loss: 0.0821 - loss: 0.2890 - val_opt_accuracy: 0.8353 - val_sar_accuracy: 0.787
5 - val_fus_accuracy: 0.8356 - val_opt_loss: 0.1151 - val_sar_loss: 0.1207 - val_fus
ion_loss: 0.1114 - val_loss: 0.3472

Epoch 00002: val_loss did not improve from 0.33385
Epoch 3/100
108/108 [=====] - 114s 1s/step - opt_accuracy: 0.8766 - sar
_accuracy: 0.7780 - fus_accuracy: 0.8694 - opt_loss: 0.0719 - sar_loss: 0.1229 - fus
ion_loss: 0.0738 - loss: 0.2687 - val_opt_accuracy: 0.8425 - val_sar_accuracy: 0.799
1 - val_fus_accuracy: 0.8413 - val_opt_loss: 0.1435 - val_sar_loss: 0.1511 - val_fus
ion_loss: 0.1466 - val_loss: 0.4412

Epoch 00003: val_loss did not improve from 0.33385
Epoch 4/100
108/108 [=====] - 109s 1s/step - opt_accuracy: 0.8811 - sar
_accuracy: 0.7730 - fus_accuracy: 0.8763 - opt_loss: 0.0698 - sar_loss: 0.1256 - fus
ion_loss: 0.0711 - loss: 0.2664 - val_opt_accuracy: 0.8584 - val_sar_accuracy: 0.803
6 - val_fus_accuracy: 0.8554 - val_opt_loss: 0.1071 - val_sar_loss: 0.1249 - val_fus
ion_loss: 0.1098 - val_loss: 0.3417

Epoch 00004: val_loss did not improve from 0.33385
Epoch 5/100
108/108 [=====] - 113s 1s/step - opt_accuracy: 0.8855 - sar
_accuracy: 0.7960 - fus_accuracy: 0.8832 - opt_loss: 0.0665 - sar_loss: 0.1160 - fus
ion_loss: 0.0671 - loss: 0.2496 - val_opt_accuracy: 0.8575 - val_sar_accuracy: 0.801
1 - val_fus_accuracy: 0.8566 - val_opt_loss: 0.1127 - val_sar_loss: 0.1188 - val_fus
ion_loss: 0.1161 - val_loss: 0.3475

Epoch 00005: val_loss did not improve from 0.33385
Epoch 6/100
108/108 [=====] - 109s 1s/step - opt_accuracy: 0.8872 - sar
_accuracy: 0.7977 - fus_accuracy: 0.8863 - opt_loss: 0.0649 - sar_loss: 0.1138 - fus
ion_loss: 0.0650 - loss: 0.2437 - val_opt_accuracy: 0.8601 - val_sar_accuracy: 0.804
5 - val_fus_accuracy: 0.8597 - val_opt_loss: 0.1280 - val_sar_loss: 0.1236 - val_fus
ion_loss: 0.1331 - val_loss: 0.3848

Epoch 00006: val_loss did not improve from 0.33385
Epoch 7/100
108/108 [=====] - 108s 1s/step - opt_accuracy: 0.8901 - sar
_accuracy: 0.8018 - fus_accuracy: 0.8891 - opt_loss: 0.0625 - sar_loss: 0.1113 - fus
ion_loss: 0.0629 - loss: 0.2367 - val_opt_accuracy: 0.8567 - val_sar_accuracy: 0.811
7 - val_fus_accuracy: 0.8565 - val_opt_loss: 0.1291 - val_sar_loss: 0.1327 - val_fus
ion_loss: 0.1367 - val_loss: 0.3985

Epoch 00007: val_loss did not improve from 0.33385

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Epoch 8/100

108/108 [=====] - 128s 1s/step - opt_accuracy: 0.8883 - sar_accuracy: 0.8011 - fus_accuracy: 0.8882 - opt_loss: 0.0614 - sar_loss: 0.1116 - fus_loss: 0.0613 - loss: 0.2343 - val_opt_accuracy: 0.8575 - val_sar_accuracy: 0.8051 - val_fus_accuracy: 0.8572 - val_opt_loss: 0.1240 - val_sar_loss: 0.1304 - val_fus_loss: 0.1281 - val_loss: 0.3825

Epoch 00008: val_loss did not improve from 0.33385

Epoch 9/100

108/108 [=====] - 130s 1s/step - opt_accuracy: 0.8943 - sar_accuracy: 0.8057 - fus_accuracy: 0.8943 - opt_loss: 0.0583 - sar_loss: 0.1083 - fus_loss: 0.0579 - loss: 0.2244 - val_opt_accuracy: 0.8571 - val_sar_accuracy: 0.8082 - val_fus_accuracy: 0.8566 - val_opt_loss: 0.1344 - val_sar_loss: 0.1296 - val_fus_loss: 0.1376 - val_loss: 0.4016

Epoch 00009: val_loss did not improve from 0.33385

Epoch 10/100

108/108 [=====] - 131s 1s/step - opt_accuracy: 0.8958 - sar_accuracy: 0.8047 - fus_accuracy: 0.8956 - opt_loss: 0.0565 - sar_loss: 0.1076 - fus_loss: 0.0559 - loss: 0.2201 - val_opt_accuracy: 0.8601 - val_sar_accuracy: 0.8073 - val_fus_accuracy: 0.8589 - val_opt_loss: 0.1344 - val_sar_loss: 0.1491 - val_fus_loss: 0.1436 - val_loss: 0.4271

Epoch 00010: val_loss did not improve from 0.33385

Epoch 11/100

108/108 [=====] - 119s 1s/step - opt_accuracy: 0.8992 - sar_accuracy: 0.8099 - fus_accuracy: 0.8993 - opt_loss: 0.0539 - sar_loss: 0.1040 - fus_loss: 0.0531 - loss: 0.2110 - val_opt_accuracy: 0.8567 - val_sar_accuracy: 0.8069 - val_fus_accuracy: 0.8564 - val_opt_loss: 0.1281 - val_sar_loss: 0.1337 - val_fus_loss: 0.1333 - val_loss: 0.3952

Epoch 00011: val_loss did not improve from 0.33385

Epoch 00011: early stopping

time: 27

Model: "model_3_28"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |

Total params: 1,406,327

Trainable params: 1,406,313

Non-trainable params: 14

Epoch 1/100

108/108 [=====] - 130s 1s/step - opt_accuracy: 0.8439 - sar_accuracy: 0.7260 - fus_accuracy: 0.8246 - opt_loss: 0.0907 - sar_loss: 0.1415 - fus_loss: 0.0993 - loss: 0.3315 - val_opt_accuracy: 0.8255 - val_sar_accuracy: 0.7374 - val_fus_accuracy: 0.8218 - val_opt_loss: 0.1167 - val_sar_loss: 0.1263 - val_fus_loss: 0.1150 - val_loss: 0.3580

Epoch 00001: val_loss improved from inf to 0.35802, saving model to imgs/experiments/exp2/models/unet_27.h5

Epoch 2/100

108/108 [=====] - 124s 1s/step - opt_accuracy: 0.8735 - sar

_accuracy: 0.7473 - fus_accuracy: 0.8645 - opt_loss: 0.0732 - sar_loss: 0.1316 - fus
ion_loss: 0.0765 - loss: 0.2814 - val_opt_accuracy: 0.8417 - val_sar_accuracy: 0.773
8 - val_fus_accuracy: 0.8365 - val_opt_loss: 0.1166 - val_sar_loss: 0.1210 - val_fus
ion_loss: 0.1189 - val_loss: 0.3565

Epoch 00002: val_loss improved from 0.35802 to 0.35646, saving model to imgs/experim
ents/exp2/models\unet_27.h5

Epoch 3/100

108/108 [=====] - 123s 1s/step - opt_accuracy: 0.8828 - sar
_accuracy: 0.7714 - fus_accuracy: 0.8759 - opt_loss: 0.0677 - sar_loss: 0.1209 - fus
ion_loss: 0.0699 - loss: 0.2585 - val_opt_accuracy: 0.8465 - val_sar_accuracy: 0.780
0 - val_fus_accuracy: 0.8425 - val_opt_loss: 0.1022 - val_sar_loss: 0.1216 - val_fus
ion_loss: 0.1033 - val_loss: 0.3272

Epoch 00003: val_loss improved from 0.35646 to 0.32716, saving model to imgs/experim
ents/exp2/models\unet_27.h5

Epoch 4/100

108/108 [=====] - 123s 1s/step - opt_accuracy: 0.8882 - sar
_accuracy: 0.7797 - fus_accuracy: 0.8830 - opt_loss: 0.0634 - sar_loss: 0.1161 - fus
ion_loss: 0.0650 - loss: 0.2445 - val_opt_accuracy: 0.8476 - val_sar_accuracy: 0.778
4 - val_fus_accuracy: 0.8448 - val_opt_loss: 0.1360 - val_sar_loss: 0.1209 - val_fus
ion_loss: 0.1327 - val_loss: 0.3896

Epoch 00004: val_loss did not improve from 0.32716

Epoch 5/100

108/108 [=====] - 121s 1s/step - opt_accuracy: 0.8934 - sar
_accuracy: 0.7880 - fus_accuracy: 0.8898 - opt_loss: 0.0584 - sar_loss: 0.1132 - fus
ion_loss: 0.0597 - loss: 0.2313 - val_opt_accuracy: 0.8546 - val_sar_accuracy: 0.794
9 - val_fus_accuracy: 0.8522 - val_opt_loss: 0.1425 - val_sar_loss: 0.1370 - val_fus
ion_loss: 0.1427 - val_loss: 0.4221

Epoch 00005: val_loss did not improve from 0.32716

Epoch 6/100

108/108 [=====] - 118s 1s/step - opt_accuracy: 0.8973 - sar
_accuracy: 0.7929 - fus_accuracy: 0.8949 - opt_loss: 0.0552 - sar_loss: 0.1116 - fus
ion_loss: 0.0560 - loss: 0.2229 - val_opt_accuracy: 0.8515 - val_sar_accuracy: 0.794
2 - val_fus_accuracy: 0.8531 - val_opt_loss: 0.1409 - val_sar_loss: 0.1469 - val_fus
ion_loss: 0.1418 - val_loss: 0.4296

Epoch 00006: val_loss did not improve from 0.32716

Epoch 7/100

108/108 [=====] - 122s 1s/step - opt_accuracy: 0.9021 - sar
_accuracy: 0.7938 - fus_accuracy: 0.9003 - opt_loss: 0.0508 - sar_loss: 0.1103 - fus
ion_loss: 0.0514 - loss: 0.2125 - val_opt_accuracy: 0.8560 - val_sar_accuracy: 0.797
8 - val_fus_accuracy: 0.8545 - val_opt_loss: 0.1351 - val_sar_loss: 0.1517 - val_fus
ion_loss: 0.1404 - val_loss: 0.4272

Epoch 00007: val_loss did not improve from 0.32716

Epoch 8/100

108/108 [=====] - 123s 1s/step - opt_accuracy: 0.9041 - sar
_accuracy: 0.7968 - fus_accuracy: 0.9026 - opt_loss: 0.0489 - sar_loss: 0.1091 - fus
ion_loss: 0.0493 - loss: 0.2074 - val_opt_accuracy: 0.8510 - val_sar_accuracy: 0.798
5 - val_fus_accuracy: 0.8513 - val_opt_loss: 0.1493 - val_sar_loss: 0.1421 - val_fus
ion_loss: 0.1503 - val_loss: 0.4417

Epoch 00008: val_loss did not improve from 0.32716

Epoch 9/100

108/108 [=====] - 122s 1s/step - opt_accuracy: 0.9081 - sar
_accuracy: 0.8025 - fus_accuracy: 0.9069 - opt_loss: 0.0462 - sar_loss: 0.1054 - fus
ion_loss: 0.0465 - loss: 0.1981 - val_opt_accuracy: 0.8632 - val_sar_accuracy: 0.795
9 - val_fus_accuracy: 0.8615 - val_opt_loss: 0.1726 - val_sar_loss: 0.1313 - val_fus
ion_loss: 0.1699 - val_loss: 0.4737

Epoch 00009: val_loss did not improve from 0.32716

Epoch 10/100

108/108 [=====] - 123s 1s/step - opt_accuracy: 0.9121 - sar_accuracy: 0.8058 - fus_accuracy: 0.9109 - opt_loss: 0.0437 - sar_loss: 0.1047 - fusion_loss: 0.0440 - loss: 0.1924 - val_opt_accuracy: 0.8647 - val_sar_accuracy: 0.7926 - val_fus_accuracy: 0.8643 - val_opt_loss: 0.1793 - val_sar_loss: 0.1512 - val_fusion_loss: 0.1794 - val_loss: 0.5099

Epoch 00010: val_loss did not improve from 0.32716

Epoch 11/100

108/108 [=====] - 125s 1s/step - opt_accuracy: 0.9136 - sar_accuracy: 0.8082 - fus_accuracy: 0.9127 - opt_loss: 0.0420 - sar_loss: 0.1033 - fusion_loss: 0.0423 - loss: 0.1876 - val_opt_accuracy: 0.8578 - val_sar_accuracy: 0.7937 - val_fus_accuracy: 0.8569 - val_opt_loss: 0.1634 - val_sar_loss: 0.1222 - val_fusion_loss: 0.1609 - val_loss: 0.4465

Epoch 00011: val_loss did not improve from 0.32716

Epoch 12/100

108/108 [=====] - 125s 1s/step - opt_accuracy: 0.9161 - sar_accuracy: 0.8137 - fus_accuracy: 0.9155 - opt_loss: 0.0402 - sar_loss: 0.1005 - fusion_loss: 0.0404 - loss: 0.1811 - val_opt_accuracy: 0.8593 - val_sar_accuracy: 0.8011 - val_fus_accuracy: 0.8581 - val_opt_loss: 0.1710 - val_sar_loss: 0.1556 - val_fusion_loss: 0.1727 - val_loss: 0.4994

Epoch 00012: val_loss did not improve from 0.32716

Epoch 13/100

108/108 [=====] - 128s 1s/step - opt_accuracy: 0.9201 - sar_accuracy: 0.8189 - fus_accuracy: 0.9195 - opt_loss: 0.0373 - sar_loss: 0.0976 - fusion_loss: 0.0375 - loss: 0.1724 - val_opt_accuracy: 0.8600 - val_sar_accuracy: 0.7971 - val_fus_accuracy: 0.8589 - val_opt_loss: 0.1847 - val_sar_loss: 0.1583 - val_fusion_loss: 0.1859 - val_loss: 0.5289

Epoch 00013: val_loss did not improve from 0.32716

Epoch 00013: early stopping

time: 28

Model: "model_3_29"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |
| Total params: 1,406,327 | | |
| Trainable params: 1,406,313 | | |
| Non-trainable params: 14 | | |

Epoch 1/100

108/108 [=====] - 139s 1s/step - opt_accuracy: 0.8424 - sar_accuracy: 0.7352 - fus_accuracy: 0.8144 - opt_loss: 0.0952 - sar_loss: 0.1381 - fusion_loss: 0.1089 - loss: 0.3422 - val_opt_accuracy: 0.8298 - val_sar_accuracy: 0.7371 - val_fus_accuracy: 0.8160 - val_opt_loss: 0.1246 - val_sar_loss: 0.1229 - val_fusion_loss: 0.1254 - val_loss: 0.3730

Epoch 00001: val_loss improved from inf to 0.37297, saving model to imgs/experiments/exp2/models/unet_28.h5

Epoch 2/100

108/108 [=====] - 128s 1s/step - opt_accuracy: 0.8721 - sar_accuracy: 0.7566 - fus_accuracy: 0.8596 - opt_loss: 0.0759 - sar_loss: 0.1298 - fus

ion_loss: 0.0808 - loss: 0.2866 - val_opt_accuracy: 0.8429 - val_sar_accuracy: 0.7819 - val_fus_accuracy: 0.8363 - val_opt_loss: 0.1426 - val_sar_loss: 0.1280 - val_fus_loss: 0.1386 - val_loss: 0.4092

Epoch 00002: val_loss did not improve from 0.37297

Epoch 3/100

108/108 [=====] - 132s 1s/step - opt_accuracy: 0.8796 - sar_accuracy: 0.7698 - fus_accuracy: 0.8711 - opt_loss: 0.0706 - sar_loss: 0.1233 - fus_loss: 0.0738 - loss: 0.2678 - val_opt_accuracy: 0.8420 - val_sar_accuracy: 0.7533 - val_fus_accuracy: 0.8361 - val_opt_loss: 0.1306 - val_sar_loss: 0.1241 - val_fus_loss: 0.1272 - val_loss: 0.3819

Epoch 00003: val_loss did not improve from 0.37297

Epoch 4/100

108/108 [=====] - 131s 1s/step - opt_accuracy: 0.8808 - sar_accuracy: 0.7733 - fus_accuracy: 0.8744 - opt_loss: 0.0688 - sar_loss: 0.1198 - fus_loss: 0.0711 - loss: 0.2596 - val_opt_accuracy: 0.8393 - val_sar_accuracy: 0.7788 - val_fus_accuracy: 0.8345 - val_opt_loss: 0.1566 - val_sar_loss: 0.1302 - val_fus_loss: 0.1527 - val_loss: 0.4395

Epoch 00004: val_loss did not improve from 0.37297

Epoch 5/100

108/108 [=====] - 129s 1s/step - opt_accuracy: 0.8855 - sar_accuracy: 0.7884 - fus_accuracy: 0.8806 - opt_loss: 0.0654 - sar_loss: 0.1139 - fus_loss: 0.0672 - loss: 0.2465 - val_opt_accuracy: 0.8476 - val_sar_accuracy: 0.7985 - val_fus_accuracy: 0.8436 - val_opt_loss: 0.1315 - val_sar_loss: 0.1203 - val_fus_loss: 0.1320 - val_loss: 0.3837

Epoch 00005: val_loss did not improve from 0.37297

Epoch 6/100

108/108 [=====] - 140s 1s/step - opt_accuracy: 0.8902 - sar_accuracy: 0.7945 - fus_accuracy: 0.8861 - opt_loss: 0.0615 - sar_loss: 0.1111 - fus_loss: 0.0627 - loss: 0.2353 - val_opt_accuracy: 0.8549 - val_sar_accuracy: 0.8009 - val_fus_accuracy: 0.8514 - val_opt_loss: 0.1360 - val_sar_loss: 0.1238 - val_fus_loss: 0.1371 - val_loss: 0.3969

Epoch 00006: val_loss did not improve from 0.37297

Epoch 7/100

108/108 [=====] - 131s 1s/step - opt_accuracy: 0.8939 - sar_accuracy: 0.7999 - fus_accuracy: 0.8904 - opt_loss: 0.0584 - sar_loss: 0.1070 - fus_loss: 0.0592 - loss: 0.2245 - val_opt_accuracy: 0.8538 - val_sar_accuracy: 0.8044 - val_fus_accuracy: 0.8497 - val_opt_loss: 0.1620 - val_sar_loss: 0.1488 - val_fus_loss: 0.1680 - val_loss: 0.4789

Epoch 00007: val_loss did not improve from 0.37297

Epoch 8/100

108/108 [=====] - 137s 1s/step - opt_accuracy: 0.8961 - sar_accuracy: 0.8018 - fus_accuracy: 0.8931 - opt_loss: 0.0571 - sar_loss: 0.1050 - fus_loss: 0.0578 - loss: 0.2199 - val_opt_accuracy: 0.8576 - val_sar_accuracy: 0.8067 - val_fus_accuracy: 0.8552 - val_opt_loss: 0.1523 - val_sar_loss: 0.1433 - val_fus_loss: 0.1604 - val_loss: 0.4560

Epoch 00008: val_loss did not improve from 0.37297

Epoch 9/100

108/108 [=====] - 134s 1s/step - opt_accuracy: 0.8985 - sar_accuracy: 0.8106 - fus_accuracy: 0.8959 - opt_loss: 0.0540 - sar_loss: 0.1011 - fus_loss: 0.0548 - loss: 0.2100 - val_opt_accuracy: 0.8582 - val_sar_accuracy: 0.8038 - val_fus_accuracy: 0.8574 - val_opt_loss: 0.1260 - val_sar_loss: 0.1247 - val_fus_loss: 0.1308 - val_loss: 0.3815

Epoch 00009: val_loss did not improve from 0.37297

Epoch 10/100

108/108 [=====] - 137s 1s/step - opt_accuracy: 0.9062 - sar_accuracy: 0.8185 - fus_accuracy: 0.9049 - opt_loss: 0.0480 - sar_loss: 0.0968 - fus_loss: 0.0480 - loss: 0.1928 - val_opt_accuracy: 0.8591 - val_sar_accuracy: 0.808

0 - val_fus_accuracy: 0.8580 - val_opt_loss: 0.1522 - val_sar_loss: 0.1360 - val_fusion_loss: 0.1548 - val_loss: 0.4430

Epoch 00010: val_loss did not improve from 0.37297

Epoch 11/100

108/108 [=====] - 140s 1s/step - opt_accuracy: 0.9088 - sar_accuracy: 0.8175 - fus_accuracy: 0.9076 - opt_loss: 0.0459 - sar_loss: 0.0975 - fusion_loss: 0.0460 - loss: 0.1894 - val_opt_accuracy: 0.8535 - val_sar_accuracy: 0.8020 - val_fus_accuracy: 0.8521 - val_opt_loss: 0.1880 - val_sar_loss: 0.1366 - val_fusion_loss: 0.1890 - val_loss: 0.5136

Epoch 00011: val_loss did not improve from 0.37297

Epoch 00011: early stopping

time: 29

Model: "model_3_30"

| Layer (type) | Output Shape | Param # |
|-----------------------------|--------------|---------|
| ===== | | |
| opt_encoder (UNET_Encoder) | multiple | 537440 |
| sar_encoder (UNET_Encoder) | multiple | 536288 |
| decoder (UNET_Decoder) | multiple | 332000 |
| opt_classifier (Classifier) | multiple | 195 |
| sar_classifier (Classifier) | multiple | 195 |
| fus_classifier (Classifier) | multiple | 195 |
| ===== | | |

Total params: 1,406,327

Trainable params: 1,406,313

Non-trainable params: 14

Epoch 1/100

108/108 [=====] - 141s 1s/step - opt_accuracy: 0.8393 - sar_accuracy: 0.7421 - fus_accuracy: 0.8148 - opt_loss: 0.0949 - sar_loss: 0.1390 - fusion_loss: 0.1070 - loss: 0.3408 - val_opt_accuracy: 0.8318 - val_sar_accuracy: 0.7776 - val_fus_accuracy: 0.8256 - val_opt_loss: 0.1154 - val_sar_loss: 0.1242 - val_fusion_loss: 0.1204 - val_loss: 0.3601

Epoch 00001: val_loss improved from inf to 0.36007, saving model to imgs/experiments/exp2/models/unet_29.h5

Epoch 2/100

108/108 [=====] - 139s 1s/step - opt_accuracy: 0.8713 - sar_accuracy: 0.7778 - fus_accuracy: 0.8613 - opt_loss: 0.0750 - sar_loss: 0.1248 - fusion_loss: 0.0805 - loss: 0.2804 - val_opt_accuracy: 0.8521 - val_sar_accuracy: 0.8011 - val_fus_accuracy: 0.8477 - val_opt_loss: 0.1134 - val_sar_loss: 0.1344 - val_fusion_loss: 0.1265 - val_loss: 0.3743

Epoch 00002: val_loss did not improve from 0.36007

Epoch 3/100

108/108 [=====] - 134s 1s/step - opt_accuracy: 0.8800 - sar_accuracy: 0.7847 - fus_accuracy: 0.8749 - opt_loss: 0.0681 - sar_loss: 0.1214 - fusion_loss: 0.0711 - loss: 0.2606 - val_opt_accuracy: 0.8485 - val_sar_accuracy: 0.7739 - val_fus_accuracy: 0.8487 - val_opt_loss: 0.1224 - val_sar_loss: 0.1516 - val_fusion_loss: 0.1375 - val_loss: 0.4115

Epoch 00003: val_loss did not improve from 0.36007

Epoch 4/100

108/108 [=====] - 132s 1s/step - opt_accuracy: 0.8859 - sar_accuracy: 0.7903 - fus_accuracy: 0.8833 - opt_loss: 0.0634 - sar_loss: 0.1165 - fusion_loss: 0.0654 - loss: 0.2453 - val_opt_accuracy: 0.8497 - val_sar_accuracy: 0.7634 - val_fus_accuracy: 0.8444 - val_opt_loss: 0.1436 - val_sar_loss: 0.1240 - val_fusion_loss: 0.1400 - val_loss: 0.4075

Epoch 00004: val_loss did not improve from 0.36007

Epoch 5/100

108/108 [=====] - 139s 1s/step - opt_accuracy: 0.8888 - sar_accuracy: 0.7829 - fus_accuracy: 0.8865 - opt_loss: 0.0603 - sar_loss: 0.1206 - fus_loss: 0.0618 - loss: 0.2427 - val_opt_accuracy: 0.8565 - val_sar_accuracy: 0.7982 - val_fus_accuracy: 0.8517 - val_opt_loss: 0.1195 - val_sar_loss: 0.1396 - val_fus_loss: 0.1273 - val_loss: 0.3865

Epoch 00005: val_loss did not improve from 0.36007

Epoch 6/100

108/108 [=====] - 139s 1s/step - opt_accuracy: 0.8934 - sar_accuracy: 0.7981 - fus_accuracy: 0.8916 - opt_loss: 0.0567 - sar_loss: 0.1124 - fus_loss: 0.0578 - loss: 0.2268 - val_opt_accuracy: 0.8557 - val_sar_accuracy: 0.8053 - val_fus_accuracy: 0.8539 - val_opt_loss: 0.1380 - val_sar_loss: 0.1612 - val_fus_loss: 0.1499 - val_loss: 0.4491

Epoch 00006: val_loss did not improve from 0.36007

Epoch 7/100

108/108 [=====] - 138s 1s/step - opt_accuracy: 0.8994 - sar_accuracy: 0.8101 - fus_accuracy: 0.8984 - opt_loss: 0.0519 - sar_loss: 0.1059 - fus_loss: 0.0525 - loss: 0.2103 - val_opt_accuracy: 0.8626 - val_sar_accuracy: 0.7937 - val_fus_accuracy: 0.8598 - val_opt_loss: 0.1425 - val_sar_loss: 0.1299 - val_fus_loss: 0.1451 - val_loss: 0.4175

Epoch 00007: val_loss did not improve from 0.36007

Epoch 8/100

108/108 [=====] - 146s 1s/step - opt_accuracy: 0.9031 - sar_accuracy: 0.8022 - fus_accuracy: 0.9021 - opt_loss: 0.0496 - sar_loss: 0.1100 - fus_loss: 0.0501 - loss: 0.2097 - val_opt_accuracy: 0.8604 - val_sar_accuracy: 0.7931 - val_fus_accuracy: 0.8572 - val_opt_loss: 0.1248 - val_sar_loss: 0.1383 - val_fus_loss: 0.1279 - val_loss: 0.3909

Epoch 00008: val_loss did not improve from 0.36007

Epoch 9/100

108/108 [=====] - 144s 1s/step - opt_accuracy: 0.9068 - sar_accuracy: 0.8068 - fus_accuracy: 0.9060 - opt_loss: 0.0461 - sar_loss: 0.1081 - fus_loss: 0.0466 - loss: 0.2008 - val_opt_accuracy: 0.8616 - val_sar_accuracy: 0.7938 - val_fus_accuracy: 0.8597 - val_opt_loss: 0.1342 - val_sar_loss: 0.1172 - val_fus_loss: 0.1330 - val_loss: 0.3844

Epoch 00009: val_loss did not improve from 0.36007

Epoch 10/100

108/108 [=====] - 149s 1s/step - opt_accuracy: 0.9080 - sar_accuracy: 0.8082 - fus_accuracy: 0.9072 - opt_loss: 0.0450 - sar_loss: 0.1071 - fus_loss: 0.0452 - loss: 0.1973 - val_opt_accuracy: 0.8603 - val_sar_accuracy: 0.8001 - val_fus_accuracy: 0.8599 - val_opt_loss: 0.1365 - val_sar_loss: 0.1394 - val_fus_loss: 0.1423 - val_loss: 0.4181

Epoch 00010: val_loss did not improve from 0.36007

Epoch 11/100

108/108 [=====] - 146s 1s/step - opt_accuracy: 0.9121 - sar_accuracy: 0.8143 - fus_accuracy: 0.9117 - opt_loss: 0.0418 - sar_loss: 0.1030 - fus_loss: 0.0420 - loss: 0.1868 - val_opt_accuracy: 0.8541 - val_sar_accuracy: 0.8001 - val_fus_accuracy: 0.8529 - val_opt_loss: 0.1753 - val_sar_loss: 0.1330 - val_fus_loss: 0.1749 - val_loss: 0.4832

Epoch 00011: val_loss did not improve from 0.36007

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)
adam = Adam(lr = 1e-3 , beta_1=0.9)
loss = weighted_categorical_crossentropy(weights)
new_model.compile(optimizer=adam, loss=loss, metrics=['accuracy'], run_eagerly=True)

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)
```

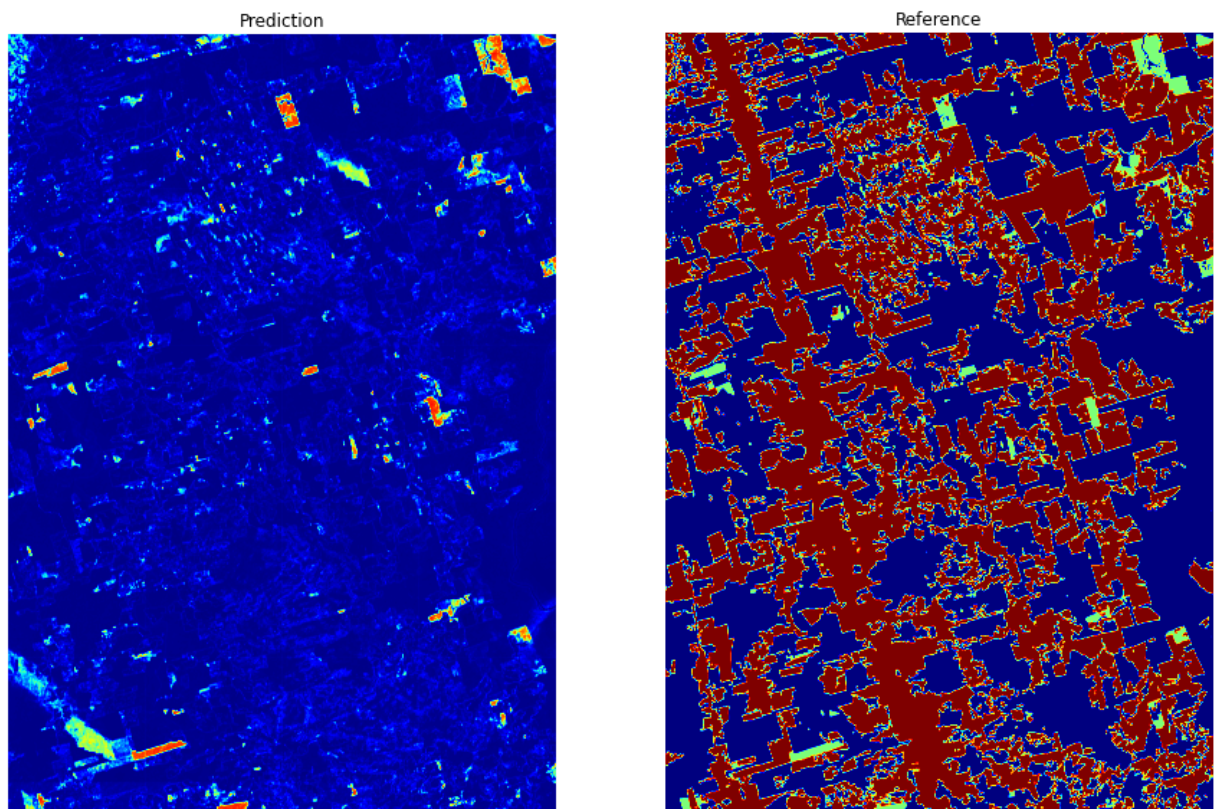
```
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
```

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_)
```

0.9729374786218007

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

```
precision_ = TP/(TP+FP)
0.9530816117111517
D:\Ferrari\proj_1\projeto\utils_unet_resunet.py:200: RuntimeWarning: invalid value encountered in longlong_scalars
precision_ = TP/(TP+FP)
0.9332257448005027
D:\Ferrari\proj_1\projeto\utils_unet_resunet.py:200: RuntimeWarning: invalid value encountered in longlong_scalars
precision_ = TP/(TP+FP)
0.9133698778898537
D:\Ferrari\proj_1\projeto\utils_unet_resunet.py:200: RuntimeWarning: invalid value encountered in longlong_scalars
precision_ = TP/(TP+FP)
0.8935140109792047
D:\Ferrari\proj_1\projeto\utils_unet_resunet.py:200: RuntimeWarning: invalid value encountered in longlong_scalars
precision_ = TP/(TP+FP)
0.8736581440685557
D:\Ferrari\proj_1\projeto\utils_unet_resunet.py:200: RuntimeWarning: invalid value encountered in longlong_scalars
precision_ = TP/(TP+FP)
0.8538022771579067
0.8339464102472578
0.8140905433366088
0.7942346764259598
0.7743788095153108
0.7545229426046618
0.7346670756940128
0.7148112087833638
0.6949553418727148
0.6750994749620658
0.6552436080514168
0.6353877411407678
0.6155318742301188
0.5956760073194698
0.5758201404088208
0.5559642734981718
0.5361084065875228
0.5162525396768738
0.49639667276622484
0.47654080585557584
0.4566849389449269
0.4368290720342779
0.4169732051236289
0.3971173382129799
0.3772614713023309
0.3574056043916819
0.3375497374810329
0.3176938705703839
0.2978380036597349
0.2779821367490859
0.2581262698384369
0.2382704029277879
0.2184145360171389
0.1985586691064899
0.1787028021958409
0.158846935285192
0.138991068374543
0.119135201463894
0.099279334553245
0.079423467642596
0.059567600731947
0.039711733821298
```

0.019855866910649
0.0

In [20]:

```
# Complete NaN values
metrics_copy = metrics_.copy()
metrics_copy = complete_nan_values(metrics_copy)
```

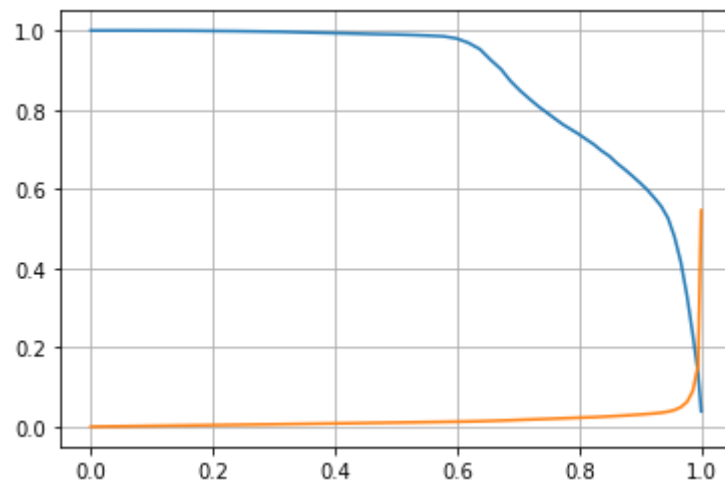
In [21]:

```
# Comput 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 0.8875491742752496



In []: