Model Training

Importing

In [1]:
```
import tensorflow as tf
from tensorflow.keras.optimizers.schedules import InverseTimeDecay
from model.models import Model_1
from testing import test_model, pred_patches
from dataloader import DataLoader
from model.losses import FocalLoss, WBCE
from model.callbacks import UpdateAccuracy
from ops import reconstruct_image
import os
import json
import shutil
import matplotlib.pyplot as plt
import numpy as np
from tqdm import tqdm
from PIL import Image
from tensorflow.keras.utils import to_categorical
from sklearn.metrics import average_precision_score
```

Parameters

In [2]:
```
# load the params-patches.json options
with open(os.path.join('v1', 'params-patches.json')) as param_file:
    params_patches = json.load(param_file)

# load the params-patches.json options
with open(os.path.join('v1', 'params-training.json')) as param_file:
    params_training = json.load(param_file)

#load the params-model.json options
with open(os.path.join('v1', 'params-model.json')) as param_file:
    params_model = json.load(param_file)

#load the shapes.json options
with open('shapes.json') as param_file:
    shapes_json = json.load(param_file)
```

In [3]:
```
patches_path = params_patches['patches_path']

train_path = os.path.join(patches_path, params_patches['train_sub'])
val_path = os.path.join(patches_path, params_patches['val_sub'])
test_path = os.path.join(patches_path, params_patches['test_sub'])
```

Setting Dataloaders

In [4]:
```
dl_train = DataLoader(
    batch_size = params_training['batch_size'],
    data_path=os.path.join(train_path, params_patches['data_sub']),
    label_path=os.path.join(train_path, params_patches['label_sub']),
    patch_size=128,
    opt_bands=8,
```

```
    sar_bands=4,
    num_classes=3,
    shuffle=True#,
    #limit=params_training['patch_limit']
)

dl_val = DataLoader(
    batch_size=params_training['batch_size'],
    data_path=os.path.join(val_path, params_patches['data_sub']),
    label_path=os.path.join(val_path, params_patches['label_sub']),
    patch_size=128,
    opt_bands=8,
    sar_bands=4,
    num_classes=3#,
    #limit=params_training['patch_limit']
)

dl_test = DataLoader(
    batch_size=params_training['batch_size'],
    data_path=os.path.join(test_path, params_patches['data_sub']),
    label_path=os.path.join(test_path, params_patches['label_sub']),
    patch_size=128,
    opt_bands=8,
    sar_bands=4,
    num_classes=3)
```

Model definition

In [5]:

```
model = Model_1(name='modelo_1')

metrics = {
}

weights = [0.2, 0.8, 0.0]

learning_rate = InverseTimeDecay(
    initial_learning_rate=1e-4,
    decay_steps=params_training['learning_reduction']*len(dl_train),
    decay_rate = 0.01,
    staircase=True
    )

optimizers = {
    'opt': tf.keras.optimizers.Adam(learning_rate = learning_rate),
    'sar': tf.keras.optimizers.Adam(learning_rate = learning_rate),
    'fusion': tf.keras.optimizers.Adam(learning_rate = learning_rate),
}

class_indexes = [0, 1]

model.compile(
    optimizers = optimizers,
    loss_fn = WBCE,
    metrics_dict = metrics,
    class_weights = weights,
    class_indexes = class_indexes,
    run_eagerly=params_training['run_eagerly']
)
```

In [6]:

```
callbacks = [
    tf.keras.callbacks.EarlyStopping(
```

```
        monitor='val_combined_f1score',
        patience = params_training['patience'],
        mode = 'max',
        restore_best_weights=True),
    UpdateAccuracy()
]


history = model.fit(
    x=dl_train,
    validation_data=dl_val,
    epochs=params_training['epochs_train'],
    callbacks=callbacks,
    verbose = 1
    )
```

```
Epoch 1/200
330/330 [==============================] - 265s 795ms/step - opt_loss: 0.2800 - sar_
loss: 0.3601 - fusion_loss: 0.3223 - loss: 0.9624 - opt_accuracy: 0.8664 - sar_accur
acy: 0.8159 - fusion_accuracy: 0.8506 - combined_accuracy: 0.8691 - opt_f1score: 0.7
580 - sar_f1score: 0.6148 - fusion_f1score: 0.7277 - combined_f1score: 0.7610 - val_
opt_loss: 0.5801 - val_sar_loss: 1.8671 - val_fusion_loss: 1.6484 - val_loss: 4.0956
- val_opt_accuracy: 0.6016 - val_sar_accuracy: 0.6016 - val_fusion_accuracy: 0.6016
- val_combined_accuracy: 0.6016 - val_opt_f1score: 1.8826e-07 - val_sar_f1score: 4.4
280e-14 - val_fusion_f1score: 4.4280e-14 - val_combined_f1score: 4.4280e-14
Epoch 2/200
330/330 [==============================] - 122s 370ms/step - opt_loss: 0.2078 - sar_
loss: 0.2854 - fusion_loss: 0.2197 - loss: 0.7129 - opt_accuracy: 0.8906 - sar_accur
acy: 0.8486 - fusion_accuracy: 0.8842 - combined_accuracy: 0.8914 - opt_f1score: 0.8
128 - sar_f1score: 0.7128 - fusion_f1score: 0.8007 - combined_f1score: 0.8120 - val_
opt_loss: 0.2017 - val_sar_loss: 0.3762 - val_fusion_loss: 0.2486 - val_loss: 0.8264
- val_opt_accuracy: 0.8726 - val_sar_accuracy: 0.6145 - val_fusion_accuracy: 0.7312
- val_combined_accuracy: 0.7546 - val_opt_f1score: 0.6965 - val_sar_f1score: 0.0355
- val_fusion_f1score: 0.4159 - val_combined_f1score: 0.3642
Epoch 3/200
330/330 [==============================] - 122s 370ms/step - opt_loss: 0.1923 - sar_
loss: 0.2663 - fusion_loss: 0.1998 - loss: 0.6584 - opt_accuracy: 0.8960 - sar_accur
acy: 0.8578 - fusion_accuracy: 0.8916 - combined_accuracy: 0.8974 - opt_f1score: 0.8
238 - sar_f1score: 0.7342 - fusion_f1score: 0.8162 - combined_f1score: 0.8242 - val_
opt_loss: 0.2344 - val_sar_loss: 0.2444 - val_fusion_loss: 0.2389 - val_loss: 0.7176
- val_opt_accuracy: 0.8769 - val_sar_accuracy: 0.8434 - val_fusion_accuracy: 0.8728
- val_combined_accuracy: 0.8754 - val_opt_f1score: 0.6090 - val_sar_f1score: 0.6167
- val_fusion_f1score: 0.5964 - val_combined_f1score: 0.5995
Epoch 4/200
330/330 [==============================] - 122s 370ms/step - opt_loss: 0.1839 - sar_
loss: 0.2569 - fusion_loss: 0.1888 - loss: 0.6296 - opt_accuracy: 0.8990 - sar_accur
acy: 0.8613 - fusion_accuracy: 0.8952 - combined_accuracy: 0.9001 - opt_f1score: 0.8
286 - sar_f1score: 0.7415 - fusion_f1score: 0.8228 - combined_f1score: 0.8294 - val_
opt_loss: 0.1600 - val_sar_loss: 0.2145 - val_fusion_loss: 0.1506 - val_loss: 0.5251
- val_opt_accuracy: 0.8963 - val_sar_accuracy: 0.8719 - val_fusion_accuracy: 0.8995
- val_combined_accuracy: 0.8999 - val_opt_f1score: 0.7598 - val_sar_f1score: 0.6735
- val_fusion_f1score: 0.7648 - val_combined_f1score: 0.7654
Epoch 5/200
330/330 [==============================] - 122s 369ms/step - opt_loss: 0.1773 - sar_
loss: 0.2486 - fusion_loss: 0.1780 - loss: 0.6038 - opt_accuracy: 0.9024 - sar_accur
acy: 0.8634 - fusion_accuracy: 0.8995 - combined_accuracy: 0.9036 - opt_f1score: 0.8
336 - sar_f1score: 0.7496 - fusion_f1score: 0.8317 - combined_f1score: 0.8374 - val_
opt_loss: 0.1564 - val_sar_loss: 0.2181 - val_fusion_loss: 0.1482 - val_loss: 0.5226
- val_opt_accuracy: 0.8910 - val_sar_accuracy: 0.8665 - val_fusion_accuracy: 0.8953
- val_combined_accuracy: 0.8945 - val_opt_f1score: 0.7712 - val_sar_f1score: 0.6542
- val_fusion_f1score: 0.7799 - val_combined_f1score: 0.7741
Epoch 6/200
330/330 [==============================] - 122s 370ms/step - opt_loss: 0.1683 - sar_
loss: 0.2347 - fusion_loss: 0.1646 - loss: 0.5676 - opt_accuracy: 0.9056 - sar_accur
acy: 0.8688 - fusion_accuracy: 0.9040 - combined_accuracy: 0.9074 - opt_f1score: 0.8
```

```
402 - sar_f1score: 0.7656 - fusion_f1score: 0.8432 - combined_f1score: 0.8473 - val_
opt_loss: 0.2948 - val_sar_loss: 0.3618 - val_fusion_loss: 0.2936 - val_loss: 0.9502
- val_opt_accuracy: 0.7611 - val_sar_accuracy: 0.8401 - val_fusion_accuracy: 0.8456
- val_combined_accuracy: 0.8589 - val_opt_f1score: 0.5994 - val_sar_f1score: 0.5013
- val_fusion_f1score: 0.6336 - val_combined_f1score: 0.6343
Epoch 7/200
330/330 [==============================] - 122s 370ms/step - opt_loss: 0.1656 - sar_
loss: 0.2260 - fusion_loss: 0.1571 - loss: 0.5487 - opt_accuracy: 0.9064 - sar_accur
acy: 0.8719 - fusion_accuracy: 0.9066 - combined_accuracy: 0.9095 - opt_f1score: 0.8
409 - sar_f1score: 0.7738 - fusion_f1score: 0.8497 - combined_f1score: 0.8530 - val_
opt_loss: 0.1416 - val_sar_loss: 0.2323 - val_fusion_loss: 0.1381 - val_loss: 0.5120
- val_opt_accuracy: 0.9023 - val_sar_accuracy: 0.8638 - val_fusion_accuracy: 0.9026
- val_combined_accuracy: 0.8973 - val_opt_f1score: 0.7757 - val_sar_f1score: 0.5586
- val_fusion_f1score: 0.7725 - val_combined_f1score: 0.7491
Epoch 8/200
330/330 [==============================] - 122s 370ms/step - opt_loss: 0.1556 - sar_
loss: 0.2079 - fusion_loss: 0.1431 - loss: 0.5065 - opt_accuracy: 0.9106 - sar_accur
acy: 0.8778 - fusion_accuracy: 0.9121 - combined_accuracy: 0.9144 - opt_f1score: 0.8
498 - sar_f1score: 0.7936 - fusion_f1score: 0.8626 - combined_f1score: 0.8649 - val_
opt_loss: 0.1316 - val_sar_loss: 0.3799 - val_fusion_loss: 0.1370 - val_loss: 0.6485
- val_opt_accuracy: 0.9114 - val_sar_accuracy: 0.7960 - val_fusion_accuracy: 0.9106
- val_combined_accuracy: 0.9075 - val_opt_f1score: 0.8017 - val_sar_f1score: 0.5300
- val_fusion_f1score: 0.8018 - val_combined_f1score: 0.7924
Epoch 9/200
330/330 [==============================] - 122s 370ms/step - opt_loss: 0.1519 - sar_
loss: 0.1975 - fusion_loss: 0.1360 - loss: 0.4854 - opt_accuracy: 0.9120 - sar_accur
acy: 0.8814 - fusion_accuracy: 0.9150 - combined_accuracy: 0.9168 - opt_f1score: 0.8
530 - sar_f1score: 0.8037 - fusion_f1score: 0.8696 - combined_f1score: 0.8713 - val_
opt_loss: 0.1367 - val_sar_loss: 0.1850 - val_fusion_loss: 0.1281 - val_loss: 0.4498
- val_opt_accuracy: 0.9035 - val_sar_accuracy: 0.8820 - val_fusion_accuracy: 0.9075
- val_combined_accuracy: 0.9071 - val_opt_f1score: 0.7873 - val_sar_f1score: 0.7057
- val_fusion_f1score: 0.8032 - val_combined_f1score: 0.8011
Epoch 10/200
330/330 [==============================] - 122s 370ms/step - opt_loss: 0.1456 - sar_
loss: 0.1912 - fusion_loss: 0.1286 - loss: 0.4654 - opt_accuracy: 0.9147 - sar_accur
acy: 0.8838 - fusion_accuracy: 0.9180 - combined_accuracy: 0.9194 - opt_f1score: 0.8
592 - sar_f1score: 0.8102 - fusion_f1score: 0.8765 - combined_f1score: 0.8776 - val_
opt_loss: 0.3241 - val_sar_loss: 0.1955 - val_fusion_loss: 0.2144 - val_loss: 0.7340
- val_opt_accuracy: 0.7762 - val_sar_accuracy: 0.8679 - val_fusion_accuracy: 0.8208
- val_combined_accuracy: 0.8435 - val_opt_f1score: 0.5031 - val_sar_f1score: 0.7052
- val_fusion_f1score: 0.6654 - val_combined_f1score: 0.7058
Epoch 11/200
330/330 [==============================] - 122s 370ms/step - opt_loss: 0.1414 - sar_
loss: 0.1815 - fusion_loss: 0.1227 - loss: 0.4456 - opt_accuracy: 0.9164 - sar_accur
acy: 0.8876 - fusion_accuracy: 0.9207 - combined_accuracy: 0.9218 - opt_f1score: 0.8
632 - sar_f1score: 0.8206 - fusion_f1score: 0.8823 - combined_f1score: 0.8831 - val_
opt_loss: 0.1584 - val_sar_loss: 0.1830 - val_fusion_loss: 0.1420 - val_loss: 0.4833
- val_opt_accuracy: 0.8784 - val_sar_accuracy: 0.8794 - val_fusion_accuracy: 0.8836
- val_combined_accuracy: 0.8894 - val_opt_f1score: 0.7670 - val_sar_f1score: 0.7070
- val_fusion_f1score: 0.7847 - val_combined_f1score: 0.7847
Epoch 12/200
330/330 [==============================] - 122s 371ms/step - opt_loss: 0.1389 - sar_
loss: 0.1778 - fusion_loss: 0.1190 - loss: 0.4356 - opt_accuracy: 0.9177 - sar_accur
acy: 0.8887 - fusion_accuracy: 0.9225 - combined_accuracy: 0.9233 - opt_f1score: 0.8
661 - sar_f1score: 0.8236 - fusion_f1score: 0.8857 - combined_f1score: 0.8862 - val_
opt_loss: 0.2699 - val_sar_loss: 0.1906 - val_fusion_loss: 0.1697 - val_loss: 0.6302
- val_opt_accuracy: 0.7761 - val_sar_accuracy: 0.8834 - val_fusion_accuracy: 0.8406
- val_combined_accuracy: 0.8512 - val_opt_f1score: 0.6084 - val_sar_f1score: 0.7316
- val_fusion_f1score: 0.7389 - val_combined_f1score: 0.7490
Epoch 13/200
330/330 [==============================] - 119s 361ms/step - opt_loss: 0.1366 - sar_
loss: 0.1718 - fusion_loss: 0.1150 - loss: 0.4234 - opt_accuracy: 0.9181 - sar_accur
acy: 0.8909 - fusion_accuracy: 0.9235 - combined_accuracy: 0.9241 - opt_f1score: 0.8
681 - sar_f1score: 0.8301 - fusion_f1score: 0.8893 - combined_f1score: 0.8894 - val_
opt_loss: 0.1335 - val_sar_loss: 0.3779 - val_fusion_loss: 0.1434 - val_loss: 0.6549
```

```
- val_opt_accuracy: 0.9045 - val_sar_accuracy: 0.8168 - val_fusion_accuracy: 0.8996
- val_combined_accuracy: 0.9012 - val_opt_f1score: 0.7812 - val_sar_f1score: 0.5745
- val_fusion_f1score: 0.7779 - val_combined_f1score: 0.7738
Epoch 14/200
330/330 [==============================] - 119s 359ms/step - opt_loss: 0.1295 - sar_
loss: 0.1651 - fusion_loss: 0.1090 - loss: 0.4036 - opt_accuracy: 0.9220 - sar_accur
acy: 0.8938 - fusion_accuracy: 0.9272 - combined_accuracy: 0.9275 - opt_f1score: 0.8
752 - sar_f1score: 0.8373 - fusion_f1score: 0.8954 - combined_f1score: 0.8952 - val_
opt_loss: 0.1246 - val_sar_loss: 0.2881 - val_fusion_loss: 0.1371 - val_loss: 0.5497
- val_opt_accuracy: 0.9115 - val_sar_accuracy: 0.8455 - val_fusion_accuracy: 0.9070
- val_combined_accuracy: 0.9065 - val_opt_f1score: 0.8135 - val_sar_f1score: 0.6300
- val_fusion_f1score: 0.7989 - val_combined_f1score: 0.8006
Epoch 15/200
330/330 [==============================] - 119s 360ms/step - opt_loss: 0.1244 - sar_
loss: 0.1574 - fusion_loss: 0.1042 - loss: 0.3860 - opt_accuracy: 0.9232 - sar_accur
acy: 0.8972 - fusion_accuracy: 0.9287 - combined_accuracy: 0.9290 - opt_f1score: 0.8
797 - sar_f1score: 0.8447 - fusion_f1score: 0.8994 - combined_f1score: 0.8991 - val_
opt_loss: 0.1284 - val_sar_loss: 0.1827 - val_fusion_loss: 0.1140 - val_loss: 0.4251
- val_opt_accuracy: 0.9116 - val_sar_accuracy: 0.8770 - val_fusion_accuracy: 0.9161
- val_combined_accuracy: 0.9148 - val_opt_f1score: 0.8088 - val_sar_f1score: 0.7380
- val_fusion_f1score: 0.8324 - val_combined_f1score: 0.8306
Epoch 16/200
330/330 [==============================] - 119s 360ms/step - opt_loss: 0.1204 - sar_
loss: 0.1499 - fusion_loss: 0.0995 - loss: 0.3698 - opt_accuracy: 0.9249 - sar_accur
acy: 0.9003 - fusion_accuracy: 0.9310 - combined_accuracy: 0.9312 - opt_f1score: 0.8
837 - sar_f1score: 0.8525 - fusion_f1score: 0.9042 - combined_f1score: 0.9038 - val_
opt_loss: 0.1229 - val_sar_loss: 0.1723 - val_fusion_loss: 0.1120 - val_loss: 0.4072
- val_opt_accuracy: 0.9100 - val_sar_accuracy: 0.8896 - val_fusion_accuracy: 0.9154
- val_combined_accuracy: 0.9167 - val_opt_f1score: 0.8155 - val_sar_f1score: 0.7569
- val_fusion_f1score: 0.8343 - val_combined_f1score: 0.8328
Epoch 17/200
330/330 [==============================] - 119s 360ms/step - opt_loss: 0.1185 - sar_
loss: 0.1490 - fusion_loss: 0.0979 - loss: 0.3654 - opt_accuracy: 0.9260 - sar_accur
acy: 0.9009 - fusion_accuracy: 0.9320 - combined_accuracy: 0.9320 - opt_f1score: 0.8
857 - sar_f1score: 0.8531 - fusion_f1score: 0.9057 - combined_f1score: 0.9051 - val_
opt_loss: 0.1160 - val_sar_loss: 0.2549 - val_fusion_loss: 0.1150 - val_loss: 0.4859
- val_opt_accuracy: 0.9164 - val_sar_accuracy: 0.8509 - val_fusion_accuracy: 0.9164
 - val_combined_accuracy: 0.9147 - val_opt_f1score: 0.8229 - val_sar_f1score: 0.6487
- val_fusion_f1score: 0.8291 - val_combined_f1score: 0.8252
Epoch 18/200
330/330 [==============================] - 118s 358ms/step - opt_loss: 0.1131 - sar_
loss: 0.1409 - fusion_loss: 0.0929 - loss: 0.3469 - opt_accuracy: 0.9286 - sar_accur
acy: 0.9044 - fusion_accuracy: 0.9348 - combined_accuracy: 0.9347 - opt_f1score: 0.8
912 - sar_f1score: 0.8614 - fusion_f1score: 0.9108 - combined_f1score: 0.9100 - val_
opt_loss: 0.1222 - val_sar_loss: 0.1697 - val_fusion_loss: 0.1128 - val_loss: 0.4047
- val_opt_accuracy: 0.9147 - val_sar_accuracy: 0.8858 - val_fusion_accuracy: 0.9177
 - val_combined_accuracy: 0.9185 - val_opt_f1score: 0.8193 - val_sar_f1score: 0.7607
- val_fusion_f1score: 0.8369 - val_combined_f1score: 0.8363
Epoch 19/200
330/330 [==============================] - 118s 358ms/step - opt_loss: 0.1106 - sar_
loss: 0.1388 - fusion_loss: 0.0907 - loss: 0.3401 - opt_accuracy: 0.9292 - sar_accur
acy: 0.9054 - fusion_accuracy: 0.9358 - combined_accuracy: 0.9356 - opt_f1score: 0.8
935 - sar_f1score: 0.8634 - fusion_f1score: 0.9130 - combined_f1score: 0.9123 - val_
opt_loss: 0.1364 - val_sar_loss: 0.2100 - val_fusion_loss: 0.1230 - val_loss: 0.4695
- val_opt_accuracy: 0.9075 - val_sar_accuracy: 0.8753 - val_fusion_accuracy: 0.9116
 - val_combined_accuracy: 0.9085 - val_opt_f1score: 0.7917 - val_sar_f1score: 0.7241
- val_fusion_f1score: 0.8136 - val_combined_f1score: 0.8090
Epoch 20/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.1087 - sar_
loss: 0.1352 - fusion_loss: 0.0887 - loss: 0.3327 - opt_accuracy: 0.9305 - sar_accur
acy: 0.9081 - fusion_accuracy: 0.9373 - combined_accuracy: 0.9372 - opt_f1score: 0.8
954 - sar_f1score: 0.8680 - fusion_f1score: 0.9153 - combined_f1score: 0.9145 - val_
opt_loss: 0.1225 - val_sar_loss: 0.2556 - val_fusion_loss: 0.1280 - val_loss: 0.5061
- val_opt_accuracy: 0.9173 - val_sar_accuracy: 0.8619 - val_fusion_accuracy: 0.9147
 - val_combined_accuracy: 0.9089 - val_opt_f1score: 0.8313 - val_sar_f1score: 0.7012
```

```
- val_fusion_f1score: 0.8271 - val_combined_f1score: 0.8218
Epoch 21/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.1038 - sar_
loss: 0.1308 - fusion_loss: 0.0850 - loss: 0.3196 - opt_accuracy: 0.9325 - sar_accur
acy: 0.9105 - fusion_accuracy: 0.9392 - combined_accuracy: 0.9389 - opt_f1score: 0.9
006 - sar_f1score: 0.8726 - fusion_f1score: 0.9189 - combined_f1score: 0.9182 - val_
opt_loss: 0.1197 - val_sar_loss: 0.1937 - val_fusion_loss: 0.1153 - val_loss: 0.4286
- val_opt_accuracy: 0.9203 - val_sar_accuracy: 0.8813 - val_fusion_accuracy: 0.9200
 - val_combined_accuracy: 0.9167 - val_opt_f1score: 0.8303 - val_sar_f1score: 0.7451
- val_fusion_f1score: 0.8364 - val_combined_f1score: 0.8325
Epoch 22/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.1024 - sar_
loss: 0.1278 - fusion_loss: 0.0828 - loss: 0.3129 - opt_accuracy: 0.9332 - sar_accur
acy: 0.9119 - fusion_accuracy: 0.9404 - combined_accuracy: 0.9401 - opt_f1score: 0.9
024 - sar_f1score: 0.8758 - fusion_f1score: 0.9214 - combined_f1score: 0.9206 - val_
opt_loss: 0.1323 - val_sar_loss: 0.3574 - val_fusion_loss: 0.1837 - val_loss: 0.6733
- val_opt_accuracy: 0.9110 - val_sar_accuracy: 0.8492 - val_fusion_accuracy: 0.9000
 - val_combined_accuracy: 0.8983 - val_opt_f1score: 0.7947 - val_sar_f1score: 0.7064
- val_fusion_f1score: 0.7988 - val_combined_f1score: 0.7911
Epoch 23/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.1005 - sar_
loss: 0.1240 - fusion_loss: 0.0814 - loss: 0.3059 - opt_accuracy: 0.9340 - sar_accur
acy: 0.9138 - fusion_accuracy: 0.9412 - combined_accuracy: 0.9409 - opt_f1score: 0.9
046 - sar_f1score: 0.8796 - fusion_f1score: 0.9229 - combined_f1score: 0.9222 - val_
opt_loss: 0.1181 - val_sar_loss: 0.1895 - val_fusion_loss: 0.1136 - val_loss: 0.4212
- val_opt_accuracy: 0.9171 - val_sar_accuracy: 0.8821 - val_fusion_accuracy: 0.9186
 - val_combined_accuracy: 0.9187 - val_opt_f1score: 0.8320 - val_sar_f1score: 0.7462
- val_fusion_f1score: 0.8368 - val_combined_f1score: 0.8329
Epoch 24/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0961 - sar_
loss: 0.1211 - fusion_loss: 0.0781 - loss: 0.2952 - opt_accuracy: 0.9359 - sar_accur
acy: 0.9152 - fusion_accuracy: 0.9429 - combined_accuracy: 0.9424 - opt_f1score: 0.9
083 - sar_f1score: 0.8821 - fusion_f1score: 0.9258 - combined_f1score: 0.9249 - val_
opt_loss: 0.1149 - val_sar_loss: 0.2014 - val_fusion_loss: 0.1132 - val_loss: 0.4294
- val_opt_accuracy: 0.9211 - val_sar_accuracy: 0.8949 - val_fusion_accuracy: 0.9245
 - val_combined_accuracy: 0.9220 - val_opt_f1score: 0.8411 - val_sar_f1score: 0.7768
- val_fusion_f1score: 0.8475 - val_combined_f1score: 0.8453
Epoch 25/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0947 - sar_
loss: 0.1161 - fusion_loss: 0.0757 - loss: 0.2864 - opt_accuracy: 0.9367 - sar_accur
acy: 0.9182 - fusion_accuracy: 0.9446 - combined_accuracy: 0.9441 - opt_f1score: 0.9
100 - sar_f1score: 0.8878 - fusion_f1score: 0.9284 - combined_f1score: 0.9276 - val_
opt_loss: 0.1250 - val_sar_loss: 0.1650 - val_fusion_loss: 0.1143 - val_loss: 0.4043
- val_opt_accuracy: 0.9134 - val_sar_accuracy: 0.8938 - val_fusion_accuracy: 0.9202
 - val_combined_accuracy: 0.9199 - val_opt_f1score: 0.8081 - val_sar_f1score: 0.7752
- val_fusion_f1score: 0.8380 - val_combined_f1score: 0.8373
Epoch 26/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0934 - sar_
loss: 0.1143 - fusion_loss: 0.0748 - loss: 0.2825 - opt_accuracy: 0.9377 - sar_accur
acy: 0.9196 - fusion_accuracy: 0.9454 - combined_accuracy: 0.9449 - opt_f1score: 0.9
120 - sar_f1score: 0.8903 - fusion_f1score: 0.9298 - combined_f1score: 0.9290 - val_
opt_loss: 0.1205 - val_sar_loss: 0.1885 - val_fusion_loss: 0.1221 - val_loss: 0.4311
- val_opt_accuracy: 0.9140 - val_sar_accuracy: 0.8883 - val_fusion_accuracy: 0.9147
 - val_combined_accuracy: 0.9146 - val_opt_f1score: 0.8220 - val_sar_f1score: 0.7868
- val_fusion_f1score: 0.8333 - val_combined_f1score: 0.8346
Epoch 27/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0910 - sar_
loss: 0.1130 - fusion_loss: 0.0732 - loss: 0.2772 - opt_accuracy: 0.9390 - sar_accur
acy: 0.9208 - fusion_accuracy: 0.9466 - combined_accuracy: 0.9461 - opt_f1score: 0.9
139 - sar_f1score: 0.8914 - fusion_f1score: 0.9311 - combined_f1score: 0.9303 - val_
opt_loss: 0.1115 - val_sar_loss: 0.1973 - val_fusion_loss: 0.1073 - val_loss: 0.4162
- val_opt_accuracy: 0.9226 - val_sar_accuracy: 0.8818 - val_fusion_accuracy: 0.9250
 - val_combined_accuracy: 0.9245 - val_opt_f1score: 0.8463 - val_sar_f1score: 0.7446
- val_fusion_f1score: 0.8516 - val_combined_f1score: 0.8478
Epoch 28/200
```

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330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0855 - sar_
loss: 0.1059 - fusion_loss: 0.0689 - loss: 0.2604 - opt_accuracy: 0.9416 - sar_accur
acy: 0.9250 - fusion_accuracy: 0.9494 - combined_accuracy: 0.9487 - opt_f1score: 0.9
197 - sar_f1score: 0.8987 - fusion_f1score: 0.9357 - combined_f1score: 0.9349 - val_
opt_loss: 0.1180 - val_sar_loss: 0.3279 - val_fusion_loss: 0.1755 - val_loss: 0.6213
- val_opt_accuracy: 0.9212 - val_sar_accuracy: 0.8433 - val_fusion_accuracy: 0.8966
 - val_combined_accuracy: 0.8963 - val_opt_f1score: 0.8471 - val_sar_f1score: 0.7524
- val_fusion_f1score: 0.8330 - val_combined_f1score: 0.8317
Epoch 29/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0887 - sar_
loss: 0.1092 - fusion_loss: 0.0707 - loss: 0.2686 - opt_accuracy: 0.9400 - sar_accur
acy: 0.9231 - fusion_accuracy: 0.9483 - combined_accuracy: 0.9477 - opt_f1score: 0.9
165 - sar_f1score: 0.8956 - fusion_f1score: 0.9341 - combined_f1score: 0.9334 - val_
opt_loss: 0.1190 - val_sar_loss: 0.1810 - val_fusion_loss: 0.1104 - val_loss: 0.4104
- val_opt_accuracy: 0.9175 - val_sar_accuracy: 0.8873 - val_fusion_accuracy: 0.9206
 - val_combined_accuracy: 0.9206 - val_opt_f1score: 0.8354 - val_sar_f1score: 0.7569
- val_fusion_f1score: 0.8507 - val_combined_f1score: 0.8506
Epoch 30/200
330/330 [==============================] - 118s 358ms/step - opt_loss: 0.0843 - sar_
loss: 0.1037 - fusion_loss: 0.0674 - loss: 0.2554 - opt_accuracy: 0.9424 - sar_accur
acy: 0.9258 - fusion_accuracy: 0.9504 - combined_accuracy: 0.9497 - opt_f1score: 0.9
211 - sar_f1score: 0.9014 - fusion_f1score: 0.9373 - combined_f1score: 0.9365 - val_
opt_loss: 0.1176 - val_sar_loss: 0.1748 - val_fusion_loss: 0.1054 - val_loss: 0.3978
- val_opt_accuracy: 0.9215 - val_sar_accuracy: 0.8946 - val_fusion_accuracy: 0.9273
 - val_combined_accuracy: 0.9263 - val_opt_f1score: 0.8451 - val_sar_f1score: 0.7684
- val_fusion_f1score: 0.8613 - val_combined_f1score: 0.8577
Epoch 31/200
330/330 [==============================] - 118s 359ms/step - opt_loss: 0.0827 - sar_
loss: 0.0996 - fusion_loss: 0.0656 - loss: 0.2479 - opt_accuracy: 0.9434 - sar_accur
acy: 0.9285 - fusion_accuracy: 0.9518 - combined_accuracy: 0.9510 - opt_f1score: 0.9
228 - sar_f1score: 0.9058 - fusion_f1score: 0.9393 - combined_f1score: 0.9386 - val_
opt_loss: 0.1091 - val_sar_loss: 0.1949 - val_fusion_loss: 0.1206 - val_loss: 0.4245
- val_opt_accuracy: 0.9222 - val_sar_accuracy: 0.9028 - val_fusion_accuracy: 0.9240
 - val_combined_accuracy: 0.9249 - val_opt_f1score: 0.8426 - val_sar_f1score: 0.7912
- val_fusion_f1score: 0.8431 - val_combined_f1score: 0.8429
Epoch 32/200
330/330 [==============================] - 119s 359ms/step - opt_loss: 0.0834 - sar_
loss: 0.0989 - fusion_loss: 0.0650 - loss: 0.2473 - opt_accuracy: 0.9432 - sar_accur
acy: 0.9289 - fusion_accuracy: 0.9521 - combined_accuracy: 0.9514 - opt_f1score: 0.9
223 - sar_f1score: 0.9062 - fusion_f1score: 0.9397 - combined_f1score: 0.9390 - val_
opt_loss: 0.1264 - val_sar_loss: 0.1955 - val_fusion_loss: 0.1143 - val_loss: 0.4362
- val_opt_accuracy: 0.9199 - val_sar_accuracy: 0.8495 - val_fusion_accuracy: 0.9149
 - val_combined_accuracy: 0.9189 - val_opt_f1score: 0.8455 - val_sar_f1score: 0.7474
- val_fusion_f1score: 0.8498 - val_combined_f1score: 0.8514
Epoch 33/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0786 - sar_
loss: 0.0962 - fusion_loss: 0.0625 - loss: 0.2373 - opt_accuracy: 0.9456 - sar_accur
acy: 0.9312 - fusion_accuracy: 0.9540 - combined_accuracy: 0.9532 - opt_f1score: 0.9
270 - sar_f1score: 0.9094 - fusion_f1score: 0.9424 - combined_f1score: 0.9417 - val_
opt_loss: 0.1077 - val_sar_loss: 0.2032 - val_fusion_loss: 0.1194 - val_loss: 0.4303
- val_opt_accuracy: 0.9277 - val_sar_accuracy: 0.8970 - val_fusion_accuracy: 0.9265
 - val_combined_accuracy: 0.9289 - val_opt_f1score: 0.8609 - val_sar_f1score: 0.7706
- val_fusion_f1score: 0.8485 - val_combined_f1score: 0.8526
Epoch 34/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0793 - sar_
loss: 0.0970 - fusion_loss: 0.0628 - loss: 0.2391 - opt_accuracy: 0.9454 - sar_accur
acy: 0.9302 - fusion_accuracy: 0.9538 - combined_accuracy: 0.9531 - opt_f1score: 0.9
265 - sar_f1score: 0.9084 - fusion_f1score: 0.9421 - combined_f1score: 0.9416 - val_
opt_loss: 0.1064 - val_sar_loss: 0.1720 - val_fusion_loss: 0.1032 - val_loss: 0.3816
- val_opt_accuracy: 0.9294 - val_sar_accuracy: 0.8933 - val_fusion_accuracy: 0.9279
 - val_combined_accuracy: 0.9299 - val_opt_f1score: 0.8605 - val_sar_f1score: 0.7919
- val_fusion_f1score: 0.8590 - val_combined_f1score: 0.8638
Epoch 35/200
330/330 [==============================] - 118s 358ms/step - opt_loss: 0.0775 - sar_
loss: 0.0951 - fusion_loss: 0.0616 - loss: 0.2342 - opt_accuracy: 0.9463 - sar_accur
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acy: 0.9322 - fusion_accuracy: 0.9549 - combined_accuracy: 0.9543 - opt_f1score: 0.9
281 - sar_f1score: 0.9110 - fusion_f1score: 0.9435 - combined_f1score: 0.9430 - val_
opt_loss: 0.1152 - val_sar_loss: 0.1914 - val_fusion_loss: 0.1154 - val_loss: 0.4220
- val_opt_accuracy: 0.9268 - val_sar_accuracy: 0.8622 - val_fusion_accuracy: 0.9244
 - val_combined_accuracy: 0.9254 - val_opt_f1score: 0.8518 - val_sar_f1score: 0.7650
- val_fusion_f1score: 0.8549 - val_combined_f1score: 0.8564
Epoch 36/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0760 - sar_
loss: 0.0923 - fusion_loss: 0.0600 - loss: 0.2283 - opt_accuracy: 0.9474 - sar_accur
acy: 0.9333 - fusion_accuracy: 0.9560 - combined_accuracy: 0.9553 - opt_f1score: 0.9
297 - sar_f1score: 0.9136 - fusion_f1score: 0.9452 - combined_f1score: 0.9447 - val_
opt_loss: 0.1247 - val_sar_loss: 0.2129 - val_fusion_loss: 0.1331 - val_loss: 0.4707
- val_opt_accuracy: 0.9181 - val_sar_accuracy: 0.9041 - val_fusion_accuracy: 0.9229
 - val_combined_accuracy: 0.9237 - val_opt_f1score: 0.8485 - val_sar_f1score: 0.7829
- val_fusion_f1score: 0.8403 - val_combined_f1score: 0.8452
Epoch 37/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0753 - sar_
loss: 0.0911 - fusion_loss: 0.0593 - loss: 0.2257 - opt_accuracy: 0.9476 - sar_accur
acy: 0.9346 - fusion_accuracy: 0.9565 - combined_accuracy: 0.9558 - opt_f1score: 0.9
305 - sar_f1score: 0.9148 - fusion_f1score: 0.9459 - combined_f1score: 0.9454 - val_
opt_loss: 0.1294 - val_sar_loss: 0.2864 - val_fusion_loss: 0.1399 - val_loss: 0.5558
- val_opt_accuracy: 0.9174 - val_sar_accuracy: 0.7779 - val_fusion_accuracy: 0.9002
 - val_combined_accuracy: 0.9039 - val_opt_f1score: 0.8301 - val_sar_f1score: 0.6379
- val_fusion_f1score: 0.8233 - val_combined_f1score: 0.8250
Epoch 38/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0735 - sar_
loss: 0.0890 - fusion_loss: 0.0581 - loss: 0.2206 - opt_accuracy: 0.9489 - sar_accur
acy: 0.9356 - fusion_accuracy: 0.9575 - combined_accuracy: 0.9569 - opt_f1score: 0.9
324 - sar_f1score: 0.9171 - fusion_f1score: 0.9472 - combined_f1score: 0.9468 - val_
opt_loss: 0.1221 - val_sar_loss: 0.2184 - val_fusion_loss: 0.1204 - val_loss: 0.4608
- val_opt_accuracy: 0.9207 - val_sar_accuracy: 0.8703 - val_fusion_accuracy: 0.9231
 - val_combined_accuracy: 0.9230 - val_opt_f1score: 0.8463 - val_sar_f1score: 0.7535
- val_fusion_f1score: 0.8470 - val_combined_f1score: 0.8485
Epoch 39/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0723 - sar_
loss: 0.0865 - fusion_loss: 0.0566 - loss: 0.2155 - opt_accuracy: 0.9500 - sar_accur
acy: 0.9377 - fusion_accuracy: 0.9588 - combined_accuracy: 0.9581 - opt_f1score: 0.9
339 - sar_f1score: 0.9195 - fusion_f1score: 0.9488 - combined_f1score: 0.9483 - val_
opt_loss: 0.1255 - val_sar_loss: 0.2590 - val_fusion_loss: 0.1371 - val_loss: 0.5216
- val_opt_accuracy: 0.9233 - val_sar_accuracy: 0.8942 - val_fusion_accuracy: 0.9248
 - val_combined_accuracy: 0.9251 - val_opt_f1score: 0.8504 - val_sar_f1score: 0.7858
- val_fusion_f1score: 0.8471 - val_combined_f1score: 0.8529
Epoch 40/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0727 - sar_
loss: 0.0872 - fusion_loss: 0.0569 - loss: 0.2168 - opt_accuracy: 0.9497 - sar_accur
acy: 0.9371 - fusion_accuracy: 0.9586 - combined_accuracy: 0.9580 - opt_f1score: 0.9
335 - sar_f1score: 0.9191 - fusion_f1score: 0.9486 - combined_f1score: 0.9481 - val_
opt_loss: 0.1205 - val_sar_loss: 0.2103 - val_fusion_loss: 0.1133 - val_loss: 0.4440
- val_opt_accuracy: 0.9246 - val_sar_accuracy: 0.8926 - val_fusion_accuracy: 0.9280
 - val_combined_accuracy: 0.9253 - val_opt_f1score: 0.8558 - val_sar_f1score: 0.7970
- val_fusion_f1score: 0.8633 - val_combined_f1score: 0.8628
Epoch 41/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0707 - sar_
loss: 0.0859 - fusion_loss: 0.0556 - loss: 0.2122 - opt_accuracy: 0.9510 - sar_accur
acy: 0.9379 - fusion_accuracy: 0.9597 - combined_accuracy: 0.9590 - opt_f1score: 0.9
356 - sar_f1score: 0.9204 - fusion_f1score: 0.9499 - combined_f1score: 0.9495 - val_
opt_loss: 0.1197 - val_sar_loss: 0.3634 - val_fusion_loss: 0.1994 - val_loss: 0.6825
- val_opt_accuracy: 0.9219 - val_sar_accuracy: 0.8646 - val_fusion_accuracy: 0.9189
 - val_combined_accuracy: 0.9174 - val_opt_f1score: 0.8465 - val_sar_f1score: 0.7665
- val_fusion_f1score: 0.8357 - val_combined_f1score: 0.8368
Epoch 42/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0698 - sar_
loss: 0.0831 - fusion_loss: 0.0545 - loss: 0.2073 - opt_accuracy: 0.9518 - sar_accur
acy: 0.9398 - fusion_accuracy: 0.9606 - combined_accuracy: 0.9600 - opt_f1score: 0.9
365 - sar_f1score: 0.9231 - fusion_f1score: 0.9511 - combined_f1score: 0.9507 - val_
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opt_loss: 0.1183 - val_sar_loss: 0.1776 - val_fusion_loss: 0.1137 - val_loss: 0.4096
- val_opt_accuracy: 0.9243 - val_sar_accuracy: 0.8999 - val_fusion_accuracy: 0.9255
 - val_combined_accuracy: 0.9268 - val_opt_f1score: 0.8593 - val_sar_f1score: 0.8057
- val_fusion_f1score: 0.8624 - val_combined_f1score: 0.8631
Epoch 43/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0692 - sar_
loss: 0.0833 - fusion_loss: 0.0542 - loss: 0.2068 - opt_accuracy: 0.9517 - sar_accur
acy: 0.9398 - fusion_accuracy: 0.9606 - combined_accuracy: 0.9601 - opt_f1score: 0.9
371 - sar_f1score: 0.9230 - fusion_f1score: 0.9514 - combined_f1score: 0.9510 - val_
opt_loss: 0.1341 - val_sar_loss: 0.2687 - val_fusion_loss: 0.1336 - val_loss: 0.5364
- val_opt_accuracy: 0.9160 - val_sar_accuracy: 0.8752 - val_fusion_accuracy: 0.9181
 - val_combined_accuracy: 0.9180 - val_opt_f1score: 0.8327 - val_sar_f1score: 0.7386
- val_fusion_f1score: 0.8364 - val_combined_f1score: 0.8382
Epoch 44/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0690 - sar_
loss: 0.0815 - fusion_loss: 0.0534 - loss: 0.2039 - opt_accuracy: 0.9526 - sar_accur
acy: 0.9411 - fusion_accuracy: 0.9614 - combined_accuracy: 0.9609 - opt_f1score: 0.9
375 - sar_f1score: 0.9251 - fusion_f1score: 0.9522 - combined_f1score: 0.9519 - val_
opt_loss: 0.1190 - val_sar_loss: 0.2503 - val_fusion_loss: 0.1434 - val_loss: 0.5127
- val_opt_accuracy: 0.9262 - val_sar_accuracy: 0.8272 - val_fusion_accuracy: 0.9089
 - val_combined_accuracy: 0.9129 - val_opt_f1score: 0.8577 - val_sar_f1score: 0.7127
- val_fusion_f1score: 0.8271 - val_combined_f1score: 0.8319
Epoch 45/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0663 - sar_
loss: 0.0803 - fusion_loss: 0.0520 - loss: 0.1985 - opt_accuracy: 0.9538 - sar_accur
acy: 0.9418 - fusion_accuracy: 0.9624 - combined_accuracy: 0.9619 - opt_f1score: 0.9
401 - sar_f1score: 0.9258 - fusion_f1score: 0.9536 - combined_f1score: 0.9533 - val_
opt_loss: 0.1136 - val_sar_loss: 0.2404 - val_fusion_loss: 0.1388 - val_loss: 0.4928
- val_opt_accuracy: 0.9281 - val_sar_accuracy: 0.9012 - val_fusion_accuracy: 0.9290
 - val_combined_accuracy: 0.9289 - val_opt_f1score: 0.8646 - val_sar_f1score: 0.8062
- val_fusion_f1score: 0.8622 - val_combined_f1score: 0.8635
Epoch 46/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0654 - sar_
loss: 0.0771 - fusion_loss: 0.0508 - loss: 0.1934 - opt_accuracy: 0.9545 - sar_accur
acy: 0.9439 - fusion_accuracy: 0.9633 - combined_accuracy: 0.9629 - opt_f1score: 0.9
412 - sar_f1score: 0.9294 - fusion_f1score: 0.9549 - combined_f1score: 0.9547 - val_
opt_loss: 0.1100 - val_sar_loss: 0.2100 - val_fusion_loss: 0.1159 - val_loss: 0.4358
- val_opt_accuracy: 0.9311 - val_sar_accuracy: 0.8883 - val_fusion_accuracy: 0.9248
 - val_combined_accuracy: 0.9287 - val_opt_f1score: 0.8696 - val_sar_f1score: 0.7825
- val_fusion_f1score: 0.8573 - val_combined_f1score: 0.8626
Epoch 47/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0722 - sar_
loss: 0.0823 - fusion_loss: 0.0548 - loss: 0.2093 - opt_accuracy: 0.9506 - sar_accur
acy: 0.9401 - fusion_accuracy: 0.9603 - combined_accuracy: 0.9599 - opt_f1score: 0.9
345 - sar_f1score: 0.9244 - fusion_f1score: 0.9510 - combined_f1score: 0.9508 - val_
opt_loss: 0.1213 - val_sar_loss: 0.3350 - val_fusion_loss: 0.1488 - val_loss: 0.6050
- val_opt_accuracy: 0.9297 - val_sar_accuracy: 0.7834 - val_fusion_accuracy: 0.9079
 - val_combined_accuracy: 0.9115 - val_opt_f1score: 0.8638 - val_sar_f1score: 0.5575
- val_fusion_f1score: 0.8124 - val_combined_f1score: 0.8185
Epoch 48/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0646 - sar_
loss: 0.0765 - fusion_loss: 0.0504 - loss: 0.1915 - opt_accuracy: 0.9549 - sar_accur
acy: 0.9441 - fusion_accuracy: 0.9636 - combined_accuracy: 0.9631 - opt_f1score: 0.9
420 - sar_f1score: 0.9299 - fusion_f1score: 0.9554 - combined_f1score: 0.9550 - val_
opt_loss: 0.1144 - val_sar_loss: 0.2196 - val_fusion_loss: 0.1201 - val_loss: 0.4540
- val_opt_accuracy: 0.9315 - val_sar_accuracy: 0.9000 - val_fusion_accuracy: 0.9330
 - val_combined_accuracy: 0.9335 - val_opt_f1score: 0.8687 - val_sar_f1score: 0.7878
- val_fusion_f1score: 0.8627 - val_combined_f1score: 0.8657
Epoch 49/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0630 - sar_
loss: 0.0726 - fusion_loss: 0.0485 - loss: 0.1842 - opt_accuracy: 0.9565 - sar_accur
acy: 0.9469 - fusion_accuracy: 0.9653 - combined_accuracy: 0.9649 - opt_f1score: 0.9
438 - sar_f1score: 0.9339 - fusion_f1score: 0.9573 - combined_f1score: 0.9572 - val_
opt_loss: 0.1156 - val_sar_loss: 0.2066 - val_fusion_loss: 0.1121 - val_loss: 0.4343
- val_opt_accuracy: 0.9333 - val_sar_accuracy: 0.8907 - val_fusion_accuracy: 0.9283
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 - val_combined_accuracy: 0.9308 - val_opt_f1score: 0.8710 - val_sar_f1score: 0.7921
- val_fusion_f1score: 0.8672 - val_combined_f1score: 0.8717
Epoch 50/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0621 - sar_
loss: 0.0748 - fusion_loss: 0.0487 - loss: 0.1856 - opt_accuracy: 0.9571 - sar_accur
acy: 0.9455 - fusion_accuracy: 0.9653 - combined_accuracy: 0.9649 - opt_f1score: 0.9
447 - sar_f1score: 0.9318 - fusion_f1score: 0.9572 - combined_f1score: 0.9570 - val_
opt_loss: 0.1431 - val_sar_loss: 0.4415 - val_fusion_loss: 0.2182 - val_loss: 0.8028
- val_opt_accuracy: 0.9124 - val_sar_accuracy: 0.8499 - val_fusion_accuracy: 0.9192
 - val_combined_accuracy: 0.9173 - val_opt_f1score: 0.8055 - val_sar_f1score: 0.7484
- val_fusion_f1score: 0.8225 - val_combined_f1score: 0.8206
Epoch 51/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0612 - sar_
loss: 0.0748 - fusion_loss: 0.0483 - loss: 0.1842 - opt_accuracy: 0.9577 - sar_accur
acy: 0.9456 - fusion_accuracy: 0.9656 - combined_accuracy: 0.9653 - opt_f1score: 0.9
457 - sar_f1score: 0.9319 - fusion_f1score: 0.9577 - combined_f1score: 0.9575 - val_
opt_loss: 0.1267 - val_sar_loss: 0.1826 - val_fusion_loss: 0.1253 - val_loss: 0.4345
- val_opt_accuracy: 0.9273 - val_sar_accuracy: 0.9000 - val_fusion_accuracy: 0.9332
 - val_combined_accuracy: 0.9339 - val_opt_f1score: 0.8520 - val_sar_f1score: 0.8076
- val_fusion_f1score: 0.8587 - val_combined_f1score: 0.8597
Epoch 52/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0620 - sar_
loss: 0.0733 - fusion_loss: 0.0482 - loss: 0.1836 - opt_accuracy: 0.9572 - sar_accur
acy: 0.9468 - fusion_accuracy: 0.9657 - combined_accuracy: 0.9653 - opt_f1score: 0.9
448 - sar_f1score: 0.9333 - fusion_f1score: 0.9577 - combined_f1score: 0.9575 - val_
opt_loss: 0.1164 - val_sar_loss: 0.2373 - val_fusion_loss: 0.1152 - val_loss: 0.4689
- val_opt_accuracy: 0.9330 - val_sar_accuracy: 0.9007 - val_fusion_accuracy: 0.9355
 - val_combined_accuracy: 0.9348 - val_opt_f1score: 0.8707 - val_sar_f1score: 0.8117
- val_fusion_f1score: 0.8723 - val_combined_f1score: 0.8729
Epoch 53/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0618 - sar_
loss: 0.0721 - fusion_loss: 0.0476 - loss: 0.1815 - opt_accuracy: 0.9573 - sar_accur
acy: 0.9478 - fusion_accuracy: 0.9661 - combined_accuracy: 0.9658 - opt_f1score: 0.9
451 - sar_f1score: 0.9348 - fusion_f1score: 0.9584 - combined_f1score: 0.9582 - val_
opt_loss: 0.1164 - val_sar_loss: 0.2397 - val_fusion_loss: 0.1381 - val_loss: 0.4942
- val_opt_accuracy: 0.9348 - val_sar_accuracy: 0.9103 - val_fusion_accuracy: 0.9351
 - val_combined_accuracy: 0.9346 - val_opt_f1score: 0.8698 - val_sar_f1score: 0.8047
- val_fusion_f1score: 0.8587 - val_combined_f1score: 0.8599
Epoch 54/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0605 - sar_
loss: 0.0715 - fusion_loss: 0.0470 - loss: 0.1790 - opt_accuracy: 0.9583 - sar_accur
acy: 0.9479 - fusion_accuracy: 0.9666 - combined_accuracy: 0.9663 - opt_f1score: 0.9
465 - sar_f1score: 0.9353 - fusion_f1score: 0.9590 - combined_f1score: 0.9589 - val_
opt_loss: 0.1333 - val_sar_loss: 0.2155 - val_fusion_loss: 0.1215 - val_loss: 0.4703
- val_opt_accuracy: 0.9212 - val_sar_accuracy: 0.9084 - val_fusion_accuracy: 0.9341
 - val_combined_accuracy: 0.9335 - val_opt_f1score: 0.8553 - val_sar_f1score: 0.8148
- val_fusion_f1score: 0.8691 - val_combined_f1score: 0.8690
Epoch 55/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0595 - sar_
loss: 0.0709 - fusion_loss: 0.0464 - loss: 0.1767 - opt_accuracy: 0.9592 - sar_accur
acy: 0.9486 - fusion_accuracy: 0.9673 - combined_accuracy: 0.9670 - opt_f1score: 0.9
475 - sar_f1score: 0.9360 - fusion_f1score: 0.9598 - combined_f1score: 0.9596 - val_
opt_loss: 0.1162 - val_sar_loss: 0.2196 - val_fusion_loss: 0.1257 - val_loss: 0.4615
- val_opt_accuracy: 0.9346 - val_sar_accuracy: 0.8976 - val_fusion_accuracy: 0.9332
 - val_combined_accuracy: 0.9355 - val_opt_f1score: 0.8729 - val_sar_f1score: 0.7913
- val_fusion_f1score: 0.8599 - val_combined_f1score: 0.8650
Epoch 56/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0592 - sar_
loss: 0.0689 - fusion_loss: 0.0456 - loss: 0.1737 - opt_accuracy: 0.9593 - sar_accur
acy: 0.9501 - fusion_accuracy: 0.9678 - combined_accuracy: 0.9675 - opt_f1score: 0.9
477 - sar_f1score: 0.9380 - fusion_f1score: 0.9604 - combined_f1score: 0.9603 - val_
opt_loss: 0.1192 - val_sar_loss: 0.1728 - val_fusion_loss: 0.1081 - val_loss: 0.4002
- val_opt_accuracy: 0.9277 - val_sar_accuracy: 0.9058 - val_fusion_accuracy: 0.9331
 - val_combined_accuracy: 0.9327 - val_opt_f1score: 0.8650 - val_sar_f1score: 0.8121
- val_fusion_f1score: 0.8732 - val_combined_f1score: 0.8725
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Epoch 57/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0589 - sar_
loss: 0.0691 - fusion_loss: 0.0455 - loss: 0.1736 - opt_accuracy: 0.9597 - sar_accur
acy: 0.9499 - fusion_accuracy: 0.9680 - combined_accuracy: 0.9678 - opt_f1score: 0.9
482 - sar_f1score: 0.9378 - fusion_f1score: 0.9607 - combined_f1score: 0.9606 - val_
opt_loss: 0.1168 - val_sar_loss: 0.2193 - val_fusion_loss: 0.1186 - val_loss: 0.4547
- val_opt_accuracy: 0.9368 - val_sar_accuracy: 0.9053 - val_fusion_accuracy: 0.9378
 - val_combined_accuracy: 0.9379 - val_opt_f1score: 0.8762 - val_sar_f1score: 0.7823
- val_fusion_f1score: 0.8659 - val_combined_f1score: 0.8675
Epoch 58/200
330/330 [==============================] - 117s 356ms/step - opt_loss: 0.0586 - sar_
loss: 0.0684 - fusion_loss: 0.0453 - loss: 0.1724 - opt_accuracy: 0.9600 - sar_accur
acy: 0.9505 - fusion_accuracy: 0.9682 - combined_accuracy: 0.9679 - opt_f1score: 0.9
484 - sar_f1score: 0.9385 - fusion_f1score: 0.9609 - combined_f1score: 0.9607 - val_
opt_loss: 0.1446 - val_sar_loss: 0.3173 - val_fusion_loss: 0.1717 - val_loss: 0.6336
- val_opt_accuracy: 0.9232 - val_sar_accuracy: 0.8786 - val_fusion_accuracy: 0.9225
 - val_combined_accuracy: 0.9209 - val_opt_f1score: 0.8537 - val_sar_f1score: 0.7719
- val_fusion_f1score: 0.8433 - val_combined_f1score: 0.8441
Epoch 59/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0574 - sar_
loss: 0.0677 - fusion_loss: 0.0446 - loss: 0.1697 - opt_accuracy: 0.9606 - sar_accur
acy: 0.9509 - fusion_accuracy: 0.9687 - combined_accuracy: 0.9684 - opt_f1score: 0.9
496 - sar_f1score: 0.9393 - fusion_f1score: 0.9616 - combined_f1score: 0.9614 - val_
opt_loss: 0.1340 - val_sar_loss: 0.2049 - val_fusion_loss: 0.1262 - val_loss: 0.4652
- val_opt_accuracy: 0.9234 - val_sar_accuracy: 0.9137 - val_fusion_accuracy: 0.9332
 - val_combined_accuracy: 0.9336 - val_opt_f1score: 0.8564 - val_sar_f1score: 0.8192
- val_fusion_f1score: 0.8673 - val_combined_f1score: 0.8701
Epoch 60/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0574 - sar_
loss: 0.0675 - fusion_loss: 0.0444 - loss: 0.1694 - opt_accuracy: 0.9609 - sar_accur
acy: 0.9506 - fusion_accuracy: 0.9689 - combined_accuracy: 0.9686 - opt_f1score: 0.9
497 - sar_f1score: 0.9392 - fusion_f1score: 0.9619 - combined_f1score: 0.9617 - val_
opt_loss: 0.1228 - val_sar_loss: 0.2775 - val_fusion_loss: 0.1382 - val_loss: 0.5385
- val_opt_accuracy: 0.9294 - val_sar_accuracy: 0.8946 - val_fusion_accuracy: 0.9309
 - val_combined_accuracy: 0.9298 - val_opt_f1score: 0.8621 - val_sar_f1score: 0.7789
- val_fusion_f1score: 0.8618 - val_combined_f1score: 0.8610
Epoch 61/200
330/330 [==============================] - 118s 359ms/step - opt_loss: 0.0580 - sar_
loss: 0.0681 - fusion_loss: 0.0446 - loss: 0.1707 - opt_accuracy: 0.9608 - sar_accur
acy: 0.9507 - fusion_accuracy: 0.9690 - combined_accuracy: 0.9687 - opt_f1score: 0.9
492 - sar_f1score: 0.9389 - fusion_f1score: 0.9617 - combined_f1score: 0.9616 - val_
opt_loss: 0.1154 - val_sar_loss: 0.1970 - val_fusion_loss: 0.1175 - val_loss: 0.4299
- val_opt_accuracy: 0.9318 - val_sar_accuracy: 0.8929 - val_fusion_accuracy: 0.9305
 - val_combined_accuracy: 0.9320 - val_opt_f1score: 0.8713 - val_sar_f1score: 0.8008
- val_fusion_f1score: 0.8684 - val_combined_f1score: 0.8708
Epoch 62/200
330/330 [==============================] - 119s 360ms/step - opt_loss: 0.0555 - sar_
loss: 0.0647 - fusion_loss: 0.0428 - loss: 0.1631 - opt_accuracy: 0.9624 - sar_accur
acy: 0.9527 - fusion_accuracy: 0.9703 - combined_accuracy: 0.9700 - opt_f1score: 0.9
517 - sar_f1score: 0.9421 - fusion_f1score: 0.9635 - combined_f1score: 0.9634 - val_
opt_loss: 0.1476 - val_sar_loss: 0.3902 - val_fusion_loss: 0.1894 - val_loss: 0.7272
- val_opt_accuracy: 0.9118 - val_sar_accuracy: 0.8615 - val_fusion_accuracy: 0.9262
 - val_combined_accuracy: 0.9244 - val_opt_f1score: 0.8292 - val_sar_f1score: 0.7806
- val_fusion_f1score: 0.8480 - val_combined_f1score: 0.8463
Epoch 63/200
330/330 [==============================] - 118s 359ms/step - opt_loss: 0.0553 - sar_
loss: 0.0653 - fusion_loss: 0.0430 - loss: 0.1637 - opt_accuracy: 0.9623 - sar_accur
acy: 0.9525 - fusion_accuracy: 0.9700 - combined_accuracy: 0.9698 - opt_f1score: 0.9
519 - sar_f1score: 0.9416 - fusion_f1score: 0.9634 - combined_f1score: 0.9632 - val_
opt_loss: 0.1241 - val_sar_loss: 0.2116 - val_fusion_loss: 0.1148 - val_loss: 0.4505
- val_opt_accuracy: 0.9331 - val_sar_accuracy: 0.9073 - val_fusion_accuracy: 0.9364
 - val_combined_accuracy: 0.9364 - val_opt_f1score: 0.8657 - val_sar_f1score: 0.8150
- val_fusion_f1score: 0.8728 - val_combined_f1score: 0.8734
Epoch 64/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0568 - sar_
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loss: 0.0653 - fusion_loss: 0.0433 - loss: 0.1654 - opt_accuracy: 0.9616 - sar_accur
acy: 0.9531 - fusion_accuracy: 0.9701 - combined_accuracy: 0.9699 - opt_f1score: 0.9
505 - sar_f1score: 0.9419 - fusion_f1score: 0.9632 - combined_f1score: 0.9631 - val_
opt_loss: 0.1295 - val_sar_loss: 0.1826 - val_fusion_loss: 0.1177 - val_loss: 0.4298
- val_opt_accuracy: 0.9304 - val_sar_accuracy: 0.9082 - val_fusion_accuracy: 0.9364
 - val_combined_accuracy: 0.9365 - val_opt_f1score: 0.8692 - val_sar_f1score: 0.8136
- val_fusion_f1score: 0.8754 - val_combined_f1score: 0.8762
Epoch 65/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0559 - sar_
loss: 0.0650 - fusion_loss: 0.0431 - loss: 0.1640 - opt_accuracy: 0.9620 - sar_accur
acy: 0.9531 - fusion_accuracy: 0.9702 - combined_accuracy: 0.9700 - opt_f1score: 0.9
515 - sar_f1score: 0.9422 - fusion_f1score: 0.9635 - combined_f1score: 0.9634 - val_
opt_loss: 0.1188 - val_sar_loss: 0.4132 - val_fusion_loss: 0.1973 - val_loss: 0.7293
- val_opt_accuracy: 0.9344 - val_sar_accuracy: 0.8480 - val_fusion_accuracy: 0.9148
 - val_combined_accuracy: 0.9125 - val_opt_f1score: 0.8708 - val_sar_f1score: 0.7587
- val_fusion_f1score: 0.8486 - val_combined_f1score: 0.8466
Epoch 66/200
330/330 [==============================] - 118s 358ms/step - opt_loss: 0.0540 - sar_
loss: 0.0628 - fusion_loss: 0.0417 - loss: 0.1585 - opt_accuracy: 0.9635 - sar_accur
acy: 0.9548 - fusion_accuracy: 0.9713 - combined_accuracy: 0.9711 - opt_f1score: 0.9
533 - sar_f1score: 0.9444 - fusion_f1score: 0.9648 - combined_f1score: 0.9647 - val_
opt_loss: 0.1366 - val_sar_loss: 0.2125 - val_fusion_loss: 0.1226 - val_loss: 0.4716
- val_opt_accuracy: 0.9330 - val_sar_accuracy: 0.8953 - val_fusion_accuracy: 0.9361
 - val_combined_accuracy: 0.9364 - val_opt_f1score: 0.8665 - val_sar_f1score: 0.7972
- val_fusion_f1score: 0.8730 - val_combined_f1score: 0.8738
Epoch 67/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0539 - sar_
loss: 0.0624 - fusion_loss: 0.0413 - loss: 0.1577 - opt_accuracy: 0.9638 - sar_accur
acy: 0.9552 - fusion_accuracy: 0.9717 - combined_accuracy: 0.9716 - opt_f1score: 0.9
535 - sar_f1score: 0.9449 - fusion_f1score: 0.9652 - combined_f1score: 0.9652 - val_
opt_loss: 0.1561 - val_sar_loss: 0.2180 - val_fusion_loss: 0.1353 - val_loss: 0.5095
- val_opt_accuracy: 0.9140 - val_sar_accuracy: 0.9094 - val_fusion_accuracy: 0.9264
 - val_combined_accuracy: 0.9301 - val_opt_f1score: 0.8298 - val_sar_f1score: 0.8077
- val_fusion_f1score: 0.8557 - val_combined_f1score: 0.8600
Epoch 68/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0539 - sar_
loss: 0.0641 - fusion_loss: 0.0417 - loss: 0.1597 - opt_accuracy: 0.9638 - sar_accur
acy: 0.9540 - fusion_accuracy: 0.9714 - combined_accuracy: 0.9711 - opt_f1score: 0.9
535 - sar_f1score: 0.9431 - fusion_f1score: 0.9648 - combined_f1score: 0.9647 - val_
opt_loss: 0.1265 - val_sar_loss: 0.3561 - val_fusion_loss: 0.2005 - val_loss: 0.6831
- val_opt_accuracy: 0.9388 - val_sar_accuracy: 0.8800 - val_fusion_accuracy: 0.9294
 - val_combined_accuracy: 0.9277 - val_opt_f1score: 0.8725 - val_sar_f1score: 0.7964
- val_fusion_f1score: 0.8625 - val_combined_f1score: 0.8601
Epoch 69/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0524 - sar_
loss: 0.0621 - fusion_loss: 0.0407 - loss: 0.1552 - opt_accuracy: 0.9644 - sar_accur
acy: 0.9553 - fusion_accuracy: 0.9720 - combined_accuracy: 0.9719 - opt_f1score: 0.9
550 - sar_f1score: 0.9451 - fusion_f1score: 0.9659 - combined_f1score: 0.9658 - val_
opt_loss: 0.1403 - val_sar_loss: 0.2037 - val_fusion_loss: 0.1365 - val_loss: 0.4806
- val_opt_accuracy: 0.9229 - val_sar_accuracy: 0.8909 - val_fusion_accuracy: 0.9280
 - val_combined_accuracy: 0.9304 - val_opt_f1score: 0.8438 - val_sar_f1score: 0.8007
- val_fusion_f1score: 0.8587 - val_combined_f1score: 0.8610
Epoch 70/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0527 - sar_
loss: 0.0622 - fusion_loss: 0.0408 - loss: 0.1557 - opt_accuracy: 0.9644 - sar_accur
acy: 0.9552 - fusion_accuracy: 0.9720 - combined_accuracy: 0.9719 - opt_f1score: 0.9
545 - sar_f1score: 0.9451 - fusion_f1score: 0.9657 - combined_f1score: 0.9656 - val_
opt_loss: 0.1278 - val_sar_loss: 0.2845 - val_fusion_loss: 0.1317 - val_loss: 0.5440
- val_opt_accuracy: 0.9373 - val_sar_accuracy: 0.7939 - val_fusion_accuracy: 0.9270
 - val_combined_accuracy: 0.9282 - val_opt_f1score: 0.8711 - val_sar_f1score: 0.6805
- val_fusion_f1score: 0.8641 - val_combined_f1score: 0.8648
Epoch 71/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0517 - sar_
loss: 0.0596 - fusion_loss: 0.0397 - loss: 0.1510 - opt_accuracy: 0.9654 - sar_accur
acy: 0.9573 - fusion_accuracy: 0.9731 - combined_accuracy: 0.9729 - opt_f1score: 0.9
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556 - sar_f1score: 0.9478 - fusion_f1score: 0.9669 - combined_f1score: 0.9668 - val_
opt_loss: 0.1315 - val_sar_loss: 0.1913 - val_fusion_loss: 0.1264 - val_loss: 0.4491
- val_opt_accuracy: 0.9367 - val_sar_accuracy: 0.8946 - val_fusion_accuracy: 0.9341
 - val_combined_accuracy: 0.9349 - val_opt_f1score: 0.8704 - val_sar_f1score: 0.7991
- val_fusion_f1score: 0.8726 - val_combined_f1score: 0.8730
Epoch 72/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0510 - sar_
loss: 0.0612 - fusion_loss: 0.0396 - loss: 0.1519 - opt_accuracy: 0.9659 - sar_accur
acy: 0.9566 - fusion_accuracy: 0.9732 - combined_accuracy: 0.9731 - opt_f1score: 0.9
564 - sar_f1score: 0.9462 - fusion_f1score: 0.9670 - combined_f1score: 0.9670 - val_
opt_loss: 0.1256 - val_sar_loss: 0.2606 - val_fusion_loss: 0.1319 - val_loss: 0.5181
- val_opt_accuracy: 0.9356 - val_sar_accuracy: 0.8927 - val_fusion_accuracy: 0.9337
 - val_combined_accuracy: 0.9330 - val_opt_f1score: 0.8711 - val_sar_f1score: 0.7997
- val_fusion_f1score: 0.8721 - val_combined_f1score: 0.8720
Epoch 73/200
330/330 [==============================] - 118s 358ms/step - opt_loss: 0.0509 - sar_
loss: 0.0582 - fusion_loss: 0.0390 - loss: 0.1481 - opt_accuracy: 0.9659 - sar_accur
acy: 0.9581 - fusion_accuracy: 0.9735 - combined_accuracy: 0.9734 - opt_f1score: 0.9
564 - sar_f1score: 0.9490 - fusion_f1score: 0.9676 - combined_f1score: 0.9676 - val_
opt_loss: 0.1129 - val_sar_loss: 0.2313 - val_fusion_loss: 0.1198 - val_loss: 0.4640
- val_opt_accuracy: 0.9376 - val_sar_accuracy: 0.9119 - val_fusion_accuracy: 0.9398
 - val_combined_accuracy: 0.9405 - val_opt_f1score: 0.8812 - val_sar_f1score: 0.8099
- val_fusion_f1score: 0.8776 - val_combined_f1score: 0.8794
Epoch 74/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0513 - sar_
loss: 0.0596 - fusion_loss: 0.0394 - loss: 0.1502 - opt_accuracy: 0.9658 - sar_accur
acy: 0.9571 - fusion_accuracy: 0.9733 - combined_accuracy: 0.9731 - opt_f1score: 0.9
563 - sar_f1score: 0.9478 - fusion_f1score: 0.9673 - combined_f1score: 0.9672 - val_
opt_loss: 0.1247 - val_sar_loss: 0.2212 - val_fusion_loss: 0.1244 - val_loss: 0.4702
- val_opt_accuracy: 0.9349 - val_sar_accuracy: 0.8558 - val_fusion_accuracy: 0.9288
 - val_combined_accuracy: 0.9305 - val_opt_f1score: 0.8712 - val_sar_f1score: 0.7674
- val_fusion_f1score: 0.8693 - val_combined_f1score: 0.8719
Epoch 75/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0519 - sar_
loss: 0.0596 - fusion_loss: 0.0395 - loss: 0.1510 - opt_accuracy: 0.9655 - sar_accur
acy: 0.9572 - fusion_accuracy: 0.9732 - combined_accuracy: 0.9731 - opt_f1score: 0.9
556 - sar_f1score: 0.9477 - fusion_f1score: 0.9671 - combined_f1score: 0.9671 - val_
opt_loss: 0.2145 - val_sar_loss: 0.2128 - val_fusion_loss: 0.1825 - val_loss: 0.6098
- val_opt_accuracy: 0.8792 - val_sar_accuracy: 0.9112 - val_fusion_accuracy: 0.9053
 - val_combined_accuracy: 0.9117 - val_opt_f1score: 0.7759 - val_sar_f1score: 0.8140
- val_fusion_f1score: 0.8209 - val_combined_f1score: 0.8261
Epoch 76/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0497 - sar_
loss: 0.0576 - fusion_loss: 0.0383 - loss: 0.1456 - opt_accuracy: 0.9668 - sar_accur
acy: 0.9584 - fusion_accuracy: 0.9741 - combined_accuracy: 0.9740 - opt_f1score: 0.9
578 - sar_f1score: 0.9496 - fusion_f1score: 0.9684 - combined_f1score: 0.9683 - val_
opt_loss: 0.1397 - val_sar_loss: 0.2030 - val_fusion_loss: 0.1199 - val_loss: 0.4626
- val_opt_accuracy: 0.9285 - val_sar_accuracy: 0.9077 - val_fusion_accuracy: 0.9387
 - val_combined_accuracy: 0.9390 - val_opt_f1score: 0.8630 - val_sar_f1score: 0.8038
- val_fusion_f1score: 0.8792 - val_combined_f1score: 0.8790
Epoch 77/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0494 - sar_
loss: 0.0567 - fusion_loss: 0.0378 - loss: 0.1438 - opt_accuracy: 0.9671 - sar_accur
acy: 0.9594 - fusion_accuracy: 0.9746 - combined_accuracy: 0.9745 - opt_f1score: 0.9
581 - sar_f1score: 0.9508 - fusion_f1score: 0.9689 - combined_f1score: 0.9689 - val_
opt_loss: 0.1235 - val_sar_loss: 0.2050 - val_fusion_loss: 0.1226 - val_loss: 0.4512
- val_opt_accuracy: 0.9337 - val_sar_accuracy: 0.9151 - val_fusion_accuracy: 0.9383
 - val_combined_accuracy: 0.9391 - val_opt_f1score: 0.8768 - val_sar_f1score: 0.8208
- val_fusion_f1score: 0.8777 - val_combined_f1score: 0.8792
Epoch 78/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0499 - sar_
loss: 0.0591 - fusion_loss: 0.0386 - loss: 0.1477 - opt_accuracy: 0.9668 - sar_accur
acy: 0.9581 - fusion_accuracy: 0.9740 - combined_accuracy: 0.9739 - opt_f1score: 0.9
576 - sar_f1score: 0.9485 - fusion_f1score: 0.9681 - combined_f1score: 0.9681 - val_
opt_loss: 0.1241 - val_sar_loss: 0.2370 - val_fusion_loss: 0.1351 - val_loss: 0.4962
```

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- val_opt_accuracy: 0.9389 - val_sar_accuracy: 0.8892 - val_fusion_accuracy: 0.9367
 - val_combined_accuracy: 0.9376 - val_opt_f1score: 0.8756 - val_sar_f1score: 0.7771
- val_fusion_f1score: 0.8633 - val_combined_f1score: 0.8647
Epoch 79/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0487 - sar_
loss: 0.0564 - fusion_loss: 0.0373 - loss: 0.1424 - opt_accuracy: 0.9676 - sar_accur
acy: 0.9598 - fusion_accuracy: 0.9750 - combined_accuracy: 0.9749 - opt_f1score: 0.9
588 - sar_f1score: 0.9510 - fusion_f1score: 0.9695 - combined_f1score: 0.9695 - val_
opt_loss: 0.1486 - val_sar_loss: 0.2215 - val_fusion_loss: 0.1312 - val_loss: 0.5013
- val_opt_accuracy: 0.9327 - val_sar_accuracy: 0.9066 - val_fusion_accuracy: 0.9358
 - val_combined_accuracy: 0.9358 - val_opt_f1score: 0.8665 - val_sar_f1score: 0.8029
- val_fusion_f1score: 0.8735 - val_combined_f1score: 0.8730
Epoch 80/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0499 - sar_
loss: 0.0562 - fusion_loss: 0.0377 - loss: 0.1438 - opt_accuracy: 0.9667 - sar_accur
acy: 0.9600 - fusion_accuracy: 0.9746 - combined_accuracy: 0.9745 - opt_f1score: 0.9
576 - sar_f1score: 0.9513 - fusion_f1score: 0.9690 - combined_f1score: 0.9690 - val_
opt_loss: 0.1305 - val_sar_loss: 0.3591 - val_fusion_loss: 0.1613 - val_loss: 0.6509
- val_opt_accuracy: 0.9380 - val_sar_accuracy: 0.8760 - val_fusion_accuracy: 0.9302
 - val_combined_accuracy: 0.9286 - val_opt_f1score: 0.8779 - val_sar_f1score: 0.7938
- val_fusion_f1score: 0.8691 - val_combined_f1score: 0.8679
Epoch 81/200
330/330 [==============================] - 118s 358ms/step - opt_loss: 0.0488 - sar_
loss: 0.0566 - fusion_loss: 0.0375 - loss: 0.1430 - opt_accuracy: 0.9675 - sar_accur
acy: 0.9597 - fusion_accuracy: 0.9748 - combined_accuracy: 0.9747 - opt_f1score: 0.9
587 - sar_f1score: 0.9509 - fusion_f1score: 0.9692 - combined_f1score: 0.9692 - val_
opt_loss: 0.1254 - val_sar_loss: 0.4403 - val_fusion_loss: 0.2147 - val_loss: 0.7804
- val_opt_accuracy: 0.9390 - val_sar_accuracy: 0.8649 - val_fusion_accuracy: 0.9211
 - val_combined_accuracy: 0.9189 - val_opt_f1score: 0.8796 - val_sar_f1score: 0.7617
- val_fusion_f1score: 0.8581 - val_combined_f1score: 0.8566
Epoch 82/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0472 - sar_
loss: 0.0556 - fusion_loss: 0.0365 - loss: 0.1393 - opt_accuracy: 0.9688 - sar_accur
acy: 0.9603 - fusion_accuracy: 0.9756 - combined_accuracy: 0.9755 - opt_f1score: 0.9
603 - sar_f1score: 0.9518 - fusion_f1score: 0.9702 - combined_f1score: 0.9702 - val_
opt_loss: 0.1353 - val_sar_loss: 0.2982 - val_fusion_loss: 0.1524 - val_loss: 0.5860
- val_opt_accuracy: 0.9359 - val_sar_accuracy: 0.9078 - val_fusion_accuracy: 0.9375
 - val_combined_accuracy: 0.9373 - val_opt_f1score: 0.8765 - val_sar_f1score: 0.7888
- val_fusion_f1score: 0.8693 - val_combined_f1score: 0.8700
Epoch 83/200
330/330 [==============================] - 118s 358ms/step - opt_loss: 0.0484 - sar_
loss: 0.0560 - fusion_loss: 0.0371 - loss: 0.1414 - opt_accuracy: 0.9682 - sar_accur
acy: 0.9603 - fusion_accuracy: 0.9753 - combined_accuracy: 0.9752 - opt_f1score: 0.9
591 - sar_f1score: 0.9515 - fusion_f1score: 0.9697 - combined_f1score: 0.9697 - val_
opt_loss: 0.1402 - val_sar_loss: 0.2463 - val_fusion_loss: 0.1483 - val_loss: 0.5347
- val_opt_accuracy: 0.9338 - val_sar_accuracy: 0.8743 - val_fusion_accuracy: 0.9324
 - val_combined_accuracy: 0.9333 - val_opt_f1score: 0.8545 - val_sar_f1score: 0.7740
- val_fusion_f1score: 0.8602 - val_combined_f1score: 0.8600
Epoch 84/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0474 - sar_
loss: 0.0551 - fusion_loss: 0.0364 - loss: 0.1389 - opt_accuracy: 0.9688 - sar_accur
acy: 0.9611 - fusion_accuracy: 0.9758 - combined_accuracy: 0.9758 - opt_f1score: 0.9
600 - sar_f1score: 0.9525 - fusion_f1score: 0.9704 - combined_f1score: 0.9704 - val_
opt_loss: 0.1283 - val_sar_loss: 0.7087 - val_fusion_loss: 0.4131 - val_loss: 1.2501
- val_opt_accuracy: 0.9386 - val_sar_accuracy: 0.8181 - val_fusion_accuracy: 0.8955
 - val_combined_accuracy: 0.8947 - val_opt_f1score: 0.8777 - val_sar_f1score: 0.7558
- val_fusion_f1score: 0.8330 - val_combined_f1score: 0.8324
Epoch 85/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0477 - sar_
loss: 0.0555 - fusion_loss: 0.0365 - loss: 0.1397 - opt_accuracy: 0.9688 - sar_accur
acy: 0.9605 - fusion_accuracy: 0.9758 - combined_accuracy: 0.9757 - opt_f1score: 0.9
599 - sar_f1score: 0.9520 - fusion_f1score: 0.9703 - combined_f1score: 0.9703 - val_
opt_loss: 0.1308 - val_sar_loss: 0.2641 - val_fusion_loss: 0.1467 - val_loss: 0.5415
- val_opt_accuracy: 0.9388 - val_sar_accuracy: 0.9137 - val_fusion_accuracy: 0.9391
 - val_combined_accuracy: 0.9392 - val_opt_f1score: 0.8825 - val_sar_f1score: 0.8183
```

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- val_fusion_f1score: 0.8788 - val_combined_f1score: 0.8782
Epoch 86/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0473 - sar_
loss: 0.0548 - fusion_loss: 0.0363 - loss: 0.1385 - opt_accuracy: 0.9687 - sar_accur
acy: 0.9612 - fusion_accuracy: 0.9759 - combined_accuracy: 0.9758 - opt_f1score: 0.9
602 - sar_f1score: 0.9527 - fusion_f1score: 0.9705 - combined_f1score: 0.9705 - val_
opt_loss: 0.1178 - val_sar_loss: 0.2765 - val_fusion_loss: 0.1296 - val_loss: 0.5239
- val_opt_accuracy: 0.9395 - val_sar_accuracy: 0.9039 - val_fusion_accuracy: 0.9383
 - val_combined_accuracy: 0.9377 - val_opt_f1score: 0.8827 - val_sar_f1score: 0.8237
- val_fusion_f1score: 0.8814 - val_combined_f1score: 0.8819
Epoch 87/200
330/330 [==============================] - 118s 356ms/step - opt_loss: 0.0465 - sar_
loss: 0.0537 - fusion_loss: 0.0357 - loss: 0.1360 - opt_accuracy: 0.9695 - sar_accur
acy: 0.9623 - fusion_accuracy: 0.9765 - combined_accuracy: 0.9764 - opt_f1score: 0.9
610 - sar_f1score: 0.9539 - fusion_f1score: 0.9711 - combined_f1score: 0.9711 - val_
opt_loss: 0.1360 - val_sar_loss: 0.2571 - val_fusion_loss: 0.1443 - val_loss: 0.5374
- val_opt_accuracy: 0.9335 - val_sar_accuracy: 0.9106 - val_fusion_accuracy: 0.9356
 - val_combined_accuracy: 0.9352 - val_opt_f1score: 0.8701 - val_sar_f1score: 0.8234
- val_fusion_f1score: 0.8756 - val_combined_f1score: 0.8744
Epoch 88/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0463 - sar_
loss: 0.0525 - fusion_loss: 0.0354 - loss: 0.1342 - opt_accuracy: 0.9696 - sar_accur
acy: 0.9629 - fusion_accuracy: 0.9766 - combined_accuracy: 0.9766 - opt_f1score: 0.9
613 - sar_f1score: 0.9551 - fusion_f1score: 0.9715 - combined_f1score: 0.9715 - val_
opt_loss: 0.1292 - val_sar_loss: 0.2538 - val_fusion_loss: 0.1319 - val_loss: 0.5148
- val_opt_accuracy: 0.9379 - val_sar_accuracy: 0.8426 - val_fusion_accuracy: 0.9346
 - val_combined_accuracy: 0.9346 - val_opt_f1score: 0.8772 - val_sar_f1score: 0.7522
- val_fusion_f1score: 0.8753 - val_combined_f1score: 0.8748
Epoch 89/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0450 - sar_
loss: 0.0518 - fusion_loss: 0.0346 - loss: 0.1315 - opt_accuracy: 0.9706 - sar_accur
acy: 0.9634 - fusion_accuracy: 0.9772 - combined_accuracy: 0.9772 - opt_f1score: 0.9
625 - sar_f1score: 0.9559 - fusion_f1score: 0.9722 - combined_f1score: 0.9722 - val_
opt_loss: 0.1355 - val_sar_loss: 0.2164 - val_fusion_loss: 0.1332 - val_loss: 0.4850
- val_opt_accuracy: 0.9350 - val_sar_accuracy: 0.9203 - val_fusion_accuracy: 0.9419
 - val_combined_accuracy: 0.9427 - val_opt_f1score: 0.8802 - val_sar_f1score: 0.8217
- val_fusion_f1score: 0.8784 - val_combined_f1score: 0.8798
Epoch 90/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0463 - sar_
loss: 0.0539 - fusion_loss: 0.0356 - loss: 0.1358 - opt_accuracy: 0.9696 - sar_accur
acy: 0.9620 - fusion_accuracy: 0.9765 - combined_accuracy: 0.9765 - opt_f1score: 0.9
611 - sar_f1score: 0.9537 - fusion_f1score: 0.9712 - combined_f1score: 0.9712 - val_
opt_loss: 0.1557 - val_sar_loss: 0.2570 - val_fusion_loss: 0.1388 - val_loss: 0.5515
- val_opt_accuracy: 0.9041 - val_sar_accuracy: 0.8986 - val_fusion_accuracy: 0.9368
 - val_combined_accuracy: 0.9365 - val_opt_f1score: 0.8384 - val_sar_f1score: 0.8110
- val_fusion_f1score: 0.8722 - val_combined_f1score: 0.8717
Epoch 91/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0458 - sar_
loss: 0.0524 - fusion_loss: 0.0349 - loss: 0.1331 - opt_accuracy: 0.9700 - sar_accur
acy: 0.9630 - fusion_accuracy: 0.9770 - combined_accuracy: 0.9770 - opt_f1score: 0.9
617 - sar_f1score: 0.9553 - fusion_f1score: 0.9720 - combined_f1score: 0.9720 - val_
opt_loss: 0.1476 - val_sar_loss: 0.2615 - val_fusion_loss: 0.1402 - val_loss: 0.5493
- val_opt_accuracy: 0.9268 - val_sar_accuracy: 0.9051 - val_fusion_accuracy: 0.9349
 - val_combined_accuracy: 0.9355 - val_opt_f1score: 0.8476 - val_sar_f1score: 0.8170
- val_fusion_f1score: 0.8651 - val_combined_f1score: 0.8654
Epoch 92/200
330/330 [==============================] - 118s 358ms/step - opt_loss: 0.0450 - sar_
loss: 0.0526 - fusion_loss: 0.0348 - loss: 0.1323 - opt_accuracy: 0.9706 - sar_accur
acy: 0.9627 - fusion_accuracy: 0.9771 - combined_accuracy: 0.9770 - opt_f1score: 0.9
625 - sar_f1score: 0.9550 - fusion_f1score: 0.9721 - combined_f1score: 0.9721 - val_
opt_loss: 0.1258 - val_sar_loss: 0.3530 - val_fusion_loss: 0.1852 - val_loss: 0.6640
- val_opt_accuracy: 0.9403 - val_sar_accuracy: 0.8954 - val_fusion_accuracy: 0.9367
 - val_combined_accuracy: 0.9353 - val_opt_f1score: 0.8831 - val_sar_f1score: 0.7369
- val_fusion_f1score: 0.8677 - val_combined_f1score: 0.8671
Epoch 93/200
```

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330/330 [==============================] - 118s 359ms/step - opt_loss: 0.0465 - sar_
loss: 0.0526 - fusion_loss: 0.0351 - loss: 0.1342 - opt_accuracy: 0.9697 - sar_accur
acy: 0.9629 - fusion_accuracy: 0.9769 - combined_accuracy: 0.9769 - opt_f1score: 0.9
610 - sar_f1score: 0.9550 - fusion_f1score: 0.9717 - combined_f1score: 0.9718 - val_
opt_loss: 0.1276 - val_sar_loss: 0.2383 - val_fusion_loss: 0.1278 - val_loss: 0.4937
- val_opt_accuracy: 0.9404 - val_sar_accuracy: 0.9006 - val_fusion_accuracy: 0.9422
 - val_combined_accuracy: 0.9438 - val_opt_f1score: 0.8847 - val_sar_f1score: 0.7933
- val_fusion_f1score: 0.8794 - val_combined_f1score: 0.8819
Epoch 94/200
330/330 [==============================] - 118s 358ms/step - opt_loss: 0.0447 - sar_
loss: 0.0520 - fusion_loss: 0.0344 - loss: 0.1311 - opt_accuracy: 0.9707 - sar_accur
acy: 0.9633 - fusion_accuracy: 0.9775 - combined_accuracy: 0.9774 - opt_f1score: 0.9
628 - sar_f1score: 0.9556 - fusion_f1score: 0.9725 - combined_f1score: 0.9725 - val_
opt_loss: 0.1312 - val_sar_loss: 0.3425 - val_fusion_loss: 0.1718 - val_loss: 0.6455
- val_opt_accuracy: 0.9412 - val_sar_accuracy: 0.8921 - val_fusion_accuracy: 0.9350
 - val_combined_accuracy: 0.9332 - val_opt_f1score: 0.8814 - val_sar_f1score: 0.8106
- val_fusion_f1score: 0.8738 - val_combined_f1score: 0.8724
Epoch 95/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0441 - sar_
loss: 0.0508 - fusion_loss: 0.0338 - loss: 0.1287 - opt_accuracy: 0.9712 - sar_accur
acy: 0.9644 - fusion_accuracy: 0.9780 - combined_accuracy: 0.9779 - opt_f1score: 0.9
635 - sar_f1score: 0.9569 - fusion_f1score: 0.9731 - combined_f1score: 0.9731 - val_
opt_loss: 0.1342 - val_sar_loss: 0.2207 - val_fusion_loss: 0.1270 - val_loss: 0.4818
- val_opt_accuracy: 0.9405 - val_sar_accuracy: 0.8954 - val_fusion_accuracy: 0.9446
 - val_combined_accuracy: 0.9453 - val_opt_f1score: 0.8825 - val_sar_f1score: 0.8058
- val_fusion_f1score: 0.8838 - val_combined_f1score: 0.8840
Epoch 96/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0439 - sar_
loss: 0.0497 - fusion_loss: 0.0335 - loss: 0.1271 - opt_accuracy: 0.9714 - sar_accur
acy: 0.9650 - fusion_accuracy: 0.9782 - combined_accuracy: 0.9781 - opt_f1score: 0.9
636 - sar_f1score: 0.9579 - fusion_f1score: 0.9734 - combined_f1score: 0.9734 - val_
opt_loss: 0.1252 - val_sar_loss: 0.2064 - val_fusion_loss: 0.1245 - val_loss: 0.4560
- val_opt_accuracy: 0.9445 - val_sar_accuracy: 0.8986 - val_fusion_accuracy: 0.9414
 - val_combined_accuracy: 0.9423 - val_opt_f1score: 0.8851 - val_sar_f1score: 0.8164
- val_fusion_f1score: 0.8832 - val_combined_f1score: 0.8840
Epoch 97/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0445 - sar_
loss: 0.0512 - fusion_loss: 0.0341 - loss: 0.1297 - opt_accuracy: 0.9709 - sar_accur
acy: 0.9639 - fusion_accuracy: 0.9777 - combined_accuracy: 0.9776 - opt_f1score: 0.9
629 - sar_f1score: 0.9565 - fusion_f1score: 0.9728 - combined_f1score: 0.9728 - val_
opt_loss: 0.1787 - val_sar_loss: 0.2385 - val_fusion_loss: 0.1699 - val_loss: 0.5871
- val_opt_accuracy: 0.9174 - val_sar_accuracy: 0.8959 - val_fusion_accuracy: 0.9316
 - val_combined_accuracy: 0.9322 - val_opt_f1score: 0.8277 - val_sar_f1score: 0.7941
- val_fusion_f1score: 0.8451 - val_combined_f1score: 0.8462
Epoch 98/200
330/330 [==============================] - 118s 358ms/step - opt_loss: 0.0455 - sar_
loss: 0.0519 - fusion_loss: 0.0345 - loss: 0.1318 - opt_accuracy: 0.9702 - sar_accur
acy: 0.9634 - fusion_accuracy: 0.9773 - combined_accuracy: 0.9772 - opt_f1score: 0.9
621 - sar_f1score: 0.9558 - fusion_f1score: 0.9724 - combined_f1score: 0.9724 - val_
opt_loss: 0.1345 - val_sar_loss: 0.3254 - val_fusion_loss: 0.1672 - val_loss: 0.6272
- val_opt_accuracy: 0.9356 - val_sar_accuracy: 0.8972 - val_fusion_accuracy: 0.9336
 - val_combined_accuracy: 0.9331 - val_opt_f1score: 0.8724 - val_sar_f1score: 0.7798
- val_fusion_f1score: 0.8596 - val_combined_f1score: 0.8610
Epoch 99/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0434 - sar_
loss: 0.0500 - fusion_loss: 0.0334 - loss: 0.1267 - opt_accuracy: 0.9719 - sar_accur
acy: 0.9649 - fusion_accuracy: 0.9783 - combined_accuracy: 0.9783 - opt_f1score: 0.9
642 - sar_f1score: 0.9577 - fusion_f1score: 0.9735 - combined_f1score: 0.9735 - val_
opt_loss: 0.1376 - val_sar_loss: 0.2100 - val_fusion_loss: 0.1276 - val_loss: 0.4753
- val_opt_accuracy: 0.9386 - val_sar_accuracy: 0.9139 - val_fusion_accuracy: 0.9447
 - val_combined_accuracy: 0.9456 - val_opt_f1score: 0.8823 - val_sar_f1score: 0.8160
- val_fusion_f1score: 0.8861 - val_combined_f1score: 0.8875
Epoch 100/200
330/330 [==============================] - 118s 358ms/step - opt_loss: 0.0448 - sar_
loss: 0.0510 - fusion_loss: 0.0340 - loss: 0.1298 - opt_accuracy: 0.9709 - sar_accur
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acy: 0.9642 - fusion_accuracy: 0.9778 - combined_accuracy: 0.9778 - opt_f1score: 0.9
627 - sar_f1score: 0.9566 - fusion_f1score: 0.9729 - combined_f1score: 0.9729 - val_
opt_loss: 0.1275 - val_sar_loss: 0.1784 - val_fusion_loss: 0.1134 - val_loss: 0.4192
- val_opt_accuracy: 0.9417 - val_sar_accuracy: 0.9154 - val_fusion_accuracy: 0.9479
 - val_combined_accuracy: 0.9484 - val_opt_f1score: 0.8892 - val_sar_f1score: 0.8201
- val_fusion_f1score: 0.8936 - val_combined_f1score: 0.8937
Epoch 101/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0430 - sar_
loss: 0.0489 - fusion_loss: 0.0327 - loss: 0.1247 - opt_accuracy: 0.9721 - sar_accur
acy: 0.9657 - fusion_accuracy: 0.9787 - combined_accuracy: 0.9786 - opt_f1score: 0.9
645 - sar_f1score: 0.9588 - fusion_f1score: 0.9741 - combined_f1score: 0.9742 - val_
opt_loss: 0.1261 - val_sar_loss: 0.4810 - val_fusion_loss: 0.2519 - val_loss: 0.8591
- val_opt_accuracy: 0.9426 - val_sar_accuracy: 0.8532 - val_fusion_accuracy: 0.9250
 - val_combined_accuracy: 0.9238 - val_opt_f1score: 0.8818 - val_sar_f1score: 0.7589
- val_fusion_f1score: 0.8553 - val_combined_f1score: 0.8551
Epoch 102/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0420 - sar_
loss: 0.0483 - fusion_loss: 0.0323 - loss: 0.1226 - opt_accuracy: 0.9728 - sar_accur
acy: 0.9664 - fusion_accuracy: 0.9792 - combined_accuracy: 0.9792 - opt_f1score: 0.9
655 - sar_f1score: 0.9595 - fusion_f1score: 0.9747 - combined_f1score: 0.9747 - val_
opt_loss: 0.1472 - val_sar_loss: 0.2543 - val_fusion_loss: 0.1453 - val_loss: 0.5468
- val_opt_accuracy: 0.9338 - val_sar_accuracy: 0.9193 - val_fusion_accuracy: 0.9394
 - val_combined_accuracy: 0.9397 - val_opt_f1score: 0.8655 - val_sar_f1score: 0.8195
- val_fusion_f1score: 0.8766 - val_combined_f1score: 0.8774
Epoch 103/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0434 - sar_
loss: 0.0542 - fusion_loss: 0.0336 - loss: 0.1312 - opt_accuracy: 0.9718 - sar_accur
acy: 0.9630 - fusion_accuracy: 0.9781 - combined_accuracy: 0.9781 - opt_f1score: 0.9
642 - sar_f1score: 0.9538 - fusion_f1score: 0.9733 - combined_f1score: 0.9733 - val_
opt_loss: 0.1574 - val_sar_loss: 0.2649 - val_fusion_loss: 0.1633 - val_loss: 0.5856
- val_opt_accuracy: 0.9276 - val_sar_accuracy: 0.8737 - val_fusion_accuracy: 0.9324
 - val_combined_accuracy: 0.9339 - val_opt_f1score: 0.8514 - val_sar_f1score: 0.7707
- val_fusion_f1score: 0.8530 - val_combined_f1score: 0.8566
Epoch 104/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0434 - sar_
loss: 0.0497 - fusion_loss: 0.0330 - loss: 0.1261 - opt_accuracy: 0.9718 - sar_accur
acy: 0.9653 - fusion_accuracy: 0.9786 - combined_accuracy: 0.9786 - opt_f1score: 0.9
642 - sar_f1score: 0.9581 - fusion_f1score: 0.9740 - combined_f1score: 0.9740 - val_
opt_loss: 0.1416 - val_sar_loss: 0.2930 - val_fusion_loss: 0.1701 - val_loss: 0.6047
- val_opt_accuracy: 0.9361 - val_sar_accuracy: 0.8995 - val_fusion_accuracy: 0.9356
 - val_combined_accuracy: 0.9348 - val_opt_f1score: 0.8752 - val_sar_f1score: 0.8241
- val_fusion_f1score: 0.8776 - val_combined_f1score: 0.8774
Epoch 105/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0424 - sar_
loss: 0.0490 - fusion_loss: 0.0326 - loss: 0.1240 - opt_accuracy: 0.9724 - sar_accur
acy: 0.9659 - fusion_accuracy: 0.9789 - combined_accuracy: 0.9788 - opt_f1score: 0.9
650 - sar_f1score: 0.9589 - fusion_f1score: 0.9743 - combined_f1score: 0.9743 - val_
opt_loss: 0.1357 - val_sar_loss: 0.1894 - val_fusion_loss: 0.1244 - val_loss: 0.4494
- val_opt_accuracy: 0.9408 - val_sar_accuracy: 0.9215 - val_fusion_accuracy: 0.9466
 - val_combined_accuracy: 0.9469 - val_opt_f1score: 0.8846 - val_sar_f1score: 0.8280
- val_fusion_f1score: 0.8891 - val_combined_f1score: 0.8900
Epoch 106/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0416 - sar_
loss: 0.0473 - fusion_loss: 0.0317 - loss: 0.1206 - opt_accuracy: 0.9733 - sar_accur
acy: 0.9670 - fusion_accuracy: 0.9797 - combined_accuracy: 0.9796 - opt_f1score: 0.9
660 - sar_f1score: 0.9605 - fusion_f1score: 0.9753 - combined_f1score: 0.9753 - val_
opt_loss: 0.1361 - val_sar_loss: 0.2997 - val_fusion_loss: 0.1493 - val_loss: 0.5851
- val_opt_accuracy: 0.9388 - val_sar_accuracy: 0.9047 - val_fusion_accuracy: 0.9408
 - val_combined_accuracy: 0.9401 - val_opt_f1score: 0.8821 - val_sar_f1score: 0.8183
- val_fusion_f1score: 0.8819 - val_combined_f1score: 0.8812
Epoch 107/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0419 - sar_
loss: 0.0480 - fusion_loss: 0.0321 - loss: 0.1220 - opt_accuracy: 0.9730 - sar_accur
acy: 0.9666 - fusion_accuracy: 0.9793 - combined_accuracy: 0.9793 - opt_f1score: 0.9
656 - sar_f1score: 0.9598 - fusion_f1score: 0.9749 - combined_f1score: 0.9749 - val_
```

```
opt_loss: 0.1326 - val_sar_loss: 0.2498 - val_fusion_loss: 0.1407 - val_loss: 0.5231
- val_opt_accuracy: 0.9393 - val_sar_accuracy: 0.8978 - val_fusion_accuracy: 0.9396
 - val_combined_accuracy: 0.9407 - val_opt_f1score: 0.8804 - val_sar_f1score: 0.7962
- val_fusion_f1score: 0.8764 - val_combined_f1score: 0.8784
Epoch 108/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0406 - sar_
loss: 0.0468 - fusion_loss: 0.0313 - loss: 0.1188 - opt_accuracy: 0.9739 - sar_accur
acy: 0.9676 - fusion_accuracy: 0.9800 - combined_accuracy: 0.9800 - opt_f1score: 0.9
669 - sar_f1score: 0.9610 - fusion_f1score: 0.9757 - combined_f1score: 0.9757 - val_
opt_loss: 0.1384 - val_sar_loss: 0.2795 - val_fusion_loss: 0.1543 - val_loss: 0.5721
- val_opt_accuracy: 0.9432 - val_sar_accuracy: 0.9162 - val_fusion_accuracy: 0.9443
 - val_combined_accuracy: 0.9435 - val_opt_f1score: 0.8860 - val_sar_f1score: 0.8292
- val_fusion_f1score: 0.8819 - val_combined_f1score: 0.8811
Epoch 109/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0404 - sar_
loss: 0.0464 - fusion_loss: 0.0310 - loss: 0.1178 - opt_accuracy: 0.9739 - sar_accur
acy: 0.9675 - fusion_accuracy: 0.9800 - combined_accuracy: 0.9800 - opt_f1score: 0.9
670 - sar_f1score: 0.9613 - fusion_f1score: 0.9759 - combined_f1score: 0.9759 - val_
opt_loss: 0.1361 - val_sar_loss: 0.2553 - val_fusion_loss: 0.1535 - val_loss: 0.5448
- val_opt_accuracy: 0.9446 - val_sar_accuracy: 0.9205 - val_fusion_accuracy: 0.9453
 - val_combined_accuracy: 0.9449 - val_opt_f1score: 0.8854 - val_sar_f1score: 0.8301
- val_fusion_f1score: 0.8800 - val_combined_f1score: 0.8797
Epoch 110/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0406 - sar_
loss: 0.0473 - fusion_loss: 0.0312 - loss: 0.1191 - opt_accuracy: 0.9739 - sar_accur
acy: 0.9674 - fusion_accuracy: 0.9800 - combined_accuracy: 0.9800 - opt_f1score: 0.9
669 - sar_f1score: 0.9606 - fusion_f1score: 0.9757 - combined_f1score: 0.9757 - val_
opt_loss: 0.1468 - val_sar_loss: 0.9167 - val_fusion_loss: 0.4847 - val_loss: 1.5482
- val_opt_accuracy: 0.9358 - val_sar_accuracy: 0.8504 - val_fusion_accuracy: 0.9118
 - val_combined_accuracy: 0.9125 - val_opt_f1score: 0.8796 - val_sar_f1score: 0.4716
- val_fusion_f1score: 0.7481 - val_combined_f1score: 0.7672
Epoch 111/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0410 - sar_
loss: 0.0489 - fusion_loss: 0.0318 - loss: 0.1217 - opt_accuracy: 0.9735 - sar_accur
acy: 0.9661 - fusion_accuracy: 0.9796 - combined_accuracy: 0.9795 - opt_f1score: 0.9
664 - sar_f1score: 0.9591 - fusion_f1score: 0.9751 - combined_f1score: 0.9751 - val_
opt_loss: 0.1185 - val_sar_loss: 0.3207 - val_fusion_loss: 0.1682 - val_loss: 0.6075
- val_opt_accuracy: 0.9410 - val_sar_accuracy: 0.8603 - val_fusion_accuracy: 0.9289
 - val_combined_accuracy: 0.9302 - val_opt_f1score: 0.8824 - val_sar_f1score: 0.7205
- val_fusion_f1score: 0.8459 - val_combined_f1score: 0.8474
Epoch 112/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0427 - sar_
loss: 0.0470 - fusion_loss: 0.0317 - loss: 0.1214 - opt_accuracy: 0.9726 - sar_accur
acy: 0.9673 - fusion_accuracy: 0.9795 - combined_accuracy: 0.9795 - opt_f1score: 0.9
650 - sar_f1score: 0.9608 - fusion_f1score: 0.9752 - combined_f1score: 0.9752 - val_
opt_loss: 0.1415 - val_sar_loss: 0.4424 - val_fusion_loss: 0.2478 - val_loss: 0.8317
- val_opt_accuracy: 0.9335 - val_sar_accuracy: 0.8769 - val_fusion_accuracy: 0.9214
 - val_combined_accuracy: 0.9194 - val_opt_f1score: 0.8721 - val_sar_f1score: 0.7883
- val_fusion_f1score: 0.8567 - val_combined_f1score: 0.8546
Epoch 113/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0409 - sar_
loss: 0.0466 - fusion_loss: 0.0312 - loss: 0.1187 - opt_accuracy: 0.9737 - sar_accur
acy: 0.9677 - fusion_accuracy: 0.9800 - combined_accuracy: 0.9800 - opt_f1score: 0.9
665 - sar_f1score: 0.9613 - fusion_f1score: 0.9757 - combined_f1score: 0.9757 - val_
opt_loss: 0.1367 - val_sar_loss: 0.3445 - val_fusion_loss: 0.1810 - val_loss: 0.6622
- val_opt_accuracy: 0.9396 - val_sar_accuracy: 0.8919 - val_fusion_accuracy: 0.9351
 - val_combined_accuracy: 0.9335 - val_opt_f1score: 0.8828 - val_sar_f1score: 0.8100
- val_fusion_f1score: 0.8770 - val_combined_f1score: 0.8753
Epoch 114/200
330/330 [==============================] - 118s 357ms/step - opt_loss: 0.0396 - sar_
loss: 0.0456 - fusion_loss: 0.0305 - loss: 0.1157 - opt_accuracy: 0.9745 - sar_accur
acy: 0.9684 - fusion_accuracy: 0.9805 - combined_accuracy: 0.9805 - opt_f1score: 0.9
678 - sar_f1score: 0.9623 - fusion_f1score: 0.9765 - combined_f1score: 0.9765 - val_
opt_loss: 0.1312 - val_sar_loss: 0.2589 - val_fusion_loss: 0.1334 - val_loss: 0.5236
- val_opt_accuracy: 0.9431 - val_sar_accuracy: 0.9191 - val_fusion_accuracy: 0.9452
```

```
 - val_combined_accuracy: 0.9447 - val_opt_f1score: 0.8893 - val_sar_f1score: 0.8336
- val_fusion_f1score: 0.8884 - val_combined_f1score: 0.8882
Epoch 115/200
330/330 [==============================] - 118s 358ms/step - opt_loss: 0.0392 - sar_
loss: 0.0452 - fusion_loss: 0.0301 - loss: 0.1145 - opt_accuracy: 0.9750 - sar_accur
acy: 0.9687 - fusion_accuracy: 0.9809 - combined_accuracy: 0.9809 - opt_f1score: 0.9
683 - sar_f1score: 0.9627 - fusion_f1score: 0.9768 - combined_f1score: 0.9769 - val_
opt_loss: 0.1332 - val_sar_loss: 0.3281 - val_fusion_loss: 0.1798 - val_loss: 0.6411
- val_opt_accuracy: 0.9437 - val_sar_accuracy: 0.9119 - val_fusion_accuracy: 0.9424
 - val_combined_accuracy: 0.9417 - val_opt_f1score: 0.8886 - val_sar_f1score: 0.7903
- val_fusion_f1score: 0.8751 - val_combined_f1score: 0.8740
```

Show training history

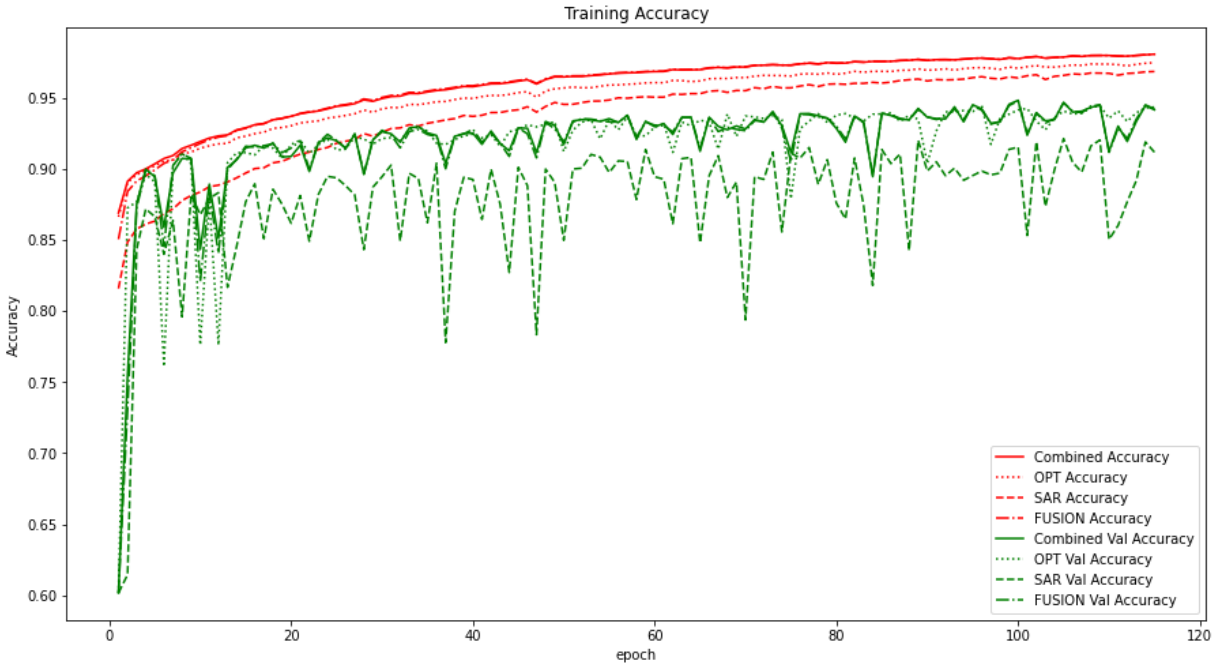
In [7]:

```
plt.figure(figsize=(15, 8))
x = np.arange(len(history.history['loss']))+1
plt.plot(x, history.history['loss'], 'r-',label='Total Loss')
plt.plot(x, history.history['opt_loss'], 'r:',label='OPT Loss')
plt.plot(x, history.history['sar_loss'], 'r--',label='SAR Loss')
plt.plot(x, history.history['fusion_loss'], 'r-.',label='FUSION Loss')

plt.plot(x, history.history['val_loss'], 'g-',label='Total Val Loss')
plt.plot(x, history.history['val_opt_loss'], 'g:',label='OPT Val Loss')
plt.plot(x, history.history['val_sar_loss'], 'g--',label='SAR Val Loss')
plt.plot(x, history.history['val_fusion_loss'], 'g-.',label='FUSION Val Loss')

plt.title('Training Loss')
plt.ylabel('Loss')
plt.xlabel('epoch')
plt.legend(loc='upper right')
plt.savefig('graphics/Loss.png')
plt.show()
```

In [8]:

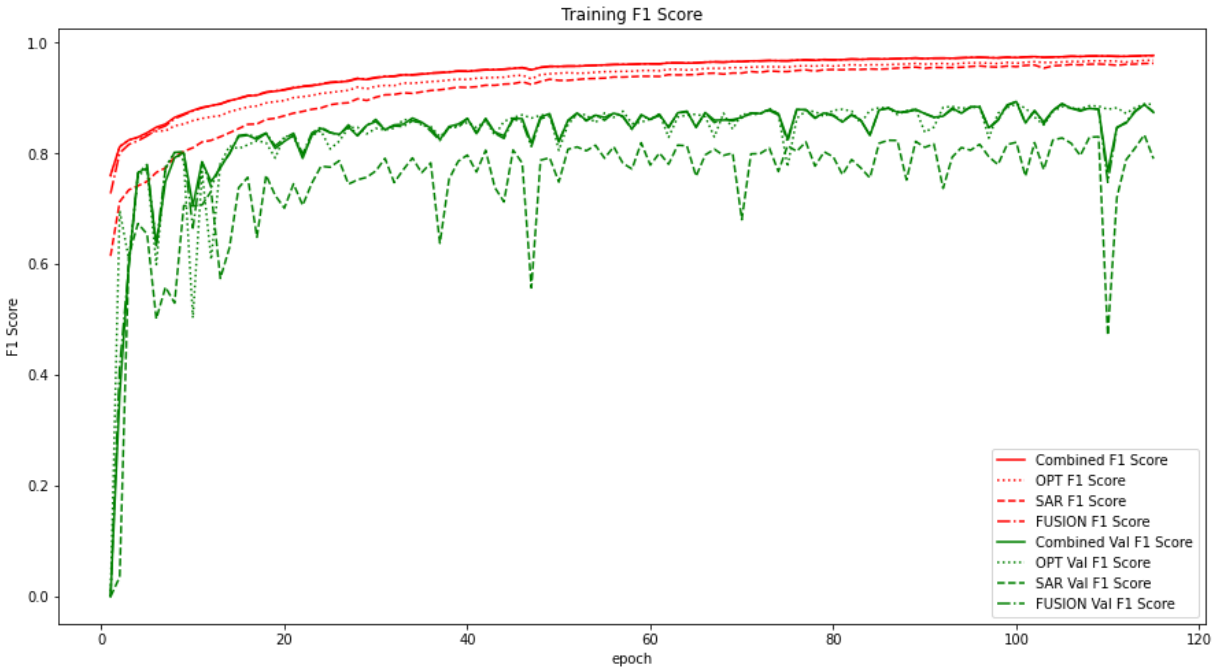
```
plt.figure(figsize=(15, 8))
x = np.arange(len(history.history['loss']))+1
plt.plot(x, history.history['combined_accuracy'], 'r-',label='Combined Accuracy')
plt.plot(x, history.history['opt_accuracy'], 'r:',label='OPT Accuracy')
plt.plot(x, history.history['sar_accuracy'], 'r--',label='SAR Accuracy')
plt.plot(x, history.history['fusion_accuracy'], 'r-.',label='FUSION Accuracy')
```

```
plt.plot(x, history.history['val_combined_accuracy'], 'g-',label='Combined Val Accur
plt.plot(x, history.history['val_opt_accuracy'], 'g:',label='OPT Val Accuracy')
plt.plot(x, history.history['val_sar_accuracy'], 'g--',label='SAR Val Accuracy')
plt.plot(x, history.history['val_fusion_accuracy'], 'g-.',label='FUSION Val Accuracy

plt.title('Training Accuracy')
plt.ylabel('Accuracy')
plt.xlabel('epoch')
plt.legend(loc='lower right')
plt.savefig('graphics/Accuracy.png')
plt.show()
```



In [9]:

```
plt.figure(figsize=(15, 8))
x = np.arange(len(history.history['loss']))+1
plt.plot(x, history.history['combined_f1score'], 'r-',label='Combined F1 Score')
plt.plot(x, history.history['opt_f1score'], 'r:',label='OPT F1 Score')
plt.plot(x, history.history['sar_f1score'], 'r--',label='SAR F1 Score')
plt.plot(x, history.history['fusion_f1score'], 'r-.',label='FUSION F1 Score')

plt.plot(x, history.history['val_combined_f1score'], 'g-',label='Combined Val F1 Sco
plt.plot(x, history.history['val_opt_f1score'], 'g:',label='OPT Val F1 Score')
plt.plot(x, history.history['val_sar_f1score'], 'g--',label='SAR Val F1 Score')
plt.plot(x, history.history['val_fusion_f1score'], 'g-.',label='FUSION Val F1 Score'

plt.title('Training F1 Score')
plt.ylabel('F1 Score')
plt.xlabel('epoch')
plt.legend(loc='lower right')
plt.savefig('graphics/F1score.png')
plt.show()
```



Evaluation

In [10]:

```
opt_avg_prec_list = []
sar_avg_prec_list = []
fusion_avg_prec_list = []
combined_avg_prec_list = []


pred_path = params_patches['pred_path']
shutil.rmtree(pred_path, ignore_errors=True)
os.makedirs(pred_path)


for tile_n in params_patches['test_tiles']:
    dl_test.set_tile(int(tile_n))

    shape_tile = shapes_json[str(tile_n)]

    y_true = np.load(os.path.join(params_patches['tiles_path'], params_patches['labe
    y_true = to_categorical(y_true, 3)

    predictions_opt = []
    predictions_sar = []
    predictions_fusion = []
    predictions_combined = []

    for batch in tqdm(range(len(dl_test))):
        pred = model.predict_on_batch(dl_test[batch][0])
        predictions_opt.append(pred[0])
        predictions_sar.append(pred[1])
        predictions_fusion.append(pred[2])
        predictions_combined.append(pred[3])

    predictions_opt = np.concatenate(predictions_opt, axis=0)
    predictions_sar = np.concatenate(predictions_sar, axis=0)
    predictions_fusion = np.concatenate(predictions_fusion, axis=0)
    predictions_combined = np.concatenate(predictions_combined, axis=0)

    predictions_opt_rec = reconstruct_image(predictions_opt, params_patches['patch_s
    predictions_sar_rec = reconstruct_image(predictions_sar, params_patches['patch_s
    predictions_fusion_rec = reconstruct_image(predictions_fusion, params_patches['p
```

```
    predictions_combined_rec = reconstruct_image(predictions_combined, params_patche

    np.save(os.path.join(params_patches['pred_path'], f'pred_opt_{tile_n:02d}.npy'),
    np.save(os.path.join(params_patches['pred_path'], f'pred_sar_{tile_n:02d}.npy'),
    np.save(os.path.join(params_patches['pred_path'], f'pred_fusion_{tile_n:02d}.npy
    np.save(os.path.join(params_patches['pred_path'], f'pred_combined_{tile_n:02d}.n

    opt_avg_prec = average_precision_score(y_true[:, :, 1].flatten(), predictions_op
    sar_avg_prec = average_precision_score(y_true[:, :, 1].flatten(), predictions_sa
    fusion_avg_prec = average_precision_score(y_true[:, :, 1].flatten(), predictions
    combined_avg_prec = average_precision_score(y_true[:, :, 1].flatten(), predictio

    opt_avg_prec_list.append(opt_avg_prec)
    sar_avg_prec_list.append(sar_avg_prec)
    fusion_avg_prec_list.append(fusion_avg_prec)
    combined_avg_prec_list.append(combined_avg_prec)

    print(f'Precision Average (Class 1) of OPT prediction of tile {tile_n} is {opt_a
    print(f'Precision Average (Class 1) of SAR prediction of tile {tile_n} is {sar_a
    print(f'Precision Average (Class 1) of FUSION prediction of tile {tile_n} is {fu
    print(f'Precision Average (Class 1) of COMBINED prediction of tile {tile_n} is {

    opt_avg_prec = average_precision_score(y_true[:, :, 0].flatten(), predictions_op
    sar_avg_prec = average_precision_score(y_true[:, :, 0].flatten(), predictions_sa
    fusion_avg_prec = average_precision_score(y_true[:, :, 0].flatten(), predictions
    combined_avg_prec = average_precision_score(y_true[:, :, 0].flatten(), predictio

    print(f'Precision Average (Class 0) of OPT prediction of tile {tile_n} is {opt_a
    print(f'Precision Average (Class 0) of SAR prediction of tile {tile_n} is {sar_a
    print(f'Precision Average (Class 0) of FUSION prediction of tile {tile_n} is {fu
    print(f'Precision Average (Class 0) of COMBINED prediction of tile {tile_n} is {
```

```
100%|██████████| 558/558 [02:33<00:00,  3.63it/s]
Precision Average (Class 1) of OPT prediction of tile 2 is 0.7756
Precision Average (Class 1) of SAR prediction of tile 2 is 0.5231
Precision Average (Class 1) of FUSION prediction of tile 2 is 0.7913
Precision Average (Class 1) of COMBINED prediction of tile 2 is 0.7427
Precision Average (Class 0) of OPT prediction of tile 2 is 0.9611
Precision Average (Class 0) of SAR prediction of tile 2 is 0.9252
Precision Average (Class 0) of FUSION prediction of tile 2 is 0.9632
Precision Average (Class 0) of COMBINED prediction of tile 2 is 0.9539
100%|██████████| 558/558 [02:33<00:00,  3.64it/s]
Precision Average (Class 1) of OPT prediction of tile 4 is 0.6024
Precision Average (Class 1) of SAR prediction of tile 4 is 0.4429
Precision Average (Class 1) of FUSION prediction of tile 4 is 0.6710
Precision Average (Class 1) of COMBINED prediction of tile 4 is 0.6470
Precision Average (Class 0) of OPT prediction of tile 4 is 0.9572
Precision Average (Class 0) of SAR prediction of tile 4 is 0.9242
Precision Average (Class 0) of FUSION prediction of tile 4 is 0.9613
Precision Average (Class 0) of COMBINED prediction of tile 4 is 0.9560
100%|██████████| 558/558 [02:18<00:00,  4.04it/s]
Precision Average (Class 1) of OPT prediction of tile 5 is 0.7813
Precision Average (Class 1) of SAR prediction of tile 5 is 0.5852
Precision Average (Class 1) of FUSION prediction of tile 5 is 0.7860
Precision Average (Class 1) of COMBINED prediction of tile 5 is 0.7584
Precision Average (Class 0) of OPT prediction of tile 5 is 0.9688
Precision Average (Class 0) of SAR prediction of tile 5 is 0.9431
Precision Average (Class 0) of FUSION prediction of tile 5 is 0.9720
Precision Average (Class 0) of COMBINED prediction of tile 5 is 0.9673
100%|██████████| 558/558 [02:33<00:00,  3.64it/s]
Precision Average (Class 1) of OPT prediction of tile 9 is 0.6836
Precision Average (Class 1) of SAR prediction of tile 9 is 0.5816
Precision Average (Class 1) of FUSION prediction of tile 9 is 0.7316
```

```
Precision Average (Class 1) of COMBINED prediction of tile 9 is 0.7110
Precision Average (Class 0) of OPT prediction of tile 9 is 0.9907
Precision Average (Class 0) of SAR prediction of tile 9 is 0.8200
Precision Average (Class 0) of FUSION prediction of tile 9 is 0.9861
Precision Average (Class 0) of COMBINED prediction of tile 9 is 0.9771
100%|██████████| 558/558 [02:33<00:00,  3.63it/s]
Precision Average (Class 1) of OPT prediction of tile 10 is 0.8132
Precision Average (Class 1) of SAR prediction of tile 10 is 0.6185
Precision Average (Class 1) of FUSION prediction of tile 10 is 0.8372
Precision Average (Class 1) of COMBINED prediction of tile 10 is 0.8167
Precision Average (Class 0) of OPT prediction of tile 10 is 0.9797
Precision Average (Class 0) of SAR prediction of tile 10 is 0.9565
Precision Average (Class 0) of FUSION prediction of tile 10 is 0.9810
Precision Average (Class 0) of COMBINED prediction of tile 10 is 0.9767
100%|██████████| 558/558 [03:57<00:00,  2.35it/s]
Precision Average (Class 1) of OPT prediction of tile 11 is 0.5356
Precision Average (Class 1) of SAR prediction of tile 11 is 0.2646
Precision Average (Class 1) of FUSION prediction of tile 11 is 0.5350
Precision Average (Class 1) of COMBINED prediction of tile 11 is 0.4935
Precision Average (Class 0) of OPT prediction of tile 11 is 0.9577
Precision Average (Class 0) of SAR prediction of tile 11 is 0.9219
Precision Average (Class 0) of FUSION prediction of tile 11 is 0.9599
Precision Average (Class 0) of COMBINED prediction of tile 11 is 0.9541
100%|██████████| 558/558 [02:58<00:00,  3.13it/s]
Precision Average (Class 1) of OPT prediction of tile 13 is 0.6150
Precision Average (Class 1) of SAR prediction of tile 13 is 0.3095
Precision Average (Class 1) of FUSION prediction of tile 13 is 0.6253
Precision Average (Class 1) of COMBINED prediction of tile 13 is 0.5760
Precision Average (Class 0) of OPT prediction of tile 13 is 0.9692
Precision Average (Class 0) of SAR prediction of tile 13 is 0.8962
Precision Average (Class 0) of FUSION prediction of tile 13 is 0.9701
Precision Average (Class 0) of COMBINED prediction of tile 13 is 0.9607
100%|██████████| 558/558 [02:11<00:00,  4.23it/s]
Precision Average (Class 1) of OPT prediction of tile 15 is 0.1909
Precision Average (Class 1) of SAR prediction of tile 15 is 0.0248
Precision Average (Class 1) of FUSION prediction of tile 15 is 0.2551
Precision Average (Class 1) of COMBINED prediction of tile 15 is 0.1790
Precision Average (Class 0) of OPT prediction of tile 15 is 0.9810
Precision Average (Class 0) of SAR prediction of tile 15 is 0.6981
Precision Average (Class 0) of FUSION prediction of tile 15 is 0.9793
Precision Average (Class 0) of COMBINED prediction of tile 15 is 0.9735
100%|██████████| 558/558 [02:12<00:00,  4.21it/s]
Precision Average (Class 1) of OPT prediction of tile 18 is 0.9284
Precision Average (Class 1) of SAR prediction of tile 18 is 0.7655
Precision Average (Class 1) of FUSION prediction of tile 18 is 0.9408
Precision Average (Class 1) of COMBINED prediction of tile 18 is 0.9267
Precision Average (Class 0) of OPT prediction of tile 18 is 0.8810
Precision Average (Class 0) of SAR prediction of tile 18 is 0.3613
Precision Average (Class 0) of FUSION prediction of tile 18 is 0.8714
Precision Average (Class 0) of COMBINED prediction of tile 18 is 0.8285
```

In [ ]: