

# Environment setup

```
In [1]: # Mount Google Drive
```

```
from google.colab import drive  
drive.mount('/content/gdrive')
```

Mounted at /content/gdrive

```
In [2]: # Copy the dataset from Google Drive to Local
```

```
!cp "/content/gdrive/My Drive/CBIS_DDSM.zip" .  
!unzip -qq CBIS_DDSM.zip  
!rm CBIS_DDSM.zip  
cbis_path = 'CBIS_DDSM'
```

```
In [3]: # Import Libraries
```

```
import tensorflow as tf  
import os  
import numpy as np  
import matplotlib.pyplot as plt  
import itertools  
from sklearn.metrics import confusion_matrix, classification_report, roc_curve  
, auc  
from tensorflow import keras  
from keras import layers  
from keras import models  
from keras import optimizers  
from keras.callbacks import EarlyStopping, ModelCheckpoint  
from keras.preprocessing.image import ImageDataGenerator  
from keras.optimizers import RMSprop, SGD, Adam, Nadam  
from keras.utils import plot_model
```

# Data Preprocess

```
In [4]: def load_training():
    """
        Load the training set
    """
    abnorm_patches = np.load(os.path.join(cbis_path, 'numpy data', 'train_tensors.npy'))[1::2]
    base_patches = np.load(os.path.join(cbis_path, 'numpy data', 'train_tensors.npy'))[0::2]
    labels = np.load(os.path.join(cbis_path, 'numpy data', 'train_labels.npy'))[1::2]
    return abnorm_patches, base_patches, labels

def load_testing():
    """
        Load the test set
    """
    abnorm_patches = np.load(os.path.join(cbis_path, 'numpy data', 'public_test_tensor.npy'))[1::2]
    base_patches = np.load(os.path.join(cbis_path, 'numpy data', 'public_test_tensor.npy'))[0::2]
    labels = np.load(os.path.join(cbis_path, 'numpy data', 'public_test_labels.npy'))[1::2]
    return abnorm_patches, base_patches, labels

def remap_label(l):
    """
        Remap the Labels to 0->mass 1->calcification
    """
    if l == 1 or l == 2:
        return 0
    elif l == 3 or l == 4:
        return 1
    else:
        print("[WARN] Unrecognized label (%d)" % l)
        return None
```

```
In [5]: # Load training and test images (abnormalities only, no baseline)
train_abn_images, train_base_images, train_labels= load_training()
test_abn_images, test_base_images, test_labels= load_testing()

# Number of images
n_train_img = train_abn_images.shape[0]
n_test_img = test_abn_images.shape[0]
print("Train size: %d \t Test size: %d" % (n_train_img, n_test_img))

# Compute width and height of images
img_w = train_abn_images.shape[1]
img_h = train_abn_images.shape[2]
print("Image size: %dx%d" % (img_w, img_h))

# Remap Labels
train_labels = np.array([remap_label(l) for l in train_labels])
test_labels = np.array([remap_label(l) for l in test_labels])

# Create a new dimension for color in the images arrays
train_abn_images = train_abn_images.reshape((n_train_img, img_w, img_h, 1))
train_base_images = train_base_images.reshape((n_train_img, img_w, img_h, 1))
test_abn_images = test_abn_images.reshape((n_test_img, img_w, img_h, 1))
test_base_images = test_base_images.reshape((n_test_img, img_w, img_h, 1))

# Convert from 16-bit (0-65535) to float (0-1)
train_abn_images = train_abn_images.astype('uint16') / 65535
train_base_images = train_base_images.astype('uint16') / 65535
test_abn_images = test_abn_images.astype('uint16') / 65535
test_base_images = test_base_images.astype('uint16') / 65535

# Shuffle the training set (originally sorted by label)
perm = np.random.permutation(n_train_img)
train_abn_images = train_abn_images[perm]
train_base_images = train_base_images[perm]
train_labels = train_labels[perm]

def double_generator(train_abn_images, train_base_images, train_labels, subset,
, batch_size=128):

    gen = ImageDataGenerator(
        validation_split=0.2,
        rotation_range=180,
        shear_range=15,
        zoom_range=0.2,
        horizontal_flip=True,
        vertical_flip=True,
        fill_mode='reflect'
    )

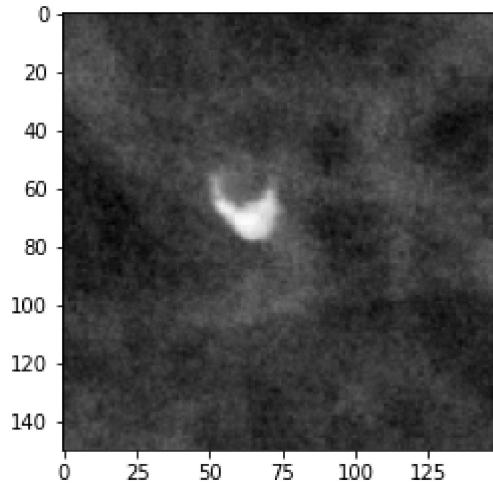
    gen.fit(train_abn_images)

    gen_abn = gen.flow(train_abn_images, train_labels, batch_size=batch_size,
subset=subset, seed=1)
    gen_base = gen.flow(train_base_images, train_labels, batch_size=batch_size
, subset=subset, seed=1)
```

```
while True:  
    abn_img, abn_label = gen_abn.next()  
    base_img, _ = gen_base.next()  
    yield [abn_img, base_img], abn_label  
  
train_generator = double_generator(train_abn_images, train_base_images, train_labels, 'training', batch_size=128)  
validation_generator = double_generator(train_abn_images, train_base_images, train_labels, 'validation', batch_size=128)  
Train size: 2676          Test size: 336  
Image size: 150x150
```

In [6]: *# Visualize one image from the dataset and its label, just to make sure the data format is correct*

```
idx = 0  
  
plt.imshow(train_abn_images[idx][:,:,0], cmap='gray')  
plt.show()  
  
print("Label: " + str(train_labels[idx]))
```



Label: 1

## Siamese Network

```
In [7]: ''' Create a Siamese network '''

def create_siamese():

    # Two input channels
    left_input = layers.Input(shape=(150, 150, 1))
    right_input = layers.Input(shape=(150, 150, 1))

    # CNN core
    cnn = models.Sequential()
    cnn.add(layers.Conv2D(32, (3, 3), activation='relu', input_shape=(150, 150, 1), name="Conv_Layer_1"))
    cnn.add(layers.MaxPooling2D((2, 2), name="MaxPool_Layer_1"))
    cnn.add(layers.Conv2D(64, (3, 3), activation='relu', name = "Conv_layer_2"))
    cnn.add(layers.MaxPooling2D((2, 2), name= "MaxPool_Layer_2"))
    cnn.add(layers.Conv2D(128, (3, 3), activation='relu', name= "Conv_Layer_3"))
    cnn.add(layers.MaxPooling2D((2, 2), name="MaxPool_layer_3"))
    cnn.add(layers.Flatten())

    # Feed both input into the same convolutional base
    left_model = cnn(left_input)
    right_model = cnn(right_input)

    # Compute the difference between the two
    diff = layers.Subtract()([left_model, right_model])

    # FC Layer
    fc = layers.Flatten()(diff)
    fc = layers.Dense(96, activation="relu")(fc)
    fc = layers.Dropout(0.5)(fc)
    fc = layers.Dense(1, activation="sigmoid")(fc)

    # Instantiate the model
    siamese = models.Model(inputs=[left_input, right_input], outputs=fc)

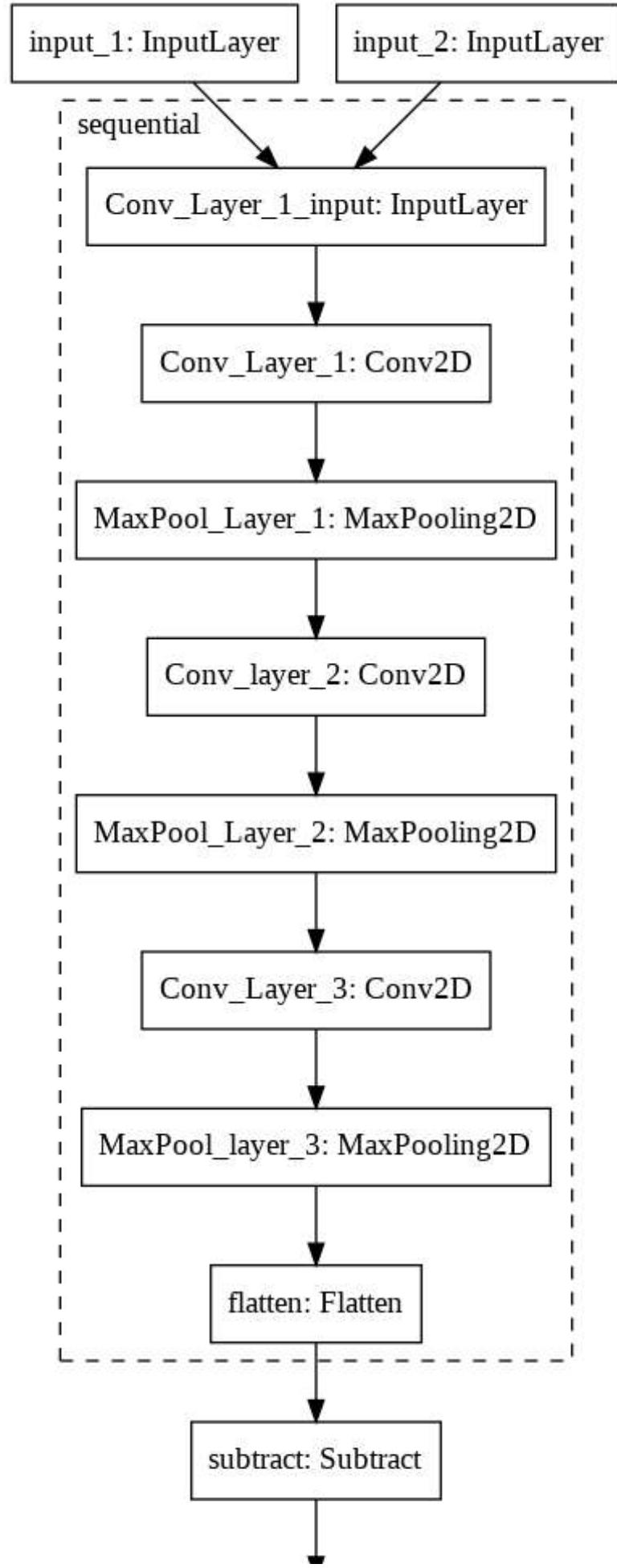
    return siamese
```

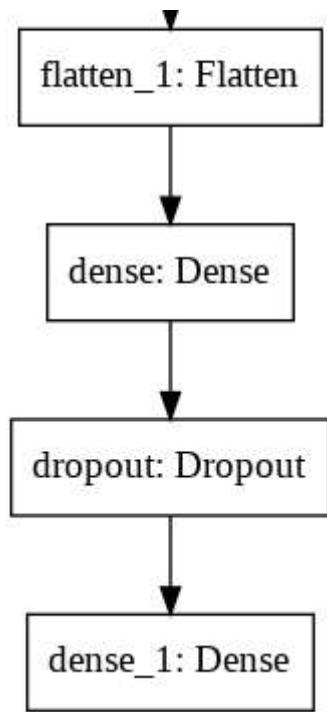
```
In [8]: siamese_example = create_siamese()
siamese_example.summary()
plot_model(siamese_example, expand_nested=True)
!cp "/root/model.png" -r "/content/gdrive/My Drive/models/model_siamese.png"
from IPython.display import Image
Image(filename='model.png')
```

Model: "functional\_1"

Layer (type)	Output Shape	Param #	Connected to
input_1 (InputLayer)	[ (None, 150, 150, 1) 0		
input_2 (InputLayer)	[ (None, 150, 150, 1) 0		
sequential (Sequential) [0]	(None, 36992)	92672	input_1[0] input_2[0]
subtract (Subtract) [0][0]	(None, 36992)	0	sequential sequential
subtract[1][0]			
flatten_1 (Flatten) [0]	(None, 36992)	0	subtract[0]
dense (Dense) [0]	(None, 96)	3551328	flatten_1[0]
dropout (Dropout)	(None, 96)	0	dense[0][0]
dense_1 (Dense) [0]	(None, 1)	97	dropout[0]
Total params: 3,644,097			
Trainable params: 3,644,097			
Non-trainable params: 0			

Out[8]:





## Run Model

```
In [10]: # Create model
siamese = create_siamese()

# Early stopping (stop training after the validation loss reaches the minimum)
earlystopping = EarlyStopping(monitor='val_loss', mode='min', patience=80, verbose=1)

# Callback for checkpointing
checkpoint = ModelCheckpoint('siamese_best.h5',
                             monitor='val_loss', mode='min', verbose=1,
                             save_best_only=True, save_freq='epoch'
)

# Compile the model
siamese.compile(optimizer= Adam(learning_rate=0.001,epsilon=1e-7), loss='binary_crossentropy', metrics=['accuracy'])

# Train
history_siamese = siamese.fit(
    train_generator,
    steps_per_epoch=int(0.8*n_train_img) // 128,
    epochs=500,
    validation_data=validation_generator,
    validation_steps = int(0.2*n_train_img) // 128,
    callbacks=[checkpoint, earlystopping],
    shuffle=True,
    verbose=1,
    initial_epoch=0
)

# Save file to drive
siamese.save( 'siamese_end.h5')
!cp "/root/siamese_best.h5" -r "/content/gdrive/My Drive/models/siamese_best.h5"
```

```
Epoch 1/500
16/16 [=====] - ETA: 0s - loss: 0.6740 - accuracy: 0.6185
Epoch 00001: val_loss improved from inf to 0.61271, saving model to siamese_best.h5
16/16 [=====] - 9s 573ms/step - loss: 0.6740 - accuracy: 0.6185 - val_loss: 0.6127 - val_accuracy: 0.7285
Epoch 2/500
16/16 [=====] - ETA: 0s - loss: 0.6148 - accuracy: 0.7019
Epoch 00002: val_loss improved from 0.61271 to 0.56883, saving model to siame se_best.h5
16/16 [=====] - 8s 528ms/step - loss: 0.6148 - accuracy: 0.7019 - val_loss: 0.5688 - val_accuracy: 0.7559
Epoch 3/500
16/16 [=====] - ETA: 0s - loss: 0.6006 - accuracy: 0.7109
Epoch 00003: val_loss improved from 0.56883 to 0.55887, saving model to siame se_best.h5
16/16 [=====] - 8s 524ms/step - loss: 0.6006 - accuracy: 0.7109 - val_loss: 0.5589 - val_accuracy: 0.7656
Epoch 4/500
16/16 [=====] - ETA: 0s - loss: 0.5762 - accuracy: 0.7258
Epoch 00004: val_loss improved from 0.55887 to 0.54958, saving model to siame se_best.h5
16/16 [=====] - 8s 527ms/step - loss: 0.5762 - accuracy: 0.7258 - val_loss: 0.5496 - val_accuracy: 0.7598
Epoch 5/500
16/16 [=====] - ETA: 0s - loss: 0.5751 - accuracy: 0.7447
Epoch 00005: val_loss improved from 0.54958 to 0.53898, saving model to siame se_best.h5
16/16 [=====] - 8s 530ms/step - loss: 0.5751 - accuracy: 0.7447 - val_loss: 0.5390 - val_accuracy: 0.7715
Epoch 6/500
16/16 [=====] - ETA: 0s - loss: 0.5485 - accuracy: 0.7556
Epoch 00006: val_loss improved from 0.53898 to 0.51634, saving model to siame se_best.h5
16/16 [=====] - 9s 534ms/step - loss: 0.5485 - accuracy: 0.7556 - val_loss: 0.5163 - val_accuracy: 0.7754
Epoch 7/500
16/16 [=====] - ETA: 0s - loss: 0.5472 - accuracy: 0.7598
Epoch 00007: val_loss did not improve from 0.51634
16/16 [=====] - 8s 530ms/step - loss: 0.5472 - accuracy: 0.7598 - val_loss: 0.5241 - val_accuracy: 0.7832
Epoch 8/500
16/16 [=====] - ETA: 0s - loss: 0.5570 - accuracy: 0.7407
Epoch 00008: val_loss did not improve from 0.51634
16/16 [=====] - 9s 533ms/step - loss: 0.5570 - accuracy: 0.7407 - val_loss: 0.5656 - val_accuracy: 0.7305
Epoch 9/500
16/16 [=====] - ETA: 0s - loss: 0.5317 - accuracy: 0.7665
```

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Epoch 00009: val_loss did not improve from 0.51634
16/16 [=====] - 8s 525ms/step - loss: 0.5317 - accuracy: 0.7665 - val_loss: 0.5363 - val_accuracy: 0.7598
Epoch 10/500
16/16 [=====] - ETA: 0s - loss: 0.5407 - accuracy: 0.7645
Epoch 00010: val_loss did not improve from 0.51634
16/16 [=====] - 8s 526ms/step - loss: 0.5407 - accuracy: 0.7645 - val_loss: 0.5186 - val_accuracy: 0.7793
Epoch 11/500
16/16 [=====] - ETA: 0s - loss: 0.4953 - accuracy: 0.7889
Epoch 00011: val_loss improved from 0.51634 to 0.48094, saving model to siame
se_best.h5
16/16 [=====] - 8s 530ms/step - loss: 0.4953 - accuracy: 0.7889 - val_loss: 0.4809 - val_accuracy: 0.7969
Epoch 12/500
16/16 [=====] - ETA: 0s - loss: 0.4760 - accuracy: 0.7973
Epoch 00012: val_loss improved from 0.48094 to 0.45411, saving model to siame
se_best.h5
16/16 [=====] - 9s 533ms/step - loss: 0.4760 - accuracy: 0.7973 - val_loss: 0.4541 - val_accuracy: 0.8027
Epoch 13/500
16/16 [=====] - ETA: 0s - loss: 0.4746 - accuracy: 0.8033
Epoch 00013: val_loss improved from 0.45411 to 0.43358, saving model to siame
se_best.h5
16/16 [=====] - 9s 536ms/step - loss: 0.4746 - accuracy: 0.8033 - val_loss: 0.4336 - val_accuracy: 0.8203
Epoch 14/500
16/16 [=====] - ETA: 0s - loss: 0.4954 - accuracy: 0.7943
Epoch 00014: val_loss did not improve from 0.43358
16/16 [=====] - 9s 533ms/step - loss: 0.4954 - accuracy: 0.7943 - val_loss: 0.4878 - val_accuracy: 0.7832
Epoch 15/500
16/16 [=====] - ETA: 0s - loss: 0.4841 - accuracy: 0.8008
Epoch 00015: val_loss did not improve from 0.43358
16/16 [=====] - 8s 528ms/step - loss: 0.4841 - accuracy: 0.8008 - val_loss: 0.4555 - val_accuracy: 0.8105
Epoch 16/500
16/16 [=====] - ETA: 0s - loss: 0.4424 - accuracy: 0.8053
Epoch 00016: val_loss improved from 0.43358 to 0.41276, saving model to siame
se_best.h5
16/16 [=====] - 9s 532ms/step - loss: 0.4424 - accuracy: 0.8053 - val_loss: 0.4128 - val_accuracy: 0.8262
Epoch 17/500
16/16 [=====] - ETA: 0s - loss: 0.4746 - accuracy: 0.7879
Epoch 00017: val_loss did not improve from 0.41276
16/16 [=====] - 8s 527ms/step - loss: 0.4746 - accuracy: 0.7879 - val_loss: 0.4392 - val_accuracy: 0.8223
Epoch 18/500
16/16 [=====] - ETA: 0s - loss: 0.4287 - accuracy:
```

0.8207  
Epoch 00018: val\_loss did not improve from 0.41276  
16/16 [=====] - 8s 521ms/step - loss: 0.4287 - accuracy: 0.8207 - val\_loss: 0.4248 - val\_accuracy: 0.8184  
Epoch 19/500  
16/16 [=====] - ETA: 0s - loss: 0.4451 - accuracy: 0.8112  
Epoch 00019: val\_loss did not improve from 0.41276  
16/16 [=====] - 8s 525ms/step - loss: 0.4451 - accuracy: 0.8112 - val\_loss: 0.4296 - val\_accuracy: 0.8340  
Epoch 20/500  
16/16 [=====] - ETA: 0s - loss: 0.4289 - accuracy: 0.8172  
Epoch 00020: val\_loss improved from 0.41276 to 0.40951, saving model to siamese\_best.h5  
16/16 [=====] - 9s 533ms/step - loss: 0.4289 - accuracy: 0.8172 - val\_loss: 0.4095 - val\_accuracy: 0.8418  
Epoch 21/500  
16/16 [=====] - ETA: 0s - loss: 0.4406 - accuracy: 0.8271  
Epoch 00021: val\_loss did not improve from 0.40951  
16/16 [=====] - 8s 523ms/step - loss: 0.4406 - accuracy: 0.8271 - val\_loss: 0.4276 - val\_accuracy: 0.8125  
Epoch 22/500  
16/16 [=====] - ETA: 0s - loss: 0.4307 - accuracy: 0.8207  
Epoch 00022: val\_loss did not improve from 0.40951  
16/16 [=====] - 8s 524ms/step - loss: 0.4307 - accuracy: 0.8207 - val\_loss: 0.4161 - val\_accuracy: 0.8164  
Epoch 23/500  
16/16 [=====] - ETA: 0s - loss: 0.4210 - accuracy: 0.8251  
Epoch 00023: val\_loss did not improve from 0.40951  
16/16 [=====] - 8s 524ms/step - loss: 0.4210 - accuracy: 0.8251 - val\_loss: 0.4609 - val\_accuracy: 0.7949  
Epoch 24/500  
16/16 [=====] - ETA: 0s - loss: 0.4691 - accuracy: 0.7930  
Epoch 00024: val\_loss did not improve from 0.40951  
16/16 [=====] - 8s 526ms/step - loss: 0.4691 - accuracy: 0.7930 - val\_loss: 0.4656 - val\_accuracy: 0.7773  
Epoch 25/500  
16/16 [=====] - ETA: 0s - loss: 0.4419 - accuracy: 0.8222  
Epoch 00025: val\_loss did not improve from 0.40951  
16/16 [=====] - 9s 535ms/step - loss: 0.4419 - accuracy: 0.8222 - val\_loss: 0.4258 - val\_accuracy: 0.8125  
Epoch 26/500  
16/16 [=====] - ETA: 0s - loss: 0.4418 - accuracy: 0.8087  
Epoch 00026: val\_loss did not improve from 0.40951  
16/16 [=====] - 8s 521ms/step - loss: 0.4418 - accuracy: 0.8087 - val\_loss: 0.4099 - val\_accuracy: 0.8301  
Epoch 27/500  
16/16 [=====] - ETA: 0s - loss: 0.4268 - accuracy: 0.8177  
Epoch 00027: val\_loss did not improve from 0.40951

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16/16 [=====] - 8s 523ms/step - loss: 0.4268 - accuracy: 0.8177 - val_loss: 0.4432 - val_accuracy: 0.8066
Epoch 28/500
16/16 [=====] - ETA: 0s - loss: 0.4142 - accuracy: 0.8212
Epoch 00028: val_loss did not improve from 0.40951
16/16 [=====] - 8s 520ms/step - loss: 0.4142 - accuracy: 0.8212 - val_loss: 0.4325 - val_accuracy: 0.8242
Epoch 29/500
16/16 [=====] - ETA: 0s - loss: 0.4159 - accuracy: 0.8217
Epoch 00029: val_loss did not improve from 0.40951
16/16 [=====] - 8s 520ms/step - loss: 0.4159 - accuracy: 0.8217 - val_loss: 0.4210 - val_accuracy: 0.8242
Epoch 30/500
16/16 [=====] - ETA: 0s - loss: 0.4393 - accuracy: 0.8058
Epoch 00030: val_loss did not improve from 0.40951
16/16 [=====] - 8s 523ms/step - loss: 0.4393 - accuracy: 0.8058 - val_loss: 0.4233 - val_accuracy: 0.8125
Epoch 31/500
16/16 [=====] - ETA: 0s - loss: 0.4300 - accuracy: 0.8107
Epoch 00031: val_loss did not improve from 0.40951
16/16 [=====] - 8s 518ms/step - loss: 0.4300 - accuracy: 0.8107 - val_loss: 0.4171 - val_accuracy: 0.8203
Epoch 32/500
16/16 [=====] - ETA: 0s - loss: 0.4167 - accuracy: 0.8236
Epoch 00032: val_loss did not improve from 0.40951
16/16 [=====] - 8s 527ms/step - loss: 0.4167 - accuracy: 0.8236 - val_loss: 0.4170 - val_accuracy: 0.8047
Epoch 33/500
16/16 [=====] - ETA: 0s - loss: 0.4313 - accuracy: 0.8147
Epoch 00033: val_loss did not improve from 0.40951
16/16 [=====] - 8s 529ms/step - loss: 0.4313 - accuracy: 0.8147 - val_loss: 0.4193 - val_accuracy: 0.8203
Epoch 34/500
16/16 [=====] - ETA: 0s - loss: 0.4334 - accuracy: 0.8048
Epoch 00034: val_loss did not improve from 0.40951
16/16 [=====] - 9s 532ms/step - loss: 0.4334 - accuracy: 0.8048 - val_loss: 0.4415 - val_accuracy: 0.8066
Epoch 35/500
16/16 [=====] - ETA: 0s - loss: 0.4332 - accuracy: 0.8187
Epoch 00035: val_loss did not improve from 0.40951
16/16 [=====] - 8s 522ms/step - loss: 0.4332 - accuracy: 0.8187 - val_loss: 0.4217 - val_accuracy: 0.8262
Epoch 36/500
16/16 [=====] - ETA: 0s - loss: 0.4367 - accuracy: 0.8053
Epoch 00036: val_loss did not improve from 0.40951
16/16 [=====] - 8s 520ms/step - loss: 0.4367 - accuracy: 0.8053 - val_loss: 0.4332 - val_accuracy: 0.8125
Epoch 37/500
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16/16 [=====] - ETA: 0s - loss: 0.4299 - accuracy: 0.8142
Epoch 00037: val_loss did not improve from 0.40951
16/16 [=====] - 8s 519ms/step - loss: 0.4299 - accuracy: 0.8142 - val_loss: 0.4280 - val_accuracy: 0.8184
Epoch 38/500
16/16 [=====] - ETA: 0s - loss: 0.4287 - accuracy: 0.8276
Epoch 00038: val_loss improved from 0.40951 to 0.39967, saving model to siamese_best.h5
16/16 [=====] - 8s 524ms/step - loss: 0.4287 - accuracy: 0.8276 - val_loss: 0.3997 - val_accuracy: 0.8301
Epoch 39/500
16/16 [=====] - ETA: 0s - loss: 0.4245 - accuracy: 0.8068
Epoch 00039: val_loss did not improve from 0.39967
16/16 [=====] - 8s 521ms/step - loss: 0.4245 - accuracy: 0.8068 - val_loss: 0.4024 - val_accuracy: 0.8457
Epoch 40/500
16/16 [=====] - ETA: 0s - loss: 0.4476 - accuracy: 0.8177
Epoch 00040: val_loss did not improve from 0.39967
16/16 [=====] - 8s 522ms/step - loss: 0.4476 - accuracy: 0.8177 - val_loss: 0.4095 - val_accuracy: 0.8223
Epoch 41/500
16/16 [=====] - ETA: 0s - loss: 0.4239 - accuracy: 0.8198
Epoch 00041: val_loss improved from 0.39967 to 0.39176, saving model to siamese_best.h5
16/16 [=====] - 9s 533ms/step - loss: 0.4239 - accuracy: 0.8198 - val_loss: 0.3918 - val_accuracy: 0.8320
Epoch 42/500
16/16 [=====] - ETA: 0s - loss: 0.4104 - accuracy: 0.8336
Epoch 00042: val_loss did not improve from 0.39176
16/16 [=====] - 8s 530ms/step - loss: 0.4104 - accuracy: 0.8336 - val_loss: 0.4331 - val_accuracy: 0.8145
Epoch 43/500
16/16 [=====] - ETA: 0s - loss: 0.4159 - accuracy: 0.8063
Epoch 00043: val_loss did not improve from 0.39176
16/16 [=====] - 8s 524ms/step - loss: 0.4159 - accuracy: 0.8063 - val_loss: 0.4129 - val_accuracy: 0.8398
Epoch 44/500
16/16 [=====] - ETA: 0s - loss: 0.4262 - accuracy: 0.8256
Epoch 00044: val_loss did not improve from 0.39176
16/16 [=====] - 8s 525ms/step - loss: 0.4262 - accuracy: 0.8256 - val_loss: 0.5038 - val_accuracy: 0.7344
Epoch 45/500
16/16 [=====] - ETA: 0s - loss: 0.4567 - accuracy: 0.7948
Epoch 00045: val_loss did not improve from 0.39176
16/16 [=====] - 8s 523ms/step - loss: 0.4567 - accuracy: 0.7948 - val_loss: 0.4294 - val_accuracy: 0.8184
Epoch 46/500
16/16 [=====] - ETA: 0s - loss: 0.4174 - accuracy:
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0.8162
Epoch 00046: val_loss did not improve from 0.39176
16/16 [=====] - 8s 519ms/step - loss: 0.4174 - accuracy: 0.8162 - val_loss: 0.4107 - val_accuracy: 0.8301
Epoch 47/500
16/16 [=====] - ETA: 0s - loss: 0.4220 - accuracy: 0.8266
Epoch 00047: val_loss did not improve from 0.39176
16/16 [=====] - 8s 519ms/step - loss: 0.4220 - accuracy: 0.8266 - val_loss: 0.4099 - val_accuracy: 0.8379
Epoch 48/500
16/16 [=====] - ETA: 0s - loss: 0.4158 - accuracy: 0.8311
Epoch 00048: val_loss did not improve from 0.39176
16/16 [=====] - 8s 521ms/step - loss: 0.4158 - accuracy: 0.8311 - val_loss: 0.4099 - val_accuracy: 0.8320
Epoch 49/500
16/16 [=====] - ETA: 0s - loss: 0.4227 - accuracy: 0.8197
Epoch 00049: val_loss did not improve from 0.39176
16/16 [=====] - 8s 518ms/step - loss: 0.4227 - accuracy: 0.8197 - val_loss: 0.4252 - val_accuracy: 0.8027
Epoch 50/500
16/16 [=====] - ETA: 0s - loss: 0.4131 - accuracy: 0.8296
Epoch 00050: val_loss did not improve from 0.39176
16/16 [=====] - 8s 520ms/step - loss: 0.4131 - accuracy: 0.8296 - val_loss: 0.4112 - val_accuracy: 0.8086
Epoch 51/500
16/16 [=====] - ETA: 0s - loss: 0.4002 - accuracy: 0.8371
Epoch 00051: val_loss improved from 0.39176 to 0.37804, saving model to siamese_best.h5
16/16 [=====] - 9s 533ms/step - loss: 0.4002 - accuracy: 0.8371 - val_loss: 0.3780 - val_accuracy: 0.8359
Epoch 52/500
16/16 [=====] - ETA: 0s - loss: 0.4073 - accuracy: 0.8286
Epoch 00052: val_loss did not improve from 0.37804
16/16 [=====] - 8s 526ms/step - loss: 0.4073 - accuracy: 0.8286 - val_loss: 0.3927 - val_accuracy: 0.8379
Epoch 53/500
16/16 [=====] - ETA: 0s - loss: 0.4122 - accuracy: 0.8326
Epoch 00053: val_loss did not improve from 0.37804
16/16 [=====] - 8s 525ms/step - loss: 0.4122 - accuracy: 0.8326 - val_loss: 0.4072 - val_accuracy: 0.8398
Epoch 54/500
16/16 [=====] - ETA: 0s - loss: 0.4112 - accuracy: 0.8296
Epoch 00054: val_loss did not improve from 0.37804
16/16 [=====] - 8s 517ms/step - loss: 0.4112 - accuracy: 0.8296 - val_loss: 0.4297 - val_accuracy: 0.8164
Epoch 55/500
16/16 [=====] - ETA: 0s - loss: 0.3919 - accuracy: 0.8346
Epoch 00055: val_loss did not improve from 0.37804
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16/16 [=====] - 8s 518ms/step - loss: 0.3919 - accuracy: 0.8346 - val_loss: 0.4134 - val_accuracy: 0.8262
Epoch 56/500
16/16 [=====] - ETA: 0s - loss: 0.4150 - accuracy: 0.8311
Epoch 00056: val_loss did not improve from 0.37804
16/16 [=====] - 8s 515ms/step - loss: 0.4150 - accuracy: 0.8311 - val_loss: 0.3819 - val_accuracy: 0.8418
Epoch 57/500
16/16 [=====] - ETA: 0s - loss: 0.4087 - accuracy: 0.8182
Epoch 00057: val_loss did not improve from 0.37804
16/16 [=====] - 8s 515ms/step - loss: 0.4087 - accuracy: 0.8182 - val_loss: 0.5241 - val_accuracy: 0.7754
Epoch 58/500
16/16 [=====] - ETA: 0s - loss: 0.4207 - accuracy: 0.8179
Epoch 00058: val_loss did not improve from 0.37804
16/16 [=====] - 8s 518ms/step - loss: 0.4207 - accuracy: 0.8179 - val_loss: 0.4215 - val_accuracy: 0.8340
Epoch 59/500
16/16 [=====] - ETA: 0s - loss: 0.4155 - accuracy: 0.8301
Epoch 00059: val_loss did not improve from 0.37804
16/16 [=====] - 8s 518ms/step - loss: 0.4155 - accuracy: 0.8301 - val_loss: 0.3826 - val_accuracy: 0.8496
Epoch 60/500
16/16 [=====] - ETA: 0s - loss: 0.4148 - accuracy: 0.8266
Epoch 00060: val_loss did not improve from 0.37804
16/16 [=====] - 8s 514ms/step - loss: 0.4148 - accuracy: 0.8266 - val_loss: 0.4227 - val_accuracy: 0.7969
Epoch 61/500
16/16 [=====] - ETA: 0s - loss: 0.4139 - accuracy: 0.8331
Epoch 00061: val_loss did not improve from 0.37804
16/16 [=====] - 8s 512ms/step - loss: 0.4139 - accuracy: 0.8331 - val_loss: 0.3864 - val_accuracy: 0.8438
Epoch 62/500
16/16 [=====] - ETA: 0s - loss: 0.3973 - accuracy: 0.8356
Epoch 00062: val_loss did not improve from 0.37804
16/16 [=====] - 8s 517ms/step - loss: 0.3973 - accuracy: 0.8356 - val_loss: 0.3892 - val_accuracy: 0.8438
Epoch 63/500
16/16 [=====] - ETA: 0s - loss: 0.3942 - accuracy: 0.8381
Epoch 00063: val_loss did not improve from 0.37804
16/16 [=====] - 8s 518ms/step - loss: 0.3942 - accuracy: 0.8381 - val_loss: 0.3842 - val_accuracy: 0.8301
Epoch 64/500
16/16 [=====] - ETA: 0s - loss: 0.4000 - accuracy: 0.8390
Epoch 00064: val_loss did not improve from 0.37804
16/16 [=====] - 8s 516ms/step - loss: 0.4000 - accuracy: 0.8390 - val_loss: 0.4128 - val_accuracy: 0.8242
Epoch 65/500
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16/16 [=====] - ETA: 0s - loss: 0.3990 - accuracy: 0.8316
Epoch 00065: val_loss did not improve from 0.37804
16/16 [=====] - 8s 512ms/step - loss: 0.3990 - accuracy: 0.8316 - val_loss: 0.4056 - val_accuracy: 0.8223
Epoch 66/500
16/16 [=====] - ETA: 0s - loss: 0.3680 - accuracy: 0.8465
Epoch 00066: val_loss did not improve from 0.37804
16/16 [=====] - 8s 512ms/step - loss: 0.3680 - accuracy: 0.8465 - val_loss: 0.4099 - val_accuracy: 0.8145
Epoch 67/500
16/16 [=====] - ETA: 0s - loss: 0.4369 - accuracy: 0.8227
Epoch 00067: val_loss did not improve from 0.37804
16/16 [=====] - 8s 508ms/step - loss: 0.4369 - accuracy: 0.8227 - val_loss: 0.3956 - val_accuracy: 0.8379
Epoch 68/500
16/16 [=====] - ETA: 0s - loss: 0.3818 - accuracy: 0.8341
Epoch 00068: val_loss did not improve from 0.37804
16/16 [=====] - 8s 511ms/step - loss: 0.3818 - accuracy: 0.8341 - val_loss: 0.3833 - val_accuracy: 0.8516
Epoch 69/500
16/16 [=====] - ETA: 0s - loss: 0.3885 - accuracy: 0.8331
Epoch 00069: val_loss improved from 0.37804 to 0.36807, saving model to siame se_best.h5
16/16 [=====] - 9s 534ms/step - loss: 0.3885 - accuracy: 0.8331 - val_loss: 0.3681 - val_accuracy: 0.8516
Epoch 70/500
16/16 [=====] - ETA: 0s - loss: 0.3916 - accuracy: 0.8410
Epoch 00070: val_loss did not improve from 0.36807
16/16 [=====] - 8s 521ms/step - loss: 0.3916 - accuracy: 0.8410 - val_loss: 0.4049 - val_accuracy: 0.8301
Epoch 71/500
16/16 [=====] - ETA: 0s - loss: 0.3931 - accuracy: 0.8400
Epoch 00071: val_loss did not improve from 0.36807
16/16 [=====] - 8s 514ms/step - loss: 0.3931 - accuracy: 0.8400 - val_loss: 0.4031 - val_accuracy: 0.8281
Epoch 72/500
16/16 [=====] - ETA: 0s - loss: 0.3944 - accuracy: 0.8316
Epoch 00072: val_loss did not improve from 0.36807
16/16 [=====] - 8s 516ms/step - loss: 0.3944 - accuracy: 0.8316 - val_loss: 0.4403 - val_accuracy: 0.8008
Epoch 73/500
16/16 [=====] - ETA: 0s - loss: 0.3944 - accuracy: 0.8381
Epoch 00073: val_loss did not improve from 0.36807
16/16 [=====] - 8s 511ms/step - loss: 0.3944 - accuracy: 0.8381 - val_loss: 0.3837 - val_accuracy: 0.8340
Epoch 74/500
16/16 [=====] - ETA: 0s - loss: 0.4065 - accuracy: 0.8296
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Epoch 00074: val_loss did not improve from 0.36807
16/16 [=====] - 8s 510ms/step - loss: 0.4065 - accuracy: 0.8296 - val_loss: 0.3918 - val_accuracy: 0.8184
Epoch 75/500
16/16 [=====] - ETA: 0s - loss: 0.3839 - accuracy: 0.8389
Epoch 00075: val_loss did not improve from 0.36807
16/16 [=====] - 8s 510ms/step - loss: 0.3839 - accuracy: 0.8389 - val_loss: 0.3937 - val_accuracy: 0.8398
Epoch 76/500
16/16 [=====] - ETA: 0s - loss: 0.3969 - accuracy: 0.8341
Epoch 00076: val_loss did not improve from 0.36807
16/16 [=====] - 8s 523ms/step - loss: 0.3969 - accuracy: 0.8341 - val_loss: 0.3887 - val_accuracy: 0.8418
Epoch 77/500
16/16 [=====] - ETA: 0s - loss: 0.3723 - accuracy: 0.8445
Epoch 00077: val_loss did not improve from 0.36807
16/16 [=====] - 8s 512ms/step - loss: 0.3723 - accuracy: 0.8445 - val_loss: 0.3683 - val_accuracy: 0.8496
Epoch 78/500
16/16 [=====] - ETA: 0s - loss: 0.4065 - accuracy: 0.8331
Epoch 00078: val_loss did not improve from 0.36807
16/16 [=====] - 8s 511ms/step - loss: 0.4065 - accuracy: 0.8331 - val_loss: 0.3955 - val_accuracy: 0.8301
Epoch 79/500
16/16 [=====] - ETA: 0s - loss: 0.3814 - accuracy: 0.8415
Epoch 00079: val_loss did not improve from 0.36807
16/16 [=====] - 8s 518ms/step - loss: 0.3814 - accuracy: 0.8415 - val_loss: 0.3956 - val_accuracy: 0.8340
Epoch 80/500
16/16 [=====] - ETA: 0s - loss: 0.3780 - accuracy: 0.8385
Epoch 00080: val_loss did not improve from 0.36807
16/16 [=====] - 8s 515ms/step - loss: 0.3780 - accuracy: 0.8385 - val_loss: 0.3983 - val_accuracy: 0.8398
Epoch 81/500
16/16 [=====] - ETA: 0s - loss: 0.3860 - accuracy: 0.8296
Epoch 00081: val_loss did not improve from 0.36807
16/16 [=====] - 8s 513ms/step - loss: 0.3860 - accuracy: 0.8296 - val_loss: 0.4093 - val_accuracy: 0.8262
Epoch 82/500
16/16 [=====] - ETA: 0s - loss: 0.3953 - accuracy: 0.8351
Epoch 00082: val_loss did not improve from 0.36807
16/16 [=====] - 8s 520ms/step - loss: 0.3953 - accuracy: 0.8351 - val_loss: 0.4089 - val_accuracy: 0.8242
Epoch 83/500
16/16 [=====] - ETA: 0s - loss: 0.4195 - accuracy: 0.8241
Epoch 00083: val_loss did not improve from 0.36807
16/16 [=====] - 8s 512ms/step - loss: 0.4195 - accuracy: 0.8241 - val_loss: 0.3827 - val_accuracy: 0.8418
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Epoch 84/500
16/16 [=====] - ETA: 0s - loss: 0.3754 - accuracy: 0.8425
Epoch 00084: val_loss did not improve from 0.36807
16/16 [=====] - 8s 513ms/step - loss: 0.3754 - accuracy: 0.8425 - val_loss: 0.3798 - val_accuracy: 0.8613
Epoch 85/500
16/16 [=====] - ETA: 0s - loss: 0.4018 - accuracy: 0.8241
Epoch 00085: val_loss did not improve from 0.36807
16/16 [=====] - 8s 511ms/step - loss: 0.4018 - accuracy: 0.8241 - val_loss: 0.4187 - val_accuracy: 0.8145
Epoch 86/500
16/16 [=====] - ETA: 0s - loss: 0.4367 - accuracy: 0.8187
Epoch 00086: val_loss did not improve from 0.36807
16/16 [=====] - 8s 512ms/step - loss: 0.4367 - accuracy: 0.8187 - val_loss: 0.4153 - val_accuracy: 0.8184
Epoch 87/500
16/16 [=====] - ETA: 0s - loss: 0.3838 - accuracy: 0.8400
Epoch 00087: val_loss did not improve from 0.36807
16/16 [=====] - 8s 515ms/step - loss: 0.3838 - accuracy: 0.8400 - val_loss: 0.3872 - val_accuracy: 0.8496
Epoch 88/500
16/16 [=====] - ETA: 0s - loss: 0.3848 - accuracy: 0.8465
Epoch 00088: val_loss did not improve from 0.36807
16/16 [=====] - 8s 510ms/step - loss: 0.3848 - accuracy: 0.8465 - val_loss: 0.3915 - val_accuracy: 0.8262
Epoch 89/500
16/16 [=====] - ETA: 0s - loss: 0.3863 - accuracy: 0.8390
Epoch 00089: val_loss did not improve from 0.36807
16/16 [=====] - 8s 512ms/step - loss: 0.3863 - accuracy: 0.8390 - val_loss: 0.3789 - val_accuracy: 0.8418
Epoch 90/500
16/16 [=====] - ETA: 0s - loss: 0.3861 - accuracy: 0.8331
Epoch 00090: val_loss improved from 0.36807 to 0.36280, saving model to siame
se_best.h5
16/16 [=====] - 8s 523ms/step - loss: 0.3861 - accuracy: 0.8331 - val_loss: 0.3628 - val_accuracy: 0.8555
Epoch 91/500
16/16 [=====] - ETA: 0s - loss: 0.3743 - accuracy: 0.8445
Epoch 00091: val_loss did not improve from 0.36280
16/16 [=====] - 8s 519ms/step - loss: 0.3743 - accuracy: 0.8445 - val_loss: 0.3678 - val_accuracy: 0.8672
Epoch 92/500
16/16 [=====] - ETA: 0s - loss: 0.3873 - accuracy: 0.8477
Epoch 00092: val_loss did not improve from 0.36280
16/16 [=====] - 8s 515ms/step - loss: 0.3873 - accuracy: 0.8477 - val_loss: 0.3744 - val_accuracy: 0.8613
Epoch 93/500
16/16 [=====] - ETA: 0s - loss: 0.3666 - accuracy:
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0.8475  
Epoch 00093: val\_loss did not improve from 0.36280  
16/16 [=====] - 8s 519ms/step - loss: 0.3666 - accuracy: 0.8475 - val\_loss: 0.3764 - val\_accuracy: 0.8613  
Epoch 94/500  
16/16 [=====] - ETA: 0s - loss: 0.3808 - accuracy: 0.8425  
Epoch 00094: val\_loss did not improve from 0.36280  
16/16 [=====] - 8s 513ms/step - loss: 0.3808 - accuracy: 0.8425 - val\_loss: 0.3737 - val\_accuracy: 0.8516  
Epoch 95/500  
16/16 [=====] - ETA: 0s - loss: 0.4008 - accuracy: 0.8390  
Epoch 00095: val\_loss did not improve from 0.36280  
16/16 [=====] - 8s 516ms/step - loss: 0.4008 - accuracy: 0.8390 - val\_loss: 0.3733 - val\_accuracy: 0.8457  
Epoch 96/500  
16/16 [=====] - ETA: 0s - loss: 0.4034 - accuracy: 0.8346  
Epoch 00096: val\_loss did not improve from 0.36280  
16/16 [=====] - 8s 514ms/step - loss: 0.4034 - accuracy: 0.8346 - val\_loss: 0.3711 - val\_accuracy: 0.8457  
Epoch 97/500  
16/16 [=====] - ETA: 0s - loss: 0.3757 - accuracy: 0.8376  
Epoch 00097: val\_loss did not improve from 0.36280  
16/16 [=====] - 8s 519ms/step - loss: 0.3757 - accuracy: 0.8376 - val\_loss: 0.3693 - val\_accuracy: 0.8418  
Epoch 98/500  
16/16 [=====] - ETA: 0s - loss: 0.3606 - accuracy: 0.8525  
Epoch 00098: val\_loss did not improve from 0.36280  
16/16 [=====] - 8s 515ms/step - loss: 0.3606 - accuracy: 0.8525 - val\_loss: 0.3794 - val\_accuracy: 0.8438  
Epoch 99/500  
16/16 [=====] - ETA: 0s - loss: 0.3906 - accuracy: 0.8261  
Epoch 00099: val\_loss improved from 0.36280 to 0.35360, saving model to siamese\_best.h5  
16/16 [=====] - 8s 520ms/step - loss: 0.3906 - accuracy: 0.8261 - val\_loss: 0.3536 - val\_accuracy: 0.8574  
Epoch 100/500  
16/16 [=====] - ETA: 0s - loss: 0.3665 - accuracy: 0.8554  
Epoch 00100: val\_loss did not improve from 0.35360  
16/16 [=====] - 8s 517ms/step - loss: 0.3665 - accuracy: 0.8554 - val\_loss: 0.3698 - val\_accuracy: 0.8555  
Epoch 101/500  
16/16 [=====] - ETA: 0s - loss: 0.3892 - accuracy: 0.8430  
Epoch 00101: val\_loss did not improve from 0.35360  
16/16 [=====] - 8s 523ms/step - loss: 0.3892 - accuracy: 0.8430 - val\_loss: 0.3677 - val\_accuracy: 0.8496  
Epoch 102/500  
16/16 [=====] - ETA: 0s - loss: 0.3645 - accuracy: 0.8490  
Epoch 00102: val\_loss did not improve from 0.35360

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16/16 [=====] - 8s 516ms/step - loss: 0.3645 - accuracy: 0.8490 - val_loss: 0.3757 - val_accuracy: 0.8379
Epoch 103/500
16/16 [=====] - ETA: 0s - loss: 0.3596 - accuracy: 0.8510
Epoch 00103: val_loss did not improve from 0.35360
16/16 [=====] - 8s 513ms/step - loss: 0.3596 - accuracy: 0.8510 - val_loss: 0.3595 - val_accuracy: 0.8516
Epoch 104/500
16/16 [=====] - ETA: 0s - loss: 0.3890 - accuracy: 0.8450
Epoch 00104: val_loss did not improve from 0.35360
16/16 [=====] - 8s 514ms/step - loss: 0.3890 - accuracy: 0.8450 - val_loss: 0.3738 - val_accuracy: 0.8496
Epoch 105/500
16/16 [=====] - ETA: 0s - loss: 0.3672 - accuracy: 0.8544
Epoch 00105: val_loss did not improve from 0.35360
16/16 [=====] - 8s 523ms/step - loss: 0.3672 - accuracy: 0.8544 - val_loss: 0.3620 - val_accuracy: 0.8555
Epoch 106/500
16/16 [=====] - ETA: 0s - loss: 0.3774 - accuracy: 0.8400
Epoch 00106: val_loss did not improve from 0.35360
16/16 [=====] - 8s 523ms/step - loss: 0.3774 - accuracy: 0.8400 - val_loss: 0.3895 - val_accuracy: 0.8242
Epoch 107/500
16/16 [=====] - ETA: 0s - loss: 0.3851 - accuracy: 0.8321
Epoch 00107: val_loss did not improve from 0.35360
16/16 [=====] - 8s 516ms/step - loss: 0.3851 - accuracy: 0.8321 - val_loss: 0.3626 - val_accuracy: 0.8516
Epoch 108/500
16/16 [=====] - ETA: 0s - loss: 0.3743 - accuracy: 0.8420
Epoch 00108: val_loss did not improve from 0.35360
16/16 [=====] - 8s 513ms/step - loss: 0.3743 - accuracy: 0.8420 - val_loss: 0.3744 - val_accuracy: 0.8320
Epoch 109/500
16/16 [=====] - ETA: 0s - loss: 0.3792 - accuracy: 0.8428
Epoch 00109: val_loss did not improve from 0.35360
16/16 [=====] - 8s 516ms/step - loss: 0.3792 - accuracy: 0.8428 - val_loss: 0.3756 - val_accuracy: 0.8418
Epoch 110/500
16/16 [=====] - ETA: 0s - loss: 0.3699 - accuracy: 0.8505
Epoch 00110: val_loss did not improve from 0.35360
16/16 [=====] - 8s 522ms/step - loss: 0.3699 - accuracy: 0.8505 - val_loss: 0.3896 - val_accuracy: 0.8262
Epoch 111/500
16/16 [=====] - ETA: 0s - loss: 0.3821 - accuracy: 0.8415
Epoch 00111: val_loss did not improve from 0.35360
16/16 [=====] - 8s 513ms/step - loss: 0.3821 - accuracy: 0.8415 - val_loss: 0.4023 - val_accuracy: 0.8262
Epoch 112/500
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16/16 [=====] - ETA: 0s - loss: 0.3726 - accuracy: 0.8410
Epoch 00112: val_loss did not improve from 0.35360
16/16 [=====] - 8s 518ms/step - loss: 0.3726 - accuracy: 0.8410 - val_loss: 0.3740 - val_accuracy: 0.8340
Epoch 113/500
16/16 [=====] - ETA: 0s - loss: 0.3822 - accuracy: 0.8455
Epoch 00113: val_loss did not improve from 0.35360
16/16 [=====] - 8s 513ms/step - loss: 0.3822 - accuracy: 0.8455 - val_loss: 0.3740 - val_accuracy: 0.8477
Epoch 114/500
16/16 [=====] - ETA: 0s - loss: 0.3686 - accuracy: 0.8465
Epoch 00114: val_loss improved from 0.35360 to 0.34896, saving model to siamese_best.h5
16/16 [=====] - 8s 516ms/step - loss: 0.3686 - accuracy: 0.8465 - val_loss: 0.3490 - val_accuracy: 0.8594
Epoch 115/500
16/16 [=====] - ETA: 0s - loss: 0.3967 - accuracy: 0.8326
Epoch 00115: val_loss did not improve from 0.34896
16/16 [=====] - 8s 518ms/step - loss: 0.3967 - accuracy: 0.8326 - val_loss: 0.3652 - val_accuracy: 0.8652
Epoch 116/500
16/16 [=====] - ETA: 0s - loss: 0.3639 - accuracy: 0.8341
Epoch 00116: val_loss did not improve from 0.34896
16/16 [=====] - 8s 514ms/step - loss: 0.3639 - accuracy: 0.8341 - val_loss: 0.3716 - val_accuracy: 0.8613
Epoch 117/500
16/16 [=====] - ETA: 0s - loss: 0.3592 - accuracy: 0.8390
Epoch 00117: val_loss did not improve from 0.34896
16/16 [=====] - 8s 512ms/step - loss: 0.3592 - accuracy: 0.8390 - val_loss: 0.3760 - val_accuracy: 0.8496
Epoch 118/500
16/16 [=====] - ETA: 0s - loss: 0.3747 - accuracy: 0.8500
Epoch 00118: val_loss did not improve from 0.34896
16/16 [=====] - 8s 511ms/step - loss: 0.3747 - accuracy: 0.8500 - val_loss: 0.3776 - val_accuracy: 0.8418
Epoch 119/500
16/16 [=====] - ETA: 0s - loss: 0.3720 - accuracy: 0.8490
Epoch 00119: val_loss did not improve from 0.34896
16/16 [=====] - 8s 510ms/step - loss: 0.3720 - accuracy: 0.8490 - val_loss: 0.3564 - val_accuracy: 0.8613
Epoch 120/500
16/16 [=====] - ETA: 0s - loss: 0.3864 - accuracy: 0.8316
Epoch 00120: val_loss did not improve from 0.34896
16/16 [=====] - 8s 522ms/step - loss: 0.3864 - accuracy: 0.8316 - val_loss: 0.3632 - val_accuracy: 0.8516
Epoch 121/500
16/16 [=====] - ETA: 0s - loss: 0.3507 - accuracy: 0.8698
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Epoch 00121: val_loss did not improve from 0.34896
16/16 [=====] - 8s 514ms/step - loss: 0.3507 - accuracy: 0.8698 - val_loss: 0.3776 - val_accuracy: 0.8594
Epoch 122/500
16/16 [=====] - ETA: 0s - loss: 0.3831 - accuracy: 0.8440
Epoch 00122: val_loss did not improve from 0.34896
16/16 [=====] - 8s 513ms/step - loss: 0.3831 - accuracy: 0.8440 - val_loss: 0.4019 - val_accuracy: 0.8281
Epoch 123/500
16/16 [=====] - ETA: 0s - loss: 0.3774 - accuracy: 0.8455
Epoch 00123: val_loss did not improve from 0.34896
16/16 [=====] - 8s 515ms/step - loss: 0.3774 - accuracy: 0.8455 - val_loss: 0.3935 - val_accuracy: 0.8320
Epoch 124/500
16/16 [=====] - ETA: 0s - loss: 0.3684 - accuracy: 0.8450
Epoch 00124: val_loss did not improve from 0.34896
16/16 [=====] - 8s 514ms/step - loss: 0.3684 - accuracy: 0.8450 - val_loss: 0.3527 - val_accuracy: 0.8574
Epoch 125/500
16/16 [=====] - ETA: 0s - loss: 0.3662 - accuracy: 0.8490
Epoch 00125: val_loss did not improve from 0.34896
16/16 [=====] - 8s 516ms/step - loss: 0.3662 - accuracy: 0.8490 - val_loss: 0.3747 - val_accuracy: 0.8457
Epoch 126/500
16/16 [=====] - ETA: 0s - loss: 0.3697 - accuracy: 0.8428
Epoch 00126: val_loss did not improve from 0.34896
16/16 [=====] - 8s 519ms/step - loss: 0.3697 - accuracy: 0.8428 - val_loss: 0.3776 - val_accuracy: 0.8457
Epoch 127/500
16/16 [=====] - ETA: 0s - loss: 0.3689 - accuracy: 0.8405
Epoch 00127: val_loss did not improve from 0.34896
16/16 [=====] - 8s 527ms/step - loss: 0.3689 - accuracy: 0.8405 - val_loss: 0.3554 - val_accuracy: 0.8535
Epoch 128/500
16/16 [=====] - ETA: 0s - loss: 0.3700 - accuracy: 0.8495
Epoch 00128: val_loss did not improve from 0.34896
16/16 [=====] - 8s 516ms/step - loss: 0.3700 - accuracy: 0.8495 - val_loss: 0.3736 - val_accuracy: 0.8438
Epoch 129/500
16/16 [=====] - ETA: 0s - loss: 0.3711 - accuracy: 0.8510
Epoch 00129: val_loss did not improve from 0.34896
16/16 [=====] - 8s 516ms/step - loss: 0.3711 - accuracy: 0.8510 - val_loss: 0.3756 - val_accuracy: 0.8379
Epoch 130/500
16/16 [=====] - ETA: 0s - loss: 0.3607 - accuracy: 0.8559
Epoch 00130: val_loss did not improve from 0.34896
16/16 [=====] - 8s 520ms/step - loss: 0.3607 - accuracy: 0.8559 - val_loss: 0.3657 - val_accuracy: 0.8516
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Epoch 131/500
16/16 [=====] - ETA: 0s - loss: 0.3641 - accuracy: 0.8485
Epoch 00131: val_loss did not improve from 0.34896
16/16 [=====] - 8s 516ms/step - loss: 0.3641 - accuracy: 0.8485 - val_loss: 0.3702 - val_accuracy: 0.8516
Epoch 132/500
16/16 [=====] - ETA: 0s - loss: 0.3567 - accuracy: 0.8495
Epoch 00132: val_loss did not improve from 0.34896
16/16 [=====] - 8s 513ms/step - loss: 0.3567 - accuracy: 0.8495 - val_loss: 0.3633 - val_accuracy: 0.8516
Epoch 133/500
16/16 [=====] - ETA: 0s - loss: 0.3590 - accuracy: 0.8465
Epoch 00133: val_loss improved from 0.34896 to 0.34765, saving model to siamese_best.h5
16/16 [=====] - 8s 518ms/step - loss: 0.3590 - accuracy: 0.8465 - val_loss: 0.3477 - val_accuracy: 0.8594
Epoch 134/500
16/16 [=====] - ETA: 0s - loss: 0.3811 - accuracy: 0.8405
Epoch 00134: val_loss did not improve from 0.34765
16/16 [=====] - 8s 516ms/step - loss: 0.3811 - accuracy: 0.8405 - val_loss: 0.3730 - val_accuracy: 0.8379
Epoch 135/500
16/16 [=====] - ETA: 0s - loss: 0.3596 - accuracy: 0.8465
Epoch 00135: val_loss did not improve from 0.34765
16/16 [=====] - 8s 516ms/step - loss: 0.3596 - accuracy: 0.8465 - val_loss: 0.3657 - val_accuracy: 0.8418
Epoch 136/500
16/16 [=====] - ETA: 0s - loss: 0.3678 - accuracy: 0.8535
Epoch 00136: val_loss did not improve from 0.34765
16/16 [=====] - 8s 512ms/step - loss: 0.3678 - accuracy: 0.8535 - val_loss: 0.3864 - val_accuracy: 0.8340
Epoch 137/500
16/16 [=====] - ETA: 0s - loss: 0.3704 - accuracy: 0.8440
Epoch 00137: val_loss did not improve from 0.34765
16/16 [=====] - 8s 515ms/step - loss: 0.3704 - accuracy: 0.8440 - val_loss: 0.3812 - val_accuracy: 0.8359
Epoch 138/500
16/16 [=====] - ETA: 0s - loss: 0.3665 - accuracy: 0.8445
Epoch 00138: val_loss did not improve from 0.34765
16/16 [=====] - 8s 514ms/step - loss: 0.3665 - accuracy: 0.8445 - val_loss: 0.3834 - val_accuracy: 0.8535
Epoch 139/500
16/16 [=====] - ETA: 0s - loss: 0.3797 - accuracy: 0.8405
Epoch 00139: val_loss did not improve from 0.34765
16/16 [=====] - 8s 519ms/step - loss: 0.3797 - accuracy: 0.8405 - val_loss: 0.3678 - val_accuracy: 0.8320
Epoch 140/500
16/16 [=====] - ETA: 0s - loss: 0.3728 - accuracy:
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0.8420
Epoch 00140: val_loss did not improve from 0.34765
16/16 [=====] - 8s 515ms/step - loss: 0.3728 - accuracy: 0.8420 - val_loss: 0.3646 - val_accuracy: 0.8398
Epoch 141/500
16/16 [=====] - ETA: 0s - loss: 0.3707 - accuracy: 0.8425
Epoch 00141: val_loss did not improve from 0.34765
16/16 [=====] - 8s 522ms/step - loss: 0.3707 - accuracy: 0.8425 - val_loss: 0.3739 - val_accuracy: 0.8477
Epoch 142/500
16/16 [=====] - ETA: 0s - loss: 0.3617 - accuracy: 0.8500
Epoch 00142: val_loss did not improve from 0.34765
16/16 [=====] - 8s 516ms/step - loss: 0.3617 - accuracy: 0.8500 - val_loss: 0.3512 - val_accuracy: 0.8418
Epoch 143/500
16/16 [=====] - ETA: 0s - loss: 0.3639 - accuracy: 0.8511
Epoch 00143: val_loss did not improve from 0.34765
16/16 [=====] - 9s 533ms/step - loss: 0.3639 - accuracy: 0.8511 - val_loss: 0.3639 - val_accuracy: 0.8496
Epoch 144/500
16/16 [=====] - ETA: 0s - loss: 0.3583 - accuracy: 0.8490
Epoch 00144: val_loss did not improve from 0.34765
16/16 [=====] - 8s 529ms/step - loss: 0.3583 - accuracy: 0.8490 - val_loss: 0.3483 - val_accuracy: 0.8652
Epoch 145/500
16/16 [=====] - ETA: 0s - loss: 0.3673 - accuracy: 0.8460
Epoch 00145: val_loss did not improve from 0.34765
16/16 [=====] - 8s 517ms/step - loss: 0.3673 - accuracy: 0.8460 - val_loss: 0.3599 - val_accuracy: 0.8691
Epoch 146/500
16/16 [=====] - ETA: 0s - loss: 0.3604 - accuracy: 0.8530
Epoch 00146: val_loss did not improve from 0.34765
16/16 [=====] - 8s 512ms/step - loss: 0.3604 - accuracy: 0.8530 - val_loss: 0.3780 - val_accuracy: 0.8398
Epoch 147/500
16/16 [=====] - ETA: 0s - loss: 0.3752 - accuracy: 0.8510
Epoch 00147: val_loss did not improve from 0.34765
16/16 [=====] - 8s 509ms/step - loss: 0.3752 - accuracy: 0.8510 - val_loss: 0.3752 - val_accuracy: 0.8340
Epoch 148/500
16/16 [=====] - ETA: 0s - loss: 0.3807 - accuracy: 0.8400
Epoch 00148: val_loss did not improve from 0.34765
16/16 [=====] - 8s 512ms/step - loss: 0.3807 - accuracy: 0.8400 - val_loss: 0.3572 - val_accuracy: 0.8535
Epoch 149/500
16/16 [=====] - ETA: 0s - loss: 0.3619 - accuracy: 0.8475
Epoch 00149: val_loss did not improve from 0.34765
16/16 [=====] - 8s 518ms/step - loss: 0.3619 - accuracy:
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acy: 0.8475 - val_loss: 0.3506 - val_accuracy: 0.8633
Epoch 150/500
16/16 [=====] - ETA: 0s - loss: 0.3589 - accuracy: 0.8624
Epoch 00150: val_loss did not improve from 0.34765
16/16 [=====] - 8s 517ms/step - loss: 0.3589 - accuracy: 0.8624 - val_loss: 0.3635 - val_accuracy: 0.8516
Epoch 151/500
16/16 [=====] - ETA: 0s - loss: 0.3604 - accuracy: 0.8510
Epoch 00151: val_loss did not improve from 0.34765
16/16 [=====] - 8s 513ms/step - loss: 0.3604 - accuracy: 0.8510 - val_loss: 0.3522 - val_accuracy: 0.8535
Epoch 152/500
16/16 [=====] - ETA: 0s - loss: 0.3476 - accuracy: 0.8515
Epoch 00152: val_loss did not improve from 0.34765
16/16 [=====] - 8s 517ms/step - loss: 0.3476 - accuracy: 0.8515 - val_loss: 0.3710 - val_accuracy: 0.8438
Epoch 153/500
16/16 [=====] - ETA: 0s - loss: 0.3705 - accuracy: 0.8430
Epoch 00153: val_loss did not improve from 0.34765
16/16 [=====] - 8s 513ms/step - loss: 0.3705 - accuracy: 0.8430 - val_loss: 0.3534 - val_accuracy: 0.8730
Epoch 154/500
16/16 [=====] - ETA: 0s - loss: 0.3539 - accuracy: 0.8505
Epoch 00154: val_loss did not improve from 0.34765
16/16 [=====] - 8s 511ms/step - loss: 0.3539 - accuracy: 0.8505 - val_loss: 0.3621 - val_accuracy: 0.8555
Epoch 155/500
16/16 [=====] - ETA: 0s - loss: 0.3755 - accuracy: 0.8470
Epoch 00155: val_loss did not improve from 0.34765
16/16 [=====] - 8s 512ms/step - loss: 0.3755 - accuracy: 0.8470 - val_loss: 0.3625 - val_accuracy: 0.8652
Epoch 156/500
16/16 [=====] - ETA: 0s - loss: 0.3695 - accuracy: 0.8450
Epoch 00156: val_loss did not improve from 0.34765
16/16 [=====] - 8s 517ms/step - loss: 0.3695 - accuracy: 0.8450 - val_loss: 0.3828 - val_accuracy: 0.8398
Epoch 157/500
16/16 [=====] - ETA: 0s - loss: 0.3750 - accuracy: 0.8495
Epoch 00157: val_loss improved from 0.34765 to 0.34033, saving model to siame
se_best.h5
16/16 [=====] - 8s 519ms/step - loss: 0.3750 - accuracy: 0.8495 - val_loss: 0.3403 - val_accuracy: 0.8633
Epoch 158/500
16/16 [=====] - ETA: 0s - loss: 0.3488 - accuracy: 0.8530
Epoch 00158: val_loss did not improve from 0.34033
16/16 [=====] - 8s 518ms/step - loss: 0.3488 - accuracy: 0.8530 - val_loss: 0.3547 - val_accuracy: 0.8535
Epoch 159/500
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16/16 [=====] - ETA: 0s - loss: 0.3611 - accuracy: 0.8574
Epoch 00159: val_loss did not improve from 0.34033
16/16 [=====] - 8s 515ms/step - loss: 0.3611 - accuracy: 0.8574 - val_loss: 0.3453 - val_accuracy: 0.8770
Epoch 160/500
16/16 [=====] - ETA: 0s - loss: 0.3507 - accuracy: 0.8530
Epoch 00160: val_loss did not improve from 0.34033
16/16 [=====] - 8s 509ms/step - loss: 0.3507 - accuracy: 0.8530 - val_loss: 0.3824 - val_accuracy: 0.8301
Epoch 161/500
16/16 [=====] - ETA: 0s - loss: 0.3594 - accuracy: 0.8559
Epoch 00161: val_loss did not improve from 0.34033
16/16 [=====] - 8s 516ms/step - loss: 0.3594 - accuracy: 0.8559 - val_loss: 0.3925 - val_accuracy: 0.8320
Epoch 162/500
16/16 [=====] - ETA: 0s - loss: 0.3576 - accuracy: 0.8455
Epoch 00162: val_loss did not improve from 0.34033
16/16 [=====] - 8s 507ms/step - loss: 0.3576 - accuracy: 0.8455 - val_loss: 0.3464 - val_accuracy: 0.8516
Epoch 163/500
16/16 [=====] - ETA: 0s - loss: 0.3469 - accuracy: 0.8564
Epoch 00163: val_loss did not improve from 0.34033
16/16 [=====] - 8s 506ms/step - loss: 0.3469 - accuracy: 0.8564 - val_loss: 0.3500 - val_accuracy: 0.8477
Epoch 164/500
16/16 [=====] - ETA: 0s - loss: 0.3834 - accuracy: 0.8395
Epoch 00164: val_loss did not improve from 0.34033
16/16 [=====] - 8s 509ms/step - loss: 0.3834 - accuracy: 0.8395 - val_loss: 0.3475 - val_accuracy: 0.8613
Epoch 165/500
16/16 [=====] - ETA: 0s - loss: 0.3503 - accuracy: 0.8535
Epoch 00165: val_loss did not improve from 0.34033
16/16 [=====] - 8s 512ms/step - loss: 0.3503 - accuracy: 0.8535 - val_loss: 0.3623 - val_accuracy: 0.8516
Epoch 166/500
16/16 [=====] - ETA: 0s - loss: 0.3699 - accuracy: 0.8460
Epoch 00166: val_loss did not improve from 0.34033
16/16 [=====] - 8s 506ms/step - loss: 0.3699 - accuracy: 0.8460 - val_loss: 0.3483 - val_accuracy: 0.8633
Epoch 167/500
16/16 [=====] - ETA: 0s - loss: 0.3536 - accuracy: 0.8475
Epoch 00167: val_loss did not improve from 0.34033
16/16 [=====] - 8s 507ms/step - loss: 0.3536 - accuracy: 0.8475 - val_loss: 0.3608 - val_accuracy: 0.8379
Epoch 168/500
16/16 [=====] - ETA: 0s - loss: 0.3455 - accuracy: 0.8554
Epoch 00168: val_loss did not improve from 0.34033
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16/16 [=====] - 8s 512ms/step - loss: 0.3455 - accuracy: 0.8554 - val_loss: 0.3483 - val_accuracy: 0.8672
Epoch 169/500
16/16 [=====] - ETA: 0s - loss: 0.3633 - accuracy: 0.8525
Epoch 00169: val_loss did not improve from 0.34033
16/16 [=====] - 8s 508ms/step - loss: 0.3633 - accuracy: 0.8525 - val_loss: 0.3597 - val_accuracy: 0.8750
Epoch 170/500
16/16 [=====] - ETA: 0s - loss: 0.3562 - accuracy: 0.8485
Epoch 00170: val_loss improved from 0.34033 to 0.32213, saving model to siamese_best.h5
16/16 [=====] - 8s 512ms/step - loss: 0.3562 - accuracy: 0.8485 - val_loss: 0.3221 - val_accuracy: 0.8789
Epoch 171/500
16/16 [=====] - ETA: 0s - loss: 0.3434 - accuracy: 0.8679
Epoch 00171: val_loss did not improve from 0.32213
16/16 [=====] - 8s 507ms/step - loss: 0.3434 - accuracy: 0.8679 - val_loss: 0.3681 - val_accuracy: 0.8496
Epoch 172/500
16/16 [=====] - ETA: 0s - loss: 0.3709 - accuracy: 0.8415
Epoch 00172: val_loss did not improve from 0.32213
16/16 [=====] - 8s 508ms/step - loss: 0.3709 - accuracy: 0.8415 - val_loss: 0.3607 - val_accuracy: 0.8516
Epoch 173/500
16/16 [=====] - ETA: 0s - loss: 0.3563 - accuracy: 0.8525
Epoch 00173: val_loss did not improve from 0.32213
16/16 [=====] - 8s 506ms/step - loss: 0.3563 - accuracy: 0.8525 - val_loss: 0.3516 - val_accuracy: 0.8574
Epoch 174/500
16/16 [=====] - ETA: 0s - loss: 0.3472 - accuracy: 0.8614
Epoch 00174: val_loss did not improve from 0.32213
16/16 [=====] - 8s 506ms/step - loss: 0.3472 - accuracy: 0.8614 - val_loss: 0.3741 - val_accuracy: 0.8457
Epoch 175/500
16/16 [=====] - ETA: 0s - loss: 0.3514 - accuracy: 0.8554
Epoch 00175: val_loss did not improve from 0.32213
16/16 [=====] - 8s 505ms/step - loss: 0.3514 - accuracy: 0.8554 - val_loss: 0.3585 - val_accuracy: 0.8516
Epoch 176/500
16/16 [=====] - ETA: 0s - loss: 0.3375 - accuracy: 0.8614
Epoch 00176: val_loss did not improve from 0.32213
16/16 [=====] - 8s 517ms/step - loss: 0.3375 - accuracy: 0.8614 - val_loss: 0.3622 - val_accuracy: 0.8633
Epoch 177/500
16/16 [=====] - ETA: 0s - loss: 0.3497 - accuracy: 0.8545
Epoch 00177: val_loss did not improve from 0.32213
16/16 [=====] - 8s 516ms/step - loss: 0.3497 - accuracy: 0.8545 - val_loss: 0.3604 - val_accuracy: 0.8652
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Epoch 178/500
16/16 [=====] - ETA: 0s - loss: 0.3510 - accuracy: 0.8530
Epoch 00178: val_loss did not improve from 0.32213
16/16 [=====] - 8s 523ms/step - loss: 0.3510 - accuracy: 0.8530 - val_loss: 0.3623 - val_accuracy: 0.8574
Epoch 179/500
16/16 [=====] - ETA: 0s - loss: 0.3489 - accuracy: 0.8564
Epoch 00179: val_loss did not improve from 0.32213
16/16 [=====] - 8s 512ms/step - loss: 0.3489 - accuracy: 0.8564 - val_loss: 0.3562 - val_accuracy: 0.8574
Epoch 180/500
16/16 [=====] - ETA: 0s - loss: 0.3482 - accuracy: 0.8584
Epoch 00180: val_loss did not improve from 0.32213
16/16 [=====] - 9s 533ms/step - loss: 0.3482 - accuracy: 0.8584 - val_loss: 0.3519 - val_accuracy: 0.8594
Epoch 181/500
16/16 [=====] - ETA: 0s - loss: 0.3510 - accuracy: 0.8609
Epoch 00181: val_loss did not improve from 0.32213
16/16 [=====] - 8s 518ms/step - loss: 0.3510 - accuracy: 0.8609 - val_loss: 0.3580 - val_accuracy: 0.8477
Epoch 182/500
16/16 [=====] - ETA: 0s - loss: 0.3448 - accuracy: 0.8559
Epoch 00182: val_loss did not improve from 0.32213
16/16 [=====] - 8s 512ms/step - loss: 0.3448 - accuracy: 0.8559 - val_loss: 0.3441 - val_accuracy: 0.8535
Epoch 183/500
16/16 [=====] - ETA: 0s - loss: 0.3425 - accuracy: 0.8584
Epoch 00183: val_loss did not improve from 0.32213
16/16 [=====] - 8s 516ms/step - loss: 0.3425 - accuracy: 0.8584 - val_loss: 0.3547 - val_accuracy: 0.8359
Epoch 184/500
16/16 [=====] - ETA: 0s - loss: 0.3604 - accuracy: 0.8475
Epoch 00184: val_loss did not improve from 0.32213
16/16 [=====] - 8s 516ms/step - loss: 0.3604 - accuracy: 0.8475 - val_loss: 0.3399 - val_accuracy: 0.8613
Epoch 185/500
16/16 [=====] - ETA: 0s - loss: 0.3358 - accuracy: 0.8599
Epoch 00185: val_loss did not improve from 0.32213
16/16 [=====] - 8s 514ms/step - loss: 0.3358 - accuracy: 0.8599 - val_loss: 0.3601 - val_accuracy: 0.8652
Epoch 186/500
16/16 [=====] - ETA: 0s - loss: 0.3359 - accuracy: 0.8510
Epoch 00186: val_loss did not improve from 0.32213
16/16 [=====] - 8s 515ms/step - loss: 0.3359 - accuracy: 0.8510 - val_loss: 0.3599 - val_accuracy: 0.8555
Epoch 187/500
16/16 [=====] - ETA: 0s - loss: 0.3629 - accuracy: 0.8539
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Epoch 00187: val_loss did not improve from 0.32213
16/16 [=====] - 8s 522ms/step - loss: 0.3629 - accuracy: 0.8539 - val_loss: 0.3388 - val_accuracy: 0.8652
Epoch 188/500
16/16 [=====] - ETA: 0s - loss: 0.3405 - accuracy: 0.8599
Epoch 00188: val_loss did not improve from 0.32213
16/16 [=====] - 8s 522ms/step - loss: 0.3405 - accuracy: 0.8599 - val_loss: 0.3499 - val_accuracy: 0.8555
Epoch 189/500
16/16 [=====] - ETA: 0s - loss: 0.3328 - accuracy: 0.8579
Epoch 00189: val_loss did not improve from 0.32213
16/16 [=====] - 8s 510ms/step - loss: 0.3328 - accuracy: 0.8579 - val_loss: 0.3474 - val_accuracy: 0.8574
Epoch 190/500
16/16 [=====] - ETA: 0s - loss: 0.3258 - accuracy: 0.8679
Epoch 00190: val_loss did not improve from 0.32213
16/16 [=====] - 8s 517ms/step - loss: 0.3258 - accuracy: 0.8679 - val_loss: 0.3598 - val_accuracy: 0.8379
Epoch 191/500
16/16 [=====] - ETA: 0s - loss: 0.3431 - accuracy: 0.8539
Epoch 00191: val_loss did not improve from 0.32213
16/16 [=====] - 8s 513ms/step - loss: 0.3431 - accuracy: 0.8539 - val_loss: 0.3677 - val_accuracy: 0.8535
Epoch 192/500
16/16 [=====] - ETA: 0s - loss: 0.3543 - accuracy: 0.8530
Epoch 00192: val_loss did not improve from 0.32213
16/16 [=====] - 8s 512ms/step - loss: 0.3543 - accuracy: 0.8530 - val_loss: 0.3473 - val_accuracy: 0.8555
Epoch 193/500
16/16 [=====] - ETA: 0s - loss: 0.3480 - accuracy: 0.8539
Epoch 00193: val_loss did not improve from 0.32213
16/16 [=====] - 8s 514ms/step - loss: 0.3480 - accuracy: 0.8539 - val_loss: 0.3449 - val_accuracy: 0.8594
Epoch 194/500
16/16 [=====] - ETA: 0s - loss: 0.3404 - accuracy: 0.8608
Epoch 00194: val_loss did not improve from 0.32213
16/16 [=====] - 8s 516ms/step - loss: 0.3404 - accuracy: 0.8608 - val_loss: 0.3487 - val_accuracy: 0.8613
Epoch 195/500
16/16 [=====] - ETA: 0s - loss: 0.3475 - accuracy: 0.8624
Epoch 00195: val_loss did not improve from 0.32213
16/16 [=====] - 8s 525ms/step - loss: 0.3475 - accuracy: 0.8624 - val_loss: 0.3417 - val_accuracy: 0.8477
Epoch 196/500
16/16 [=====] - ETA: 0s - loss: 0.3431 - accuracy: 0.8614
Epoch 00196: val_loss did not improve from 0.32213
16/16 [=====] - 8s 515ms/step - loss: 0.3431 - accuracy: 0.8614 - val_loss: 0.3498 - val_accuracy: 0.8574
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Epoch 197/500
16/16 [=====] - ETA: 0s - loss: 0.3379 - accuracy: 0.8589
Epoch 00197: val_loss did not improve from 0.32213
16/16 [=====] - 8s 521ms/step - loss: 0.3379 - accuracy: 0.8589 - val_loss: 0.3596 - val_accuracy: 0.8555
Epoch 198/500
16/16 [=====] - ETA: 0s - loss: 0.3391 - accuracy: 0.8634
Epoch 00198: val_loss did not improve from 0.32213
16/16 [=====] - 8s 518ms/step - loss: 0.3391 - accuracy: 0.8634 - val_loss: 0.3736 - val_accuracy: 0.8535
Epoch 199/500
16/16 [=====] - ETA: 0s - loss: 0.3379 - accuracy: 0.8539
Epoch 00199: val_loss did not improve from 0.32213
16/16 [=====] - 8s 518ms/step - loss: 0.3379 - accuracy: 0.8539 - val_loss: 0.3225 - val_accuracy: 0.8672
Epoch 200/500
16/16 [=====] - ETA: 0s - loss: 0.3564 - accuracy: 0.8495
Epoch 00200: val_loss did not improve from 0.32213
16/16 [=====] - 8s 515ms/step - loss: 0.3564 - accuracy: 0.8495 - val_loss: 0.3564 - val_accuracy: 0.8457
Epoch 201/500
16/16 [=====] - ETA: 0s - loss: 0.3481 - accuracy: 0.8604
Epoch 00201: val_loss did not improve from 0.32213
16/16 [=====] - 8s 514ms/step - loss: 0.3481 - accuracy: 0.8604 - val_loss: 0.3506 - val_accuracy: 0.8613
Epoch 202/500
16/16 [=====] - ETA: 0s - loss: 0.3393 - accuracy: 0.8589
Epoch 00202: val_loss did not improve from 0.32213
16/16 [=====] - 8s 511ms/step - loss: 0.3393 - accuracy: 0.8589 - val_loss: 0.3600 - val_accuracy: 0.8457
Epoch 203/500
16/16 [=====] - ETA: 0s - loss: 0.3353 - accuracy: 0.8664
Epoch 00203: val_loss did not improve from 0.32213
16/16 [=====] - 8s 517ms/step - loss: 0.3353 - accuracy: 0.8664 - val_loss: 0.3610 - val_accuracy: 0.8535
Epoch 204/500
16/16 [=====] - ETA: 0s - loss: 0.3783 - accuracy: 0.8470
Epoch 00204: val_loss did not improve from 0.32213
16/16 [=====] - 8s 512ms/step - loss: 0.3783 - accuracy: 0.8470 - val_loss: 0.3743 - val_accuracy: 0.8516
Epoch 205/500
16/16 [=====] - ETA: 0s - loss: 0.3509 - accuracy: 0.8490
Epoch 00205: val_loss did not improve from 0.32213
16/16 [=====] - 8s 517ms/step - loss: 0.3509 - accuracy: 0.8490 - val_loss: 0.3573 - val_accuracy: 0.8652
Epoch 206/500
16/16 [=====] - ETA: 0s - loss: 0.3396 - accuracy: 0.8564
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Epoch 00206: val_loss did not improve from 0.32213
16/16 [=====] - 8s 520ms/step - loss: 0.3396 - accuracy: 0.8564 - val_loss: 0.3629 - val_accuracy: 0.8613
Epoch 207/500
16/16 [=====] - ETA: 0s - loss: 0.3417 - accuracy: 0.8634
Epoch 00207: val_loss did not improve from 0.32213
16/16 [=====] - 8s 516ms/step - loss: 0.3417 - accuracy: 0.8634 - val_loss: 0.3390 - val_accuracy: 0.8535
Epoch 208/500
16/16 [=====] - ETA: 0s - loss: 0.3284 - accuracy: 0.8728
Epoch 00208: val_loss did not improve from 0.32213
16/16 [=====] - 8s 514ms/step - loss: 0.3284 - accuracy: 0.8728 - val_loss: 0.3399 - val_accuracy: 0.8672
Epoch 209/500
16/16 [=====] - ETA: 0s - loss: 0.3412 - accuracy: 0.8629
Epoch 00209: val_loss did not improve from 0.32213
16/16 [=====] - 8s 514ms/step - loss: 0.3412 - accuracy: 0.8629 - val_loss: 0.3289 - val_accuracy: 0.8730
Epoch 210/500
16/16 [=====] - ETA: 0s - loss: 0.3276 - accuracy: 0.8589
Epoch 00210: val_loss did not improve from 0.32213
16/16 [=====] - 8s 513ms/step - loss: 0.3276 - accuracy: 0.8589 - val_loss: 0.3641 - val_accuracy: 0.8438
Epoch 211/500
16/16 [=====] - ETA: 0s - loss: 0.3359 - accuracy: 0.8599
Epoch 00211: val_loss did not improve from 0.32213
16/16 [=====] - 8s 511ms/step - loss: 0.3359 - accuracy: 0.8599 - val_loss: 0.3342 - val_accuracy: 0.8633
Epoch 212/500
16/16 [=====] - ETA: 0s - loss: 0.3337 - accuracy: 0.8559
Epoch 00212: val_loss did not improve from 0.32213
16/16 [=====] - 8s 528ms/step - loss: 0.3337 - accuracy: 0.8559 - val_loss: 0.3565 - val_accuracy: 0.8477
Epoch 213/500
16/16 [=====] - ETA: 0s - loss: 0.3458 - accuracy: 0.8549
Epoch 00213: val_loss did not improve from 0.32213
16/16 [=====] - 8s 512ms/step - loss: 0.3458 - accuracy: 0.8549 - val_loss: 0.3663 - val_accuracy: 0.8477
Epoch 214/500
16/16 [=====] - ETA: 0s - loss: 0.3358 - accuracy: 0.8634
Epoch 00214: val_loss did not improve from 0.32213
16/16 [=====] - 8s 516ms/step - loss: 0.3358 - accuracy: 0.8634 - val_loss: 0.3405 - val_accuracy: 0.8633
Epoch 215/500
16/16 [=====] - ETA: 0s - loss: 0.3528 - accuracy: 0.8564
Epoch 00215: val_loss did not improve from 0.32213
16/16 [=====] - 8s 522ms/step - loss: 0.3528 - accuracy: 0.8564 - val_loss: 0.3515 - val_accuracy: 0.8418
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Epoch 216/500
16/16 [=====] - ETA: 0s - loss: 0.3318 - accuracy: 0.8624
Epoch 00216: val_loss did not improve from 0.32213
16/16 [=====] - 8s 525ms/step - loss: 0.3318 - accuracy: 0.8624 - val_loss: 0.3424 - val_accuracy: 0.8555
Epoch 217/500
16/16 [=====] - ETA: 0s - loss: 0.3537 - accuracy: 0.8559
Epoch 00217: val_loss did not improve from 0.32213
16/16 [=====] - 8s 524ms/step - loss: 0.3537 - accuracy: 0.8559 - val_loss: 0.3412 - val_accuracy: 0.8555
Epoch 218/500
16/16 [=====] - ETA: 0s - loss: 0.3371 - accuracy: 0.8564
Epoch 00218: val_loss did not improve from 0.32213
16/16 [=====] - 8s 520ms/step - loss: 0.3371 - accuracy: 0.8564 - val_loss: 0.3513 - val_accuracy: 0.8613
Epoch 219/500
16/16 [=====] - ETA: 0s - loss: 0.3589 - accuracy: 0.8569
Epoch 00219: val_loss did not improve from 0.32213
16/16 [=====] - 8s 522ms/step - loss: 0.3589 - accuracy: 0.8569 - val_loss: 0.3447 - val_accuracy: 0.8633
Epoch 220/500
16/16 [=====] - ETA: 0s - loss: 0.3560 - accuracy: 0.8589
Epoch 00220: val_loss did not improve from 0.32213
16/16 [=====] - 8s 519ms/step - loss: 0.3560 - accuracy: 0.8589 - val_loss: 0.3374 - val_accuracy: 0.8535
Epoch 221/500
16/16 [=====] - ETA: 0s - loss: 0.3510 - accuracy: 0.8629
Epoch 00221: val_loss did not improve from 0.32213
16/16 [=====] - 8s 516ms/step - loss: 0.3510 - accuracy: 0.8629 - val_loss: 0.3459 - val_accuracy: 0.8535
Epoch 222/500
16/16 [=====] - ETA: 0s - loss: 0.3592 - accuracy: 0.8500
Epoch 00222: val_loss did not improve from 0.32213
16/16 [=====] - 8s 515ms/step - loss: 0.3592 - accuracy: 0.8500 - val_loss: 0.3387 - val_accuracy: 0.8555
Epoch 223/500
16/16 [=====] - ETA: 0s - loss: 0.3532 - accuracy: 0.8480
Epoch 00223: val_loss did not improve from 0.32213
16/16 [=====] - 8s 515ms/step - loss: 0.3532 - accuracy: 0.8480 - val_loss: 0.3456 - val_accuracy: 0.8691
Epoch 224/500
16/16 [=====] - ETA: 0s - loss: 0.3384 - accuracy: 0.8664
Epoch 00224: val_loss did not improve from 0.32213
16/16 [=====] - 8s 522ms/step - loss: 0.3384 - accuracy: 0.8664 - val_loss: 0.3281 - val_accuracy: 0.8730
Epoch 225/500
16/16 [=====] - ETA: 0s - loss: 0.3390 - accuracy: 0.8649
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Epoch 00225: val_loss did not improve from 0.32213
16/16 [=====] - 8s 524ms/step - loss: 0.3390 - accuracy: 0.8649 - val_loss: 0.3429 - val_accuracy: 0.8613
Epoch 226/500
16/16 [=====] - ETA: 0s - loss: 0.3243 - accuracy: 0.8639
Epoch 00226: val_loss did not improve from 0.32213
16/16 [=====] - 8s 518ms/step - loss: 0.3243 - accuracy: 0.8639 - val_loss: 0.3589 - val_accuracy: 0.8457
Epoch 227/500
16/16 [=====] - ETA: 0s - loss: 0.3457 - accuracy: 0.8584
Epoch 00227: val_loss did not improve from 0.32213
16/16 [=====] - 8s 515ms/step - loss: 0.3457 - accuracy: 0.8584 - val_loss: 0.3657 - val_accuracy: 0.8438
Epoch 228/500
16/16 [=====] - ETA: 0s - loss: 0.3441 - accuracy: 0.8584
Epoch 00228: val_loss did not improve from 0.32213
16/16 [=====] - 8s 518ms/step - loss: 0.3441 - accuracy: 0.8584 - val_loss: 0.3473 - val_accuracy: 0.8594
Epoch 229/500
16/16 [=====] - ETA: 0s - loss: 0.3333 - accuracy: 0.8659
Epoch 00229: val_loss did not improve from 0.32213
16/16 [=====] - 8s 520ms/step - loss: 0.3333 - accuracy: 0.8659 - val_loss: 0.3555 - val_accuracy: 0.8652
Epoch 230/500
16/16 [=====] - ETA: 0s - loss: 0.3410 - accuracy: 0.8639
Epoch 00230: val_loss did not improve from 0.32213
16/16 [=====] - 8s 508ms/step - loss: 0.3410 - accuracy: 0.8639 - val_loss: 0.3457 - val_accuracy: 0.8691
Epoch 231/500
16/16 [=====] - ETA: 0s - loss: 0.3379 - accuracy: 0.8609
Epoch 00231: val_loss did not improve from 0.32213
16/16 [=====] - 8s 509ms/step - loss: 0.3379 - accuracy: 0.8609 - val_loss: 0.3375 - val_accuracy: 0.8633
Epoch 232/500
16/16 [=====] - ETA: 0s - loss: 0.3227 - accuracy: 0.8689
Epoch 00232: val_loss did not improve from 0.32213
16/16 [=====] - 8s 507ms/step - loss: 0.3227 - accuracy: 0.8689 - val_loss: 0.3377 - val_accuracy: 0.8750
Epoch 233/500
16/16 [=====] - ETA: 0s - loss: 0.3267 - accuracy: 0.8733
Epoch 00233: val_loss did not improve from 0.32213
16/16 [=====] - 8s 513ms/step - loss: 0.3267 - accuracy: 0.8733 - val_loss: 0.3355 - val_accuracy: 0.8633
Epoch 234/500
16/16 [=====] - ETA: 0s - loss: 0.3223 - accuracy: 0.8649
Epoch 00234: val_loss did not improve from 0.32213
16/16 [=====] - 8s 512ms/step - loss: 0.3223 - accuracy: 0.8649 - val_loss: 0.3586 - val_accuracy: 0.8594
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Epoch 235/500
16/16 [=====] - ETA: 0s - loss: 0.3303 - accuracy: 0.8728
Epoch 00235: val_loss did not improve from 0.32213
16/16 [=====] - 8s 516ms/step - loss: 0.3303 - accuracy: 0.8728 - val_loss: 0.3370 - val_accuracy: 0.8652
Epoch 236/500
16/16 [=====] - ETA: 0s - loss: 0.3435 - accuracy: 0.8589
Epoch 00236: val_loss did not improve from 0.32213
16/16 [=====] - 8s 511ms/step - loss: 0.3435 - accuracy: 0.8589 - val_loss: 0.3571 - val_accuracy: 0.8555
Epoch 237/500
16/16 [=====] - ETA: 0s - loss: 0.3304 - accuracy: 0.8569
Epoch 00237: val_loss improved from 0.32213 to 0.31938, saving model to siamese_best.h5
16/16 [=====] - 8s 515ms/step - loss: 0.3304 - accuracy: 0.8569 - val_loss: 0.3194 - val_accuracy: 0.8770
Epoch 238/500
16/16 [=====] - ETA: 0s - loss: 0.3247 - accuracy: 0.8654
Epoch 00238: val_loss did not improve from 0.31938
16/16 [=====] - 8s 510ms/step - loss: 0.3247 - accuracy: 0.8654 - val_loss: 0.3457 - val_accuracy: 0.8613
Epoch 239/500
16/16 [=====] - ETA: 0s - loss: 0.3369 - accuracy: 0.8644
Epoch 00239: val_loss did not improve from 0.31938
16/16 [=====] - 8s 509ms/step - loss: 0.3369 - accuracy: 0.8644 - val_loss: 0.3488 - val_accuracy: 0.8477
Epoch 240/500
16/16 [=====] - ETA: 0s - loss: 0.3176 - accuracy: 0.8703
Epoch 00240: val_loss did not improve from 0.31938
16/16 [=====] - 8s 517ms/step - loss: 0.3176 - accuracy: 0.8703 - val_loss: 0.3674 - val_accuracy: 0.8535
Epoch 241/500
16/16 [=====] - ETA: 0s - loss: 0.3321 - accuracy: 0.8669
Epoch 00241: val_loss did not improve from 0.31938
16/16 [=====] - 8s 506ms/step - loss: 0.3321 - accuracy: 0.8669 - val_loss: 0.3442 - val_accuracy: 0.8555
Epoch 242/500
16/16 [=====] - ETA: 0s - loss: 0.3316 - accuracy: 0.8679
Epoch 00242: val_loss did not improve from 0.31938
16/16 [=====] - 8s 509ms/step - loss: 0.3316 - accuracy: 0.8679 - val_loss: 0.3421 - val_accuracy: 0.8555
Epoch 243/500
16/16 [=====] - ETA: 0s - loss: 0.3315 - accuracy: 0.8624
Epoch 00243: val_loss did not improve from 0.31938
16/16 [=====] - 8s 513ms/step - loss: 0.3315 - accuracy: 0.8624 - val_loss: 0.3532 - val_accuracy: 0.8516
Epoch 244/500
16/16 [=====] - ETA: 0s - loss: 0.3314 - accuracy:
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0.8569
Epoch 00244: val_loss did not improve from 0.31938
16/16 [=====] - 8s 515ms/step - loss: 0.3314 - accuracy: 0.8569 - val_loss: 0.3362 - val_accuracy: 0.8574
Epoch 245/500
16/16 [=====] - ETA: 0s - loss: 0.3351 - accuracy: 0.8608
Epoch 00245: val_loss did not improve from 0.31938
16/16 [=====] - 8s 512ms/step - loss: 0.3351 - accuracy: 0.8608 - val_loss: 0.3409 - val_accuracy: 0.8574
Epoch 246/500
16/16 [=====] - ETA: 0s - loss: 0.3271 - accuracy: 0.8664
Epoch 00246: val_loss did not improve from 0.31938
16/16 [=====] - 8s 514ms/step - loss: 0.3271 - accuracy: 0.8664 - val_loss: 0.3495 - val_accuracy: 0.8594
Epoch 247/500
16/16 [=====] - ETA: 0s - loss: 0.3230 - accuracy: 0.8684
Epoch 00247: val_loss did not improve from 0.31938
16/16 [=====] - 8s 511ms/step - loss: 0.3230 - accuracy: 0.8684 - val_loss: 0.3467 - val_accuracy: 0.8594
Epoch 248/500
16/16 [=====] - ETA: 0s - loss: 0.3170 - accuracy: 0.8713
Epoch 00248: val_loss did not improve from 0.31938
16/16 [=====] - 8s 510ms/step - loss: 0.3170 - accuracy: 0.8713 - val_loss: 0.3335 - val_accuracy: 0.8574
Epoch 249/500
16/16 [=====] - ETA: 0s - loss: 0.3247 - accuracy: 0.8654
Epoch 00249: val_loss did not improve from 0.31938
16/16 [=====] - 8s 512ms/step - loss: 0.3247 - accuracy: 0.8654 - val_loss: 0.3355 - val_accuracy: 0.8574
Epoch 250/500
16/16 [=====] - ETA: 0s - loss: 0.3337 - accuracy: 0.8609
Epoch 00250: val_loss did not improve from 0.31938
16/16 [=====] - 8s 507ms/step - loss: 0.3337 - accuracy: 0.8609 - val_loss: 0.3360 - val_accuracy: 0.8594
Epoch 251/500
16/16 [=====] - ETA: 0s - loss: 0.3187 - accuracy: 0.8708
Epoch 00251: val_loss did not improve from 0.31938
16/16 [=====] - 8s 512ms/step - loss: 0.3187 - accuracy: 0.8708 - val_loss: 0.3404 - val_accuracy: 0.8516
Epoch 252/500
16/16 [=====] - ETA: 0s - loss: 0.3305 - accuracy: 0.8619
Epoch 00252: val_loss did not improve from 0.31938
16/16 [=====] - 8s 512ms/step - loss: 0.3305 - accuracy: 0.8619 - val_loss: 0.3501 - val_accuracy: 0.8574
Epoch 253/500
16/16 [=====] - ETA: 0s - loss: 0.3370 - accuracy: 0.8554
Epoch 00253: val_loss did not improve from 0.31938
16/16 [=====] - 8s 509ms/step - loss: 0.3370 - accuracy:
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acy: 0.8554 - val_loss: 0.3747 - val_accuracy: 0.8418
Epoch 254/500
16/16 [=====] - ETA: 0s - loss: 0.3288 - accuracy: 0.8584
Epoch 00254: val_loss did not improve from 0.31938
16/16 [=====] - 8s 520ms/step - loss: 0.3288 - accuracy: 0.8584 - val_loss: 0.3377 - val_accuracy: 0.8594
Epoch 255/500
16/16 [=====] - ETA: 0s - loss: 0.3185 - accuracy: 0.8743
Epoch 00255: val_loss did not improve from 0.31938
16/16 [=====] - 8s 512ms/step - loss: 0.3185 - accuracy: 0.8743 - val_loss: 0.3314 - val_accuracy: 0.8535
Epoch 256/500
16/16 [=====] - ETA: 0s - loss: 0.3126 - accuracy: 0.8703
Epoch 00256: val_loss did not improve from 0.31938
16/16 [=====] - 8s 505ms/step - loss: 0.3126 - accuracy: 0.8703 - val_loss: 0.3255 - val_accuracy: 0.8652
Epoch 257/500
16/16 [=====] - ETA: 0s - loss: 0.3409 - accuracy: 0.8559
Epoch 00257: val_loss did not improve from 0.31938
16/16 [=====] - 8s 502ms/step - loss: 0.3409 - accuracy: 0.8559 - val_loss: 0.3657 - val_accuracy: 0.8516
Epoch 258/500
16/16 [=====] - ETA: 0s - loss: 0.3120 - accuracy: 0.8723
Epoch 00258: val_loss did not improve from 0.31938
16/16 [=====] - 8s 499ms/step - loss: 0.3120 - accuracy: 0.8723 - val_loss: 0.3560 - val_accuracy: 0.8555
Epoch 259/500
16/16 [=====] - ETA: 0s - loss: 0.3200 - accuracy: 0.8619
Epoch 00259: val_loss did not improve from 0.31938
16/16 [=====] - 8s 505ms/step - loss: 0.3200 - accuracy: 0.8619 - val_loss: 0.3600 - val_accuracy: 0.8574
Epoch 260/500
16/16 [=====] - ETA: 0s - loss: 0.3567 - accuracy: 0.8520
Epoch 00260: val_loss did not improve from 0.31938
16/16 [=====] - 8s 499ms/step - loss: 0.3567 - accuracy: 0.8520 - val_loss: 0.3493 - val_accuracy: 0.8750
Epoch 261/500
16/16 [=====] - ETA: 0s - loss: 0.3224 - accuracy: 0.8708
Epoch 00261: val_loss did not improve from 0.31938
16/16 [=====] - 8s 509ms/step - loss: 0.3224 - accuracy: 0.8708 - val_loss: 0.3468 - val_accuracy: 0.8477
Epoch 262/500
16/16 [=====] - ETA: 0s - loss: 0.3369 - accuracy: 0.8604
Epoch 00262: val_loss did not improve from 0.31938
16/16 [=====] - 8s 509ms/step - loss: 0.3369 - accuracy: 0.8604 - val_loss: 0.3487 - val_accuracy: 0.8652
Epoch 263/500
16/16 [=====] - ETA: 0s - loss: 0.3124 - accuracy:
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0.8738  
Epoch 00263: val\_loss did not improve from 0.31938  
16/16 [=====] - 8s 510ms/step - loss: 0.3124 - accuracy: 0.8738 - val\_loss: 0.3601 - val\_accuracy: 0.8418  
Epoch 264/500  
16/16 [=====] - ETA: 0s - loss: 0.3193 - accuracy: 0.8708  
Epoch 00264: val\_loss improved from 0.31938 to 0.31593, saving model to siamese\_best.h5  
16/16 [=====] - 8s 513ms/step - loss: 0.3193 - accuracy: 0.8708 - val\_loss: 0.3159 - val\_accuracy: 0.8770  
Epoch 265/500  
16/16 [=====] - ETA: 0s - loss: 0.3134 - accuracy: 0.8758  
Epoch 00265: val\_loss did not improve from 0.31593  
16/16 [=====] - 8s 503ms/step - loss: 0.3134 - accuracy: 0.8758 - val\_loss: 0.3339 - val\_accuracy: 0.8672  
Epoch 266/500  
16/16 [=====] - ETA: 0s - loss: 0.3449 - accuracy: 0.8564  
Epoch 00266: val\_loss did not improve from 0.31593  
16/16 [=====] - 8s 505ms/step - loss: 0.3449 - accuracy: 0.8564 - val\_loss: 0.3410 - val\_accuracy: 0.8574  
Epoch 267/500  
16/16 [=====] - ETA: 0s - loss: 0.3351 - accuracy: 0.8634  
Epoch 00267: val\_loss did not improve from 0.31593  
16/16 [=====] - 8s 507ms/step - loss: 0.3351 - accuracy: 0.8634 - val\_loss: 0.3291 - val\_accuracy: 0.8652  
Epoch 268/500  
16/16 [=====] - ETA: 0s - loss: 0.2877 - accuracy: 0.8773  
Epoch 00268: val\_loss did not improve from 0.31593  
16/16 [=====] - 8s 503ms/step - loss: 0.2877 - accuracy: 0.8773 - val\_loss: 0.3249 - val\_accuracy: 0.8730  
Epoch 269/500  
16/16 [=====] - ETA: 0s - loss: 0.3299 - accuracy: 0.8619  
Epoch 00269: val\_loss did not improve from 0.31593  
16/16 [=====] - 8s 506ms/step - loss: 0.3299 - accuracy: 0.8619 - val\_loss: 0.3250 - val\_accuracy: 0.8691  
Epoch 270/500  
16/16 [=====] - ETA: 0s - loss: 0.3096 - accuracy: 0.8679  
Epoch 00270: val\_loss did not improve from 0.31593  
16/16 [=====] - 8s 506ms/step - loss: 0.3096 - accuracy: 0.8679 - val\_loss: 0.3403 - val\_accuracy: 0.8789  
Epoch 271/500  
16/16 [=====] - ETA: 0s - loss: 0.3286 - accuracy: 0.8619  
Epoch 00271: val\_loss did not improve from 0.31593  
16/16 [=====] - 8s 499ms/step - loss: 0.3286 - accuracy: 0.8619 - val\_loss: 0.3375 - val\_accuracy: 0.8730  
Epoch 272/500  
16/16 [=====] - ETA: 0s - loss: 0.3131 - accuracy: 0.8674  
Epoch 00272: val\_loss did not improve from 0.31593

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16/16 [=====] - 8s 505ms/step - loss: 0.3131 - accuracy: 0.8674 - val_loss: 0.3185 - val_accuracy: 0.8770
Epoch 273/500
16/16 [=====] - ETA: 0s - loss: 0.3141 - accuracy: 0.8639
Epoch 00273: val_loss did not improve from 0.31593
16/16 [=====] - 8s 506ms/step - loss: 0.3141 - accuracy: 0.8639 - val_loss: 0.3264 - val_accuracy: 0.8770
Epoch 274/500
16/16 [=====] - ETA: 0s - loss: 0.3229 - accuracy: 0.8689
Epoch 00274: val_loss did not improve from 0.31593
16/16 [=====] - 8s 509ms/step - loss: 0.3229 - accuracy: 0.8689 - val_loss: 0.3369 - val_accuracy: 0.8613
Epoch 275/500
16/16 [=====] - ETA: 0s - loss: 0.3174 - accuracy: 0.8813
Epoch 00275: val_loss did not improve from 0.31593
16/16 [=====] - 8s 503ms/step - loss: 0.3174 - accuracy: 0.8813 - val_loss: 0.3343 - val_accuracy: 0.8691
Epoch 276/500
16/16 [=====] - ETA: 0s - loss: 0.2922 - accuracy: 0.8733
Epoch 00276: val_loss did not improve from 0.31593
16/16 [=====] - 8s 502ms/step - loss: 0.2922 - accuracy: 0.8733 - val_loss: 0.3319 - val_accuracy: 0.8633
Epoch 277/500
16/16 [=====] - ETA: 0s - loss: 0.3077 - accuracy: 0.8723
Epoch 00277: val_loss did not improve from 0.31593
16/16 [=====] - 8s 499ms/step - loss: 0.3077 - accuracy: 0.8723 - val_loss: 0.3447 - val_accuracy: 0.8672
Epoch 278/500
16/16 [=====] - ETA: 0s - loss: 0.3133 - accuracy: 0.8758
Epoch 00278: val_loss did not improve from 0.31593
16/16 [=====] - 8s 506ms/step - loss: 0.3133 - accuracy: 0.8758 - val_loss: 0.3283 - val_accuracy: 0.8555
Epoch 279/500
16/16 [=====] - ETA: 0s - loss: 0.3228 - accuracy: 0.8696
Epoch 00279: val_loss did not improve from 0.31593
16/16 [=====] - 8s 504ms/step - loss: 0.3228 - accuracy: 0.8696 - val_loss: 0.3393 - val_accuracy: 0.8496
Epoch 280/500
16/16 [=====] - ETA: 0s - loss: 0.3085 - accuracy: 0.8679
Epoch 00280: val_loss did not improve from 0.31593
16/16 [=====] - 8s 510ms/step - loss: 0.3085 - accuracy: 0.8679 - val_loss: 0.3360 - val_accuracy: 0.8652
Epoch 281/500
16/16 [=====] - ETA: 0s - loss: 0.3365 - accuracy: 0.8669
Epoch 00281: val_loss did not improve from 0.31593
16/16 [=====] - 8s 502ms/step - loss: 0.3365 - accuracy: 0.8669 - val_loss: 0.3313 - val_accuracy: 0.8633
Epoch 282/500
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16/16 [=====] - ETA: 0s - loss: 0.3029 - accuracy: 0.8693
Epoch 00282: val_loss did not improve from 0.31593
16/16 [=====] - 8s 505ms/step - loss: 0.3029 - accuracy: 0.8693 - val_loss: 0.3220 - val_accuracy: 0.8652
Epoch 283/500
16/16 [=====] - ETA: 0s - loss: 0.3046 - accuracy: 0.8773
Epoch 00283: val_loss did not improve from 0.31593
16/16 [=====] - 8s 507ms/step - loss: 0.3046 - accuracy: 0.8773 - val_loss: 0.3331 - val_accuracy: 0.8574
Epoch 284/500
16/16 [=====] - ETA: 0s - loss: 0.3314 - accuracy: 0.8609
Epoch 00284: val_loss did not improve from 0.31593
16/16 [=====] - 8s 513ms/step - loss: 0.3314 - accuracy: 0.8609 - val_loss: 0.3189 - val_accuracy: 0.8613
Epoch 285/500
16/16 [=====] - ETA: 0s - loss: 0.3018 - accuracy: 0.8713
Epoch 00285: val_loss did not improve from 0.31593
16/16 [=====] - 8s 502ms/step - loss: 0.3018 - accuracy: 0.8713 - val_loss: 0.3354 - val_accuracy: 0.8652
Epoch 286/500
16/16 [=====] - ETA: 0s - loss: 0.3204 - accuracy: 0.8684
Epoch 00286: val_loss did not improve from 0.31593
16/16 [=====] - 8s 502ms/step - loss: 0.3204 - accuracy: 0.8684 - val_loss: 0.3464 - val_accuracy: 0.8496
Epoch 287/500
16/16 [=====] - ETA: 0s - loss: 0.3137 - accuracy: 0.8743
Epoch 00287: val_loss did not improve from 0.31593
16/16 [=====] - 8s 501ms/step - loss: 0.3137 - accuracy: 0.8743 - val_loss: 0.3357 - val_accuracy: 0.8574
Epoch 288/500
16/16 [=====] - ETA: 0s - loss: 0.3108 - accuracy: 0.8634
Epoch 00288: val_loss did not improve from 0.31593
16/16 [=====] - 8s 503ms/step - loss: 0.3108 - accuracy: 0.8634 - val_loss: 0.3332 - val_accuracy: 0.8652
Epoch 289/500
16/16 [=====] - ETA: 0s - loss: 0.3073 - accuracy: 0.8728
Epoch 00289: val_loss improved from 0.31593 to 0.31253, saving model to siamese_best.h5
16/16 [=====] - 8s 507ms/step - loss: 0.3073 - accuracy: 0.8728 - val_loss: 0.3125 - val_accuracy: 0.8809
Epoch 290/500
16/16 [=====] - ETA: 0s - loss: 0.3135 - accuracy: 0.8803
Epoch 00290: val_loss did not improve from 0.31253
16/16 [=====] - 8s 503ms/step - loss: 0.3135 - accuracy: 0.8803 - val_loss: 0.3288 - val_accuracy: 0.8672
Epoch 291/500
16/16 [=====] - ETA: 0s - loss: 0.3197 - accuracy: 0.8743
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Epoch 00291: val_loss did not improve from 0.31253
16/16 [=====] - 8s 510ms/step - loss: 0.3197 - accuracy: 0.8743 - val_loss: 0.3320 - val_accuracy: 0.8613
Epoch 292/500
16/16 [=====] - ETA: 0s - loss: 0.3197 - accuracy: 0.8689
Epoch 00292: val_loss did not improve from 0.31253
16/16 [=====] - 8s 516ms/step - loss: 0.3197 - accuracy: 0.8689 - val_loss: 0.3316 - val_accuracy: 0.8594
Epoch 293/500
16/16 [=====] - ETA: 0s - loss: 0.3261 - accuracy: 0.8689
Epoch 00293: val_loss did not improve from 0.31253
16/16 [=====] - 8s 510ms/step - loss: 0.3261 - accuracy: 0.8689 - val_loss: 0.3211 - val_accuracy: 0.8613
Epoch 294/500
16/16 [=====] - ETA: 0s - loss: 0.3155 - accuracy: 0.8748
Epoch 00294: val_loss did not improve from 0.31253
16/16 [=====] - 8s 508ms/step - loss: 0.3155 - accuracy: 0.8748 - val_loss: 0.3477 - val_accuracy: 0.8477
Epoch 295/500
16/16 [=====] - ETA: 0s - loss: 0.3148 - accuracy: 0.8679
Epoch 00295: val_loss did not improve from 0.31253
16/16 [=====] - 8s 506ms/step - loss: 0.3148 - accuracy: 0.8679 - val_loss: 0.3313 - val_accuracy: 0.8516
Epoch 296/500
16/16 [=====] - ETA: 0s - loss: 0.3214 - accuracy: 0.8691
Epoch 00296: val_loss did not improve from 0.31253
16/16 [=====] - 8s 510ms/step - loss: 0.3214 - accuracy: 0.8691 - val_loss: 0.3274 - val_accuracy: 0.8711
Epoch 297/500
16/16 [=====] - ETA: 0s - loss: 0.3155 - accuracy: 0.8669
Epoch 00297: val_loss did not improve from 0.31253
16/16 [=====] - 8s 516ms/step - loss: 0.3155 - accuracy: 0.8669 - val_loss: 0.3441 - val_accuracy: 0.8574
Epoch 298/500
16/16 [=====] - ETA: 0s - loss: 0.3100 - accuracy: 0.8708
Epoch 00298: val_loss did not improve from 0.31253
16/16 [=====] - 8s 514ms/step - loss: 0.3100 - accuracy: 0.8708 - val_loss: 0.3406 - val_accuracy: 0.8516
Epoch 299/500
16/16 [=====] - ETA: 0s - loss: 0.3124 - accuracy: 0.8733
Epoch 00299: val_loss did not improve from 0.31253
16/16 [=====] - 8s 502ms/step - loss: 0.3124 - accuracy: 0.8733 - val_loss: 0.3511 - val_accuracy: 0.8516
Epoch 300/500
16/16 [=====] - ETA: 0s - loss: 0.3066 - accuracy: 0.8738
Epoch 00300: val_loss did not improve from 0.31253
16/16 [=====] - 8s 503ms/step - loss: 0.3066 - accuracy: 0.8738 - val_loss: 0.3292 - val_accuracy: 0.8633
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Epoch 301/500
16/16 [=====] - ETA: 0s - loss: 0.3019 - accuracy: 0.8703
Epoch 00301: val_loss did not improve from 0.31253
16/16 [=====] - 8s 509ms/step - loss: 0.3019 - accuracy: 0.8703 - val_loss: 0.3517 - val_accuracy: 0.8496
Epoch 302/500
16/16 [=====] - ETA: 0s - loss: 0.2962 - accuracy: 0.8753
Epoch 00302: val_loss did not improve from 0.31253
16/16 [=====] - 8s 509ms/step - loss: 0.2962 - accuracy: 0.8753 - val_loss: 0.3160 - val_accuracy: 0.8730
Epoch 303/500
16/16 [=====] - ETA: 0s - loss: 0.3136 - accuracy: 0.8644
Epoch 00303: val_loss did not improve from 0.31253
16/16 [=====] - 8s 513ms/step - loss: 0.3136 - accuracy: 0.8644 - val_loss: 0.3408 - val_accuracy: 0.8496
Epoch 304/500
16/16 [=====] - ETA: 0s - loss: 0.3042 - accuracy: 0.8758
Epoch 00304: val_loss did not improve from 0.31253
16/16 [=====] - 8s 508ms/step - loss: 0.3042 - accuracy: 0.8758 - val_loss: 0.3416 - val_accuracy: 0.8555
Epoch 305/500
16/16 [=====] - ETA: 0s - loss: 0.3272 - accuracy: 0.8639
Epoch 00305: val_loss improved from 0.31253 to 0.30869, saving model to siame
se_best.h5
16/16 [=====] - 8s 513ms/step - loss: 0.3272 - accuracy: 0.8639 - val_loss: 0.3087 - val_accuracy: 0.8672
Epoch 306/500
16/16 [=====] - ETA: 0s - loss: 0.3167 - accuracy: 0.8738
Epoch 00306: val_loss did not improve from 0.30869
16/16 [=====] - 8s 508ms/step - loss: 0.3167 - accuracy: 0.8738 - val_loss: 0.3361 - val_accuracy: 0.8574
Epoch 307/500
16/16 [=====] - ETA: 0s - loss: 0.3045 - accuracy: 0.8773
Epoch 00307: val_loss improved from 0.30869 to 0.30853, saving model to siame
se_best.h5
16/16 [=====] - 8s 514ms/step - loss: 0.3045 - accuracy: 0.8773 - val_loss: 0.3085 - val_accuracy: 0.8633
Epoch 308/500
16/16 [=====] - ETA: 0s - loss: 0.3160 - accuracy: 0.8723
Epoch 00308: val_loss did not improve from 0.30853
16/16 [=====] - 8s 507ms/step - loss: 0.3160 - accuracy: 0.8723 - val_loss: 0.3278 - val_accuracy: 0.8652
Epoch 309/500
16/16 [=====] - ETA: 0s - loss: 0.3207 - accuracy: 0.8689
Epoch 00309: val_loss did not improve from 0.30853
16/16 [=====] - 8s 505ms/step - loss: 0.3207 - accuracy: 0.8689 - val_loss: 0.3252 - val_accuracy: 0.8594
Epoch 310/500
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16/16 [=====] - ETA: 0s - loss: 0.2933 - accuracy: 0.8743
Epoch 00310: val_loss did not improve from 0.30853
16/16 [=====] - 8s 506ms/step - loss: 0.2933 - accuracy: 0.8743 - val_loss: 0.3225 - val_accuracy: 0.8672
Epoch 311/500
16/16 [=====] - ETA: 0s - loss: 0.3060 - accuracy: 0.8708
Epoch 00311: val_loss did not improve from 0.30853
16/16 [=====] - 8s 507ms/step - loss: 0.3060 - accuracy: 0.8708 - val_loss: 0.3353 - val_accuracy: 0.8594
Epoch 312/500
16/16 [=====] - ETA: 0s - loss: 0.3052 - accuracy: 0.8713
Epoch 00312: val_loss did not improve from 0.30853
16/16 [=====] - 8s 512ms/step - loss: 0.3052 - accuracy: 0.8713 - val_loss: 0.3379 - val_accuracy: 0.8555
Epoch 313/500
16/16 [=====] - ETA: 0s - loss: 0.2978 - accuracy: 0.8799
Epoch 00313: val_loss improved from 0.30853 to 0.30217, saving model to siamese_best.h5
16/16 [=====] - 8s 519ms/step - loss: 0.2978 - accuracy: 0.8799 - val_loss: 0.3022 - val_accuracy: 0.8711
Epoch 314/500
16/16 [=====] - ETA: 0s - loss: 0.3052 - accuracy: 0.8698
Epoch 00314: val_loss did not improve from 0.30217
16/16 [=====] - 8s 511ms/step - loss: 0.3052 - accuracy: 0.8698 - val_loss: 0.3166 - val_accuracy: 0.8691
Epoch 315/500
16/16 [=====] - ETA: 0s - loss: 0.3083 - accuracy: 0.8763
Epoch 00315: val_loss did not improve from 0.30217
16/16 [=====] - 8s 502ms/step - loss: 0.3083 - accuracy: 0.8763 - val_loss: 0.3159 - val_accuracy: 0.8711
Epoch 316/500
16/16 [=====] - ETA: 0s - loss: 0.2872 - accuracy: 0.8803
Epoch 00316: val_loss did not improve from 0.30217
16/16 [=====] - 8s 506ms/step - loss: 0.2872 - accuracy: 0.8803 - val_loss: 0.3220 - val_accuracy: 0.8652
Epoch 317/500
16/16 [=====] - ETA: 0s - loss: 0.3196 - accuracy: 0.8728
Epoch 00317: val_loss did not improve from 0.30217
16/16 [=====] - 8s 507ms/step - loss: 0.3196 - accuracy: 0.8728 - val_loss: 0.3251 - val_accuracy: 0.8633
Epoch 318/500
16/16 [=====] - ETA: 0s - loss: 0.3103 - accuracy: 0.8733
Epoch 00318: val_loss did not improve from 0.30217
16/16 [=====] - 8s 505ms/step - loss: 0.3103 - accuracy: 0.8733 - val_loss: 0.3395 - val_accuracy: 0.8594
Epoch 319/500
16/16 [=====] - ETA: 0s - loss: 0.3236 - accuracy: 0.8703
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Epoch 00319: val_loss did not improve from 0.30217
16/16 [=====] - 8s 503ms/step - loss: 0.3236 - accuracy: 0.8703 - val_loss: 0.3334 - val_accuracy: 0.8672
Epoch 320/500
16/16 [=====] - ETA: 0s - loss: 0.3068 - accuracy: 0.8748
Epoch 00320: val_loss did not improve from 0.30217
16/16 [=====] - 8s 518ms/step - loss: 0.3068 - accuracy: 0.8748 - val_loss: 0.3382 - val_accuracy: 0.8496
Epoch 321/500
16/16 [=====] - ETA: 0s - loss: 0.2913 - accuracy: 0.8803
Epoch 00321: val_loss did not improve from 0.30217
16/16 [=====] - 8s 503ms/step - loss: 0.2913 - accuracy: 0.8803 - val_loss: 0.3080 - val_accuracy: 0.8672
Epoch 322/500
16/16 [=====] - ETA: 0s - loss: 0.2895 - accuracy: 0.8788
Epoch 00322: val_loss improved from 0.30217 to 0.30120, saving model to siamese_best.h5
16/16 [=====] - 8s 516ms/step - loss: 0.2895 - accuracy: 0.8788 - val_loss: 0.3012 - val_accuracy: 0.8828
Epoch 323/500
16/16 [=====] - ETA: 0s - loss: 0.3074 - accuracy: 0.8718
Epoch 00323: val_loss did not improve from 0.30120
16/16 [=====] - 8s 511ms/step - loss: 0.3074 - accuracy: 0.8718 - val_loss: 0.3417 - val_accuracy: 0.8535
Epoch 324/500
16/16 [=====] - ETA: 0s - loss: 0.3116 - accuracy: 0.8783
Epoch 00324: val_loss did not improve from 0.30120
16/16 [=====] - 8s 507ms/step - loss: 0.3116 - accuracy: 0.8783 - val_loss: 0.3333 - val_accuracy: 0.8672
Epoch 325/500
16/16 [=====] - ETA: 0s - loss: 0.2864 - accuracy: 0.8867
Epoch 00325: val_loss did not improve from 0.30120
16/16 [=====] - 8s 507ms/step - loss: 0.2864 - accuracy: 0.8867 - val_loss: 0.3184 - val_accuracy: 0.8652
Epoch 326/500
16/16 [=====] - ETA: 0s - loss: 0.3121 - accuracy: 0.8718
Epoch 00326: val_loss improved from 0.30120 to 0.29912, saving model to siamese_best.h5
16/16 [=====] - 8s 514ms/step - loss: 0.3121 - accuracy: 0.8718 - val_loss: 0.2991 - val_accuracy: 0.8848
Epoch 327/500
16/16 [=====] - ETA: 0s - loss: 0.3038 - accuracy: 0.8823
Epoch 00327: val_loss did not improve from 0.29912
16/16 [=====] - 8s 512ms/step - loss: 0.3038 - accuracy: 0.8823 - val_loss: 0.3273 - val_accuracy: 0.8691
Epoch 328/500
16/16 [=====] - ETA: 0s - loss: 0.3013 - accuracy: 0.8763
Epoch 00328: val_loss did not improve from 0.29912
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16/16 [=====] - 8s 506ms/step - loss: 0.3013 - accuracy: 0.8763 - val_loss: 0.3329 - val_accuracy: 0.8652
Epoch 329/500
16/16 [=====] - ETA: 0s - loss: 0.2989 - accuracy: 0.8748
Epoch 00329: val_loss did not improve from 0.29912
16/16 [=====] - 8s 514ms/step - loss: 0.2989 - accuracy: 0.8748 - val_loss: 0.3206 - val_accuracy: 0.8652
Epoch 330/500
16/16 [=====] - ETA: 0s - loss: 0.3001 - accuracy: 0.8711
Epoch 00330: val_loss did not improve from 0.29912
16/16 [=====] - 8s 510ms/step - loss: 0.3001 - accuracy: 0.8711 - val_loss: 0.3260 - val_accuracy: 0.8535
Epoch 331/500
16/16 [=====] - ETA: 0s - loss: 0.2918 - accuracy: 0.8828
Epoch 00331: val_loss did not improve from 0.29912
16/16 [=====] - 8s 514ms/step - loss: 0.2918 - accuracy: 0.8828 - val_loss: 0.3268 - val_accuracy: 0.8672
Epoch 332/500
16/16 [=====] - ETA: 0s - loss: 0.2931 - accuracy: 0.8838
Epoch 00332: val_loss did not improve from 0.29912
16/16 [=====] - 8s 511ms/step - loss: 0.2931 - accuracy: 0.8838 - val_loss: 0.3214 - val_accuracy: 0.8594
Epoch 333/500
16/16 [=====] - ETA: 0s - loss: 0.3098 - accuracy: 0.8773
Epoch 00333: val_loss did not improve from 0.29912
16/16 [=====] - 8s 505ms/step - loss: 0.3098 - accuracy: 0.8773 - val_loss: 0.3078 - val_accuracy: 0.8750
Epoch 334/500
16/16 [=====] - ETA: 0s - loss: 0.3017 - accuracy: 0.8833
Epoch 00334: val_loss did not improve from 0.29912
16/16 [=====] - 8s 509ms/step - loss: 0.3017 - accuracy: 0.8833 - val_loss: 0.3538 - val_accuracy: 0.8516
Epoch 335/500
16/16 [=====] - ETA: 0s - loss: 0.3025 - accuracy: 0.8798
Epoch 00335: val_loss did not improve from 0.29912
16/16 [=====] - 8s 510ms/step - loss: 0.3025 - accuracy: 0.8798 - val_loss: 0.3370 - val_accuracy: 0.8516
Epoch 336/500
16/16 [=====] - ETA: 0s - loss: 0.3095 - accuracy: 0.8768
Epoch 00336: val_loss did not improve from 0.29912
16/16 [=====] - 8s 507ms/step - loss: 0.3095 - accuracy: 0.8768 - val_loss: 0.3337 - val_accuracy: 0.8496
Epoch 337/500
16/16 [=====] - ETA: 0s - loss: 0.2993 - accuracy: 0.8718
Epoch 00337: val_loss did not improve from 0.29912
16/16 [=====] - 8s 502ms/step - loss: 0.2993 - accuracy: 0.8718 - val_loss: 0.3436 - val_accuracy: 0.8555
Epoch 338/500
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16/16 [=====] - ETA: 0s - loss: 0.2941 - accuracy: 0.8823
Epoch 00338: val_loss did not improve from 0.29912
16/16 [=====] - 8s 506ms/step - loss: 0.2941 - accuracy: 0.8823 - val_loss: 0.3220 - val_accuracy: 0.8652
Epoch 339/500
16/16 [=====] - ETA: 0s - loss: 0.2656 - accuracy: 0.8947
Epoch 00339: val_loss did not improve from 0.29912
16/16 [=====] - 8s 509ms/step - loss: 0.2656 - accuracy: 0.8947 - val_loss: 0.3034 - val_accuracy: 0.8828
Epoch 340/500
16/16 [=====] - ETA: 0s - loss: 0.2987 - accuracy: 0.8823
Epoch 00340: val_loss did not improve from 0.29912
16/16 [=====] - 8s 508ms/step - loss: 0.2987 - accuracy: 0.8823 - val_loss: 0.3159 - val_accuracy: 0.8750
Epoch 341/500
16/16 [=====] - ETA: 0s - loss: 0.2949 - accuracy: 0.8793
Epoch 00341: val_loss did not improve from 0.29912
16/16 [=====] - 8s 507ms/step - loss: 0.2949 - accuracy: 0.8793 - val_loss: 0.3012 - val_accuracy: 0.8691
Epoch 342/500
16/16 [=====] - ETA: 0s - loss: 0.2888 - accuracy: 0.8798
Epoch 00342: val_loss did not improve from 0.29912
16/16 [=====] - 8s 514ms/step - loss: 0.2888 - accuracy: 0.8798 - val_loss: 0.3267 - val_accuracy: 0.8672
Epoch 343/500
16/16 [=====] - ETA: 0s - loss: 0.2772 - accuracy: 0.8882
Epoch 00343: val_loss did not improve from 0.29912
16/16 [=====] - 8s 505ms/step - loss: 0.2772 - accuracy: 0.8882 - val_loss: 0.3013 - val_accuracy: 0.8828
Epoch 344/500
16/16 [=====] - ETA: 0s - loss: 0.3009 - accuracy: 0.8793
Epoch 00344: val_loss did not improve from 0.29912
16/16 [=====] - 8s 507ms/step - loss: 0.3009 - accuracy: 0.8793 - val_loss: 0.3076 - val_accuracy: 0.8730
Epoch 345/500
16/16 [=====] - ETA: 0s - loss: 0.2975 - accuracy: 0.8798
Epoch 00345: val_loss did not improve from 0.29912
16/16 [=====] - 8s 506ms/step - loss: 0.2975 - accuracy: 0.8798 - val_loss: 0.3321 - val_accuracy: 0.8711
Epoch 346/500
16/16 [=====] - ETA: 0s - loss: 0.2945 - accuracy: 0.8843
Epoch 00346: val_loss did not improve from 0.29912
16/16 [=====] - 8s 505ms/step - loss: 0.2945 - accuracy: 0.8843 - val_loss: 0.3085 - val_accuracy: 0.8672
Epoch 347/500
16/16 [=====] - ETA: 0s - loss: 0.2890 - accuracy: 0.8848
Epoch 00347: val_loss did not improve from 0.29912
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16/16 [=====] - 8s 508ms/step - loss: 0.2890 - accuracy: 0.8848 - val_loss: 0.3476 - val_accuracy: 0.8633
Epoch 348/500
16/16 [=====] - ETA: 0s - loss: 0.3110 - accuracy: 0.8708
Epoch 00348: val_loss did not improve from 0.29912
16/16 [=====] - 8s 511ms/step - loss: 0.3110 - accuracy: 0.8708 - val_loss: 0.3399 - val_accuracy: 0.8574
Epoch 349/500
16/16 [=====] - ETA: 0s - loss: 0.3173 - accuracy: 0.8738
Epoch 00349: val_loss did not improve from 0.29912
16/16 [=====] - 8s 507ms/step - loss: 0.3173 - accuracy: 0.8738 - val_loss: 0.3414 - val_accuracy: 0.8652
Epoch 350/500
16/16 [=====] - ETA: 0s - loss: 0.2887 - accuracy: 0.8798
Epoch 00350: val_loss did not improve from 0.29912
16/16 [=====] - 8s 509ms/step - loss: 0.2887 - accuracy: 0.8798 - val_loss: 0.3215 - val_accuracy: 0.8652
Epoch 351/500
16/16 [=====] - ETA: 0s - loss: 0.3046 - accuracy: 0.8768
Epoch 00351: val_loss did not improve from 0.29912
16/16 [=====] - 8s 510ms/step - loss: 0.3046 - accuracy: 0.8768 - val_loss: 0.3197 - val_accuracy: 0.8789
Epoch 352/500
16/16 [=====] - ETA: 0s - loss: 0.2879 - accuracy: 0.8798
Epoch 00352: val_loss did not improve from 0.29912
16/16 [=====] - 8s 508ms/step - loss: 0.2879 - accuracy: 0.8798 - val_loss: 0.3111 - val_accuracy: 0.8770
Epoch 353/500
16/16 [=====] - ETA: 0s - loss: 0.2866 - accuracy: 0.8838
Epoch 00353: val_loss did not improve from 0.29912
16/16 [=====] - 8s 507ms/step - loss: 0.2866 - accuracy: 0.8838 - val_loss: 0.3300 - val_accuracy: 0.8691
Epoch 354/500
16/16 [=====] - ETA: 0s - loss: 0.2856 - accuracy: 0.8798
Epoch 00354: val_loss did not improve from 0.29912
16/16 [=====] - 8s 507ms/step - loss: 0.2856 - accuracy: 0.8798 - val_loss: 0.3044 - val_accuracy: 0.8750
Epoch 355/500
16/16 [=====] - ETA: 0s - loss: 0.3043 - accuracy: 0.8748
Epoch 00355: val_loss did not improve from 0.29912
16/16 [=====] - 8s 505ms/step - loss: 0.3043 - accuracy: 0.8748 - val_loss: 0.3178 - val_accuracy: 0.8691
Epoch 356/500
16/16 [=====] - ETA: 0s - loss: 0.2711 - accuracy: 0.8887
Epoch 00356: val_loss did not improve from 0.29912
16/16 [=====] - 8s 515ms/step - loss: 0.2711 - accuracy: 0.8887 - val_loss: 0.3009 - val_accuracy: 0.8809
Epoch 357/500
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16/16 [=====] - ETA: 0s - loss: 0.2888 - accuracy: 0.8783
Epoch 00357: val_loss did not improve from 0.29912
16/16 [=====] - 8s 510ms/step - loss: 0.2888 - accuracy: 0.8783 - val_loss: 0.3065 - val_accuracy: 0.8672
Epoch 358/500
16/16 [=====] - ETA: 0s - loss: 0.2815 - accuracy: 0.8808
Epoch 00358: val_loss did not improve from 0.29912
16/16 [=====] - 8s 508ms/step - loss: 0.2815 - accuracy: 0.8808 - val_loss: 0.3108 - val_accuracy: 0.8633
Epoch 359/500
16/16 [=====] - ETA: 0s - loss: 0.3099 - accuracy: 0.8763
Epoch 00359: val_loss did not improve from 0.29912
16/16 [=====] - 8s 502ms/step - loss: 0.3099 - accuracy: 0.8763 - val_loss: 0.3208 - val_accuracy: 0.8691
Epoch 360/500
16/16 [=====] - ETA: 0s - loss: 0.3127 - accuracy: 0.8689
Epoch 00360: val_loss did not improve from 0.29912
16/16 [=====] - 8s 509ms/step - loss: 0.3127 - accuracy: 0.8689 - val_loss: 0.3246 - val_accuracy: 0.8633
Epoch 361/500
16/16 [=====] - ETA: 0s - loss: 0.2858 - accuracy: 0.8793
Epoch 00361: val_loss did not improve from 0.29912
16/16 [=====] - 8s 515ms/step - loss: 0.2858 - accuracy: 0.8793 - val_loss: 0.3361 - val_accuracy: 0.8730
Epoch 362/500
16/16 [=====] - ETA: 0s - loss: 0.2813 - accuracy: 0.8867
Epoch 00362: val_loss did not improve from 0.29912
16/16 [=====] - 8s 509ms/step - loss: 0.2813 - accuracy: 0.8867 - val_loss: 0.3155 - val_accuracy: 0.8711
Epoch 363/500
16/16 [=====] - ETA: 0s - loss: 0.2977 - accuracy: 0.8758
Epoch 00363: val_loss did not improve from 0.29912
16/16 [=====] - 8s 508ms/step - loss: 0.2977 - accuracy: 0.8758 - val_loss: 0.3450 - val_accuracy: 0.8633
Epoch 364/500
16/16 [=====] - ETA: 0s - loss: 0.2970 - accuracy: 0.8848
Epoch 00364: val_loss did not improve from 0.29912
16/16 [=====] - 8s 508ms/step - loss: 0.2970 - accuracy: 0.8848 - val_loss: 0.3288 - val_accuracy: 0.8691
Epoch 365/500
16/16 [=====] - ETA: 0s - loss: 0.3008 - accuracy: 0.8783
Epoch 00365: val_loss did not improve from 0.29912
16/16 [=====] - 8s 518ms/step - loss: 0.3008 - accuracy: 0.8783 - val_loss: 0.3221 - val_accuracy: 0.8750
Epoch 366/500
16/16 [=====] - ETA: 0s - loss: 0.2757 - accuracy: 0.8877
Epoch 00366: val_loss did not improve from 0.29912
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16/16 [=====] - 8s 514ms/step - loss: 0.2757 - accuracy: 0.8877 - val_loss: 0.3258 - val_accuracy: 0.8516
Epoch 367/500
16/16 [=====] - ETA: 0s - loss: 0.2881 - accuracy: 0.8803
Epoch 00367: val_loss did not improve from 0.29912
16/16 [=====] - 8s 517ms/step - loss: 0.2881 - accuracy: 0.8803 - val_loss: 0.3168 - val_accuracy: 0.8574
Epoch 368/500
16/16 [=====] - ETA: 0s - loss: 0.3149 - accuracy: 0.8748
Epoch 00368: val_loss improved from 0.29912 to 0.28797, saving model to siamese_best.h5
16/16 [=====] - 8s 509ms/step - loss: 0.3149 - accuracy: 0.8748 - val_loss: 0.2880 - val_accuracy: 0.8691
Epoch 369/500
16/16 [=====] - ETA: 0s - loss: 0.2992 - accuracy: 0.8808
Epoch 00369: val_loss did not improve from 0.28797
16/16 [=====] - 8s 515ms/step - loss: 0.2992 - accuracy: 0.8808 - val_loss: 0.3395 - val_accuracy: 0.8711
Epoch 370/500
16/16 [=====] - ETA: 0s - loss: 0.2707 - accuracy: 0.9001
Epoch 00370: val_loss did not improve from 0.28797
16/16 [=====] - 8s 511ms/step - loss: 0.2707 - accuracy: 0.9001 - val_loss: 0.3153 - val_accuracy: 0.8574
Epoch 371/500
16/16 [=====] - ETA: 0s - loss: 0.2912 - accuracy: 0.8843
Epoch 00371: val_loss did not improve from 0.28797
16/16 [=====] - 8s 518ms/step - loss: 0.2912 - accuracy: 0.8843 - val_loss: 0.2918 - val_accuracy: 0.8770
Epoch 372/500
16/16 [=====] - ETA: 0s - loss: 0.2797 - accuracy: 0.8823
Epoch 00372: val_loss did not improve from 0.28797
16/16 [=====] - 8s 509ms/step - loss: 0.2797 - accuracy: 0.8823 - val_loss: 0.3140 - val_accuracy: 0.8691
Epoch 373/500
16/16 [=====] - ETA: 0s - loss: 0.2909 - accuracy: 0.8808
Epoch 00373: val_loss did not improve from 0.28797
16/16 [=====] - 8s 509ms/step - loss: 0.2909 - accuracy: 0.8808 - val_loss: 0.3025 - val_accuracy: 0.8945
Epoch 374/500
16/16 [=====] - ETA: 0s - loss: 0.2876 - accuracy: 0.8758
Epoch 00374: val_loss did not improve from 0.28797
16/16 [=====] - 8s 507ms/step - loss: 0.2876 - accuracy: 0.8758 - val_loss: 0.2952 - val_accuracy: 0.8730
Epoch 375/500
16/16 [=====] - ETA: 0s - loss: 0.2689 - accuracy: 0.8828
Epoch 00375: val_loss did not improve from 0.28797
16/16 [=====] - 8s 509ms/step - loss: 0.2689 - accuracy: 0.8828 - val_loss: 0.3278 - val_accuracy: 0.8652
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Epoch 376/500
16/16 [=====] - ETA: 0s - loss: 0.2985 - accuracy: 0.8743
Epoch 00376: val_loss did not improve from 0.28797
16/16 [=====] - 8s 509ms/step - loss: 0.2985 - accuracy: 0.8743 - val_loss: 0.3167 - val_accuracy: 0.8672
Epoch 377/500
16/16 [=====] - ETA: 0s - loss: 0.2878 - accuracy: 0.8798
Epoch 00377: val_loss did not improve from 0.28797
16/16 [=====] - 8s 506ms/step - loss: 0.2878 - accuracy: 0.8798 - val_loss: 0.3111 - val_accuracy: 0.8613
Epoch 378/500
16/16 [=====] - ETA: 0s - loss: 0.2788 - accuracy: 0.8927
Epoch 00378: val_loss did not improve from 0.28797
16/16 [=====] - 8s 512ms/step - loss: 0.2788 - accuracy: 0.8927 - val_loss: 0.3131 - val_accuracy: 0.8770
Epoch 379/500
16/16 [=====] - ETA: 0s - loss: 0.2698 - accuracy: 0.8917
Epoch 00379: val_loss did not improve from 0.28797
16/16 [=====] - 8s 510ms/step - loss: 0.2698 - accuracy: 0.8917 - val_loss: 0.2987 - val_accuracy: 0.8770
Epoch 380/500
16/16 [=====] - ETA: 0s - loss: 0.2819 - accuracy: 0.8862
Epoch 00380: val_loss did not improve from 0.28797
16/16 [=====] - 8s 518ms/step - loss: 0.2819 - accuracy: 0.8862 - val_loss: 0.3021 - val_accuracy: 0.8848
Epoch 381/500
16/16 [=====] - ETA: 0s - loss: 0.2801 - accuracy: 0.8867
Epoch 00381: val_loss did not improve from 0.28797
16/16 [=====] - 8s 512ms/step - loss: 0.2801 - accuracy: 0.8867 - val_loss: 0.3004 - val_accuracy: 0.8789
Epoch 382/500
16/16 [=====] - ETA: 0s - loss: 0.2922 - accuracy: 0.8803
Epoch 00382: val_loss did not improve from 0.28797
16/16 [=====] - 8s 516ms/step - loss: 0.2922 - accuracy: 0.8803 - val_loss: 0.2974 - val_accuracy: 0.8809
Epoch 383/500
16/16 [=====] - ETA: 0s - loss: 0.2679 - accuracy: 0.8897
Epoch 00383: val_loss did not improve from 0.28797
16/16 [=====] - 8s 507ms/step - loss: 0.2679 - accuracy: 0.8897 - val_loss: 0.3096 - val_accuracy: 0.8770
Epoch 384/500
16/16 [=====] - ETA: 0s - loss: 0.2905 - accuracy: 0.8788
Epoch 00384: val_loss did not improve from 0.28797
16/16 [=====] - 8s 507ms/step - loss: 0.2905 - accuracy: 0.8788 - val_loss: 0.3139 - val_accuracy: 0.8750
Epoch 385/500
16/16 [=====] - ETA: 0s - loss: 0.2747 - accuracy: 0.8902
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Epoch 00385: val_loss did not improve from 0.28797
16/16 [=====] - 8s 511ms/step - loss: 0.2747 - accuracy: 0.8902 - val_loss: 0.3106 - val_accuracy: 0.8730
Epoch 386/500
16/16 [=====] - ETA: 0s - loss: 0.2924 - accuracy: 0.8803
Epoch 00386: val_loss did not improve from 0.28797
16/16 [=====] - 8s 508ms/step - loss: 0.2924 - accuracy: 0.8803 - val_loss: 0.2937 - val_accuracy: 0.8750
Epoch 387/500
16/16 [=====] - ETA: 0s - loss: 0.2540 - accuracy: 0.8987
Epoch 00387: val_loss did not improve from 0.28797
16/16 [=====] - 8s 508ms/step - loss: 0.2540 - accuracy: 0.8987 - val_loss: 0.3036 - val_accuracy: 0.8730
Epoch 388/500
16/16 [=====] - ETA: 0s - loss: 0.2844 - accuracy: 0.8892
Epoch 00388: val_loss did not improve from 0.28797
16/16 [=====] - 8s 510ms/step - loss: 0.2844 - accuracy: 0.8892 - val_loss: 0.3393 - val_accuracy: 0.8711
Epoch 389/500
16/16 [=====] - ETA: 0s - loss: 0.2818 - accuracy: 0.8912
Epoch 00389: val_loss did not improve from 0.28797
16/16 [=====] - 8s 513ms/step - loss: 0.2818 - accuracy: 0.8912 - val_loss: 0.2968 - val_accuracy: 0.8828
Epoch 390/500
16/16 [=====] - ETA: 0s - loss: 0.2817 - accuracy: 0.8902
Epoch 00390: val_loss did not improve from 0.28797
16/16 [=====] - 8s 514ms/step - loss: 0.2817 - accuracy: 0.8902 - val_loss: 0.2896 - val_accuracy: 0.8926
Epoch 391/500
16/16 [=====] - ETA: 0s - loss: 0.2905 - accuracy: 0.8823
Epoch 00391: val_loss did not improve from 0.28797
16/16 [=====] - 8s 503ms/step - loss: 0.2905 - accuracy: 0.8823 - val_loss: 0.3058 - val_accuracy: 0.8730
Epoch 392/500
16/16 [=====] - ETA: 0s - loss: 0.2867 - accuracy: 0.8818
Epoch 00392: val_loss did not improve from 0.28797
16/16 [=====] - 8s 511ms/step - loss: 0.2867 - accuracy: 0.8818 - val_loss: 0.2944 - val_accuracy: 0.8789
Epoch 393/500
16/16 [=====] - ETA: 0s - loss: 0.3068 - accuracy: 0.8763
Epoch 00393: val_loss did not improve from 0.28797
16/16 [=====] - 8s 508ms/step - loss: 0.3068 - accuracy: 0.8763 - val_loss: 0.3492 - val_accuracy: 0.8672
Epoch 394/500
16/16 [=====] - ETA: 0s - loss: 0.2875 - accuracy: 0.8872
Epoch 00394: val_loss did not improve from 0.28797
16/16 [=====] - 8s 510ms/step - loss: 0.2875 - accuracy: 0.8872 - val_loss: 0.3144 - val_accuracy: 0.8828
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Epoch 395/500
16/16 [=====] - ETA: 0s - loss: 0.2996 - accuracy: 0.8783
Epoch 00395: val_loss did not improve from 0.28797
16/16 [=====] - 8s 510ms/step - loss: 0.2996 - accuracy: 0.8783 - val_loss: 0.3163 - val_accuracy: 0.8711
Epoch 396/500
16/16 [=====] - ETA: 0s - loss: 0.2805 - accuracy: 0.8867
Epoch 00396: val_loss improved from 0.28797 to 0.28410, saving model to siamese_best.h5
16/16 [=====] - 8s 513ms/step - loss: 0.2805 - accuracy: 0.8867 - val_loss: 0.2841 - val_accuracy: 0.8828
Epoch 397/500
16/16 [=====] - ETA: 0s - loss: 0.2826 - accuracy: 0.8907
Epoch 00397: val_loss did not improve from 0.28410
16/16 [=====] - 8s 511ms/step - loss: 0.2826 - accuracy: 0.8907 - val_loss: 0.3072 - val_accuracy: 0.8730
Epoch 398/500
16/16 [=====] - ETA: 0s - loss: 0.2795 - accuracy: 0.8882
Epoch 00398: val_loss did not improve from 0.28410
16/16 [=====] - 8s 508ms/step - loss: 0.2795 - accuracy: 0.8882 - val_loss: 0.3303 - val_accuracy: 0.8613
Epoch 399/500
16/16 [=====] - ETA: 0s - loss: 0.2807 - accuracy: 0.8788
Epoch 00399: val_loss did not improve from 0.28410
16/16 [=====] - 8s 520ms/step - loss: 0.2807 - accuracy: 0.8788 - val_loss: 0.3198 - val_accuracy: 0.8730
Epoch 400/500
16/16 [=====] - ETA: 0s - loss: 0.2770 - accuracy: 0.8833
Epoch 00400: val_loss did not improve from 0.28410
16/16 [=====] - 8s 515ms/step - loss: 0.2770 - accuracy: 0.8833 - val_loss: 0.3082 - val_accuracy: 0.8789
Epoch 401/500
16/16 [=====] - ETA: 0s - loss: 0.2639 - accuracy: 0.8907
Epoch 00401: val_loss did not improve from 0.28410
16/16 [=====] - 8s 507ms/step - loss: 0.2639 - accuracy: 0.8907 - val_loss: 0.3103 - val_accuracy: 0.8691
Epoch 402/500
16/16 [=====] - ETA: 0s - loss: 0.2786 - accuracy: 0.8902
Epoch 00402: val_loss did not improve from 0.28410
16/16 [=====] - 8s 506ms/step - loss: 0.2786 - accuracy: 0.8902 - val_loss: 0.2925 - val_accuracy: 0.8867
Epoch 403/500
16/16 [=====] - ETA: 0s - loss: 0.2603 - accuracy: 0.8957
Epoch 00403: val_loss did not improve from 0.28410
16/16 [=====] - 8s 513ms/step - loss: 0.2603 - accuracy: 0.8957 - val_loss: 0.2941 - val_accuracy: 0.8828
Epoch 404/500
16/16 [=====] - ETA: 0s - loss: 0.2980 - accuracy:
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0.8798
Epoch 00404: val_loss did not improve from 0.28410
16/16 [=====] - 8s 519ms/step - loss: 0.2980 - accuracy: 0.8798 - val_loss: 0.3400 - val_accuracy: 0.8594
Epoch 405/500
16/16 [=====] - ETA: 0s - loss: 0.2484 - accuracy: 0.8937
Epoch 00405: val_loss did not improve from 0.28410
16/16 [=====] - 8s 513ms/step - loss: 0.2484 - accuracy: 0.8937 - val_loss: 0.3088 - val_accuracy: 0.8750
Epoch 406/500
16/16 [=====] - ETA: 0s - loss: 0.2743 - accuracy: 0.8867
Epoch 00406: val_loss did not improve from 0.28410
16/16 [=====] - 8s 515ms/step - loss: 0.2743 - accuracy: 0.8867 - val_loss: 0.3078 - val_accuracy: 0.8770
Epoch 407/500
16/16 [=====] - ETA: 0s - loss: 0.2860 - accuracy: 0.8803
Epoch 00407: val_loss did not improve from 0.28410
16/16 [=====] - 8s 519ms/step - loss: 0.2860 - accuracy: 0.8803 - val_loss: 0.2957 - val_accuracy: 0.8809
Epoch 408/500
16/16 [=====] - ETA: 0s - loss: 0.2696 - accuracy: 0.8882
Epoch 00408: val_loss did not improve from 0.28410
16/16 [=====] - 8s 517ms/step - loss: 0.2696 - accuracy: 0.8882 - val_loss: 0.3143 - val_accuracy: 0.8691
Epoch 409/500
16/16 [=====] - ETA: 0s - loss: 0.2902 - accuracy: 0.8788
Epoch 00409: val_loss did not improve from 0.28410
16/16 [=====] - 8s 521ms/step - loss: 0.2902 - accuracy: 0.8788 - val_loss: 0.3032 - val_accuracy: 0.8828
Epoch 410/500
16/16 [=====] - ETA: 0s - loss: 0.2744 - accuracy: 0.8902
Epoch 00410: val_loss did not improve from 0.28410
16/16 [=====] - 8s 513ms/step - loss: 0.2744 - accuracy: 0.8902 - val_loss: 0.3133 - val_accuracy: 0.8770
Epoch 411/500
16/16 [=====] - ETA: 0s - loss: 0.2784 - accuracy: 0.8892
Epoch 00411: val_loss did not improve from 0.28410
16/16 [=====] - 8s 509ms/step - loss: 0.2784 - accuracy: 0.8892 - val_loss: 0.2999 - val_accuracy: 0.8770
Epoch 412/500
16/16 [=====] - ETA: 0s - loss: 0.2583 - accuracy: 0.8907
Epoch 00412: val_loss improved from 0.28410 to 0.28314, saving model to siamese_best.h5
16/16 [=====] - 8s 514ms/step - loss: 0.2583 - accuracy: 0.8907 - val_loss: 0.2831 - val_accuracy: 0.8887
Epoch 413/500
16/16 [=====] - ETA: 0s - loss: 0.2826 - accuracy: 0.8838
Epoch 00413: val_loss did not improve from 0.28314
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16/16 [=====] - 8s 509ms/step - loss: 0.2826 - accuracy: 0.8838 - val_loss: 0.3018 - val_accuracy: 0.8809
Epoch 414/500
16/16 [=====] - ETA: 0s - loss: 0.2735 - accuracy: 0.8977
Epoch 00414: val_loss did not improve from 0.28314
16/16 [=====] - 8s 512ms/step - loss: 0.2735 - accuracy: 0.8977 - val_loss: 0.3033 - val_accuracy: 0.8770
Epoch 415/500
16/16 [=====] - ETA: 0s - loss: 0.2841 - accuracy: 0.8813
Epoch 00415: val_loss did not improve from 0.28314
16/16 [=====] - 8s 509ms/step - loss: 0.2841 - accuracy: 0.8813 - val_loss: 0.3172 - val_accuracy: 0.8691
Epoch 416/500
16/16 [=====] - ETA: 0s - loss: 0.2691 - accuracy: 0.8937
Epoch 00416: val_loss did not improve from 0.28314
16/16 [=====] - 8s 513ms/step - loss: 0.2691 - accuracy: 0.8937 - val_loss: 0.3033 - val_accuracy: 0.8750
Epoch 417/500
16/16 [=====] - ETA: 0s - loss: 0.2726 - accuracy: 0.8917
Epoch 00417: val_loss did not improve from 0.28314
16/16 [=====] - 8s 510ms/step - loss: 0.2726 - accuracy: 0.8917 - val_loss: 0.3287 - val_accuracy: 0.8477
Epoch 418/500
16/16 [=====] - ETA: 0s - loss: 0.2719 - accuracy: 0.8872
Epoch 00418: val_loss did not improve from 0.28314
16/16 [=====] - 8s 515ms/step - loss: 0.2719 - accuracy: 0.8872 - val_loss: 0.3113 - val_accuracy: 0.8848
Epoch 419/500
16/16 [=====] - ETA: 0s - loss: 0.2711 - accuracy: 0.8942
Epoch 00419: val_loss did not improve from 0.28314
16/16 [=====] - 8s 515ms/step - loss: 0.2711 - accuracy: 0.8942 - val_loss: 0.3148 - val_accuracy: 0.8672
Epoch 420/500
16/16 [=====] - ETA: 0s - loss: 0.2768 - accuracy: 0.8942
Epoch 00420: val_loss did not improve from 0.28314
16/16 [=====] - 8s 506ms/step - loss: 0.2768 - accuracy: 0.8942 - val_loss: 0.3228 - val_accuracy: 0.8633
Epoch 421/500
16/16 [=====] - ETA: 0s - loss: 0.2692 - accuracy: 0.8937
Epoch 00421: val_loss did not improve from 0.28314
16/16 [=====] - 8s 508ms/step - loss: 0.2692 - accuracy: 0.8937 - val_loss: 0.3046 - val_accuracy: 0.8711
Epoch 422/500
16/16 [=====] - ETA: 0s - loss: 0.2888 - accuracy: 0.8872
Epoch 00422: val_loss did not improve from 0.28314
16/16 [=====] - 8s 511ms/step - loss: 0.2888 - accuracy: 0.8872 - val_loss: 0.3208 - val_accuracy: 0.8730
Epoch 423/500
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16/16 [=====] - ETA: 0s - loss: 0.2803 - accuracy: 0.8857
Epoch 00423: val_loss did not improve from 0.28314
16/16 [=====] - 8s 505ms/step - loss: 0.2803 - accuracy: 0.8857 - val_loss: 0.3124 - val_accuracy: 0.8828
Epoch 424/500
16/16 [=====] - ETA: 0s - loss: 0.2910 - accuracy: 0.8773
Epoch 00424: val_loss did not improve from 0.28314
16/16 [=====] - 8s 503ms/step - loss: 0.2910 - accuracy: 0.8773 - val_loss: 0.3381 - val_accuracy: 0.8770
Epoch 425/500
16/16 [=====] - ETA: 0s - loss: 0.2580 - accuracy: 0.8987
Epoch 00425: val_loss did not improve from 0.28314
16/16 [=====] - 8s 510ms/step - loss: 0.2580 - accuracy: 0.8987 - val_loss: 0.3003 - val_accuracy: 0.8711
Epoch 426/500
16/16 [=====] - ETA: 0s - loss: 0.2625 - accuracy: 0.8992
Epoch 00426: val_loss did not improve from 0.28314
16/16 [=====] - 8s 511ms/step - loss: 0.2625 - accuracy: 0.8992 - val_loss: 0.3229 - val_accuracy: 0.8809
Epoch 427/500
16/16 [=====] - ETA: 0s - loss: 0.2740 - accuracy: 0.8838
Epoch 00427: val_loss did not improve from 0.28314
16/16 [=====] - 8s 506ms/step - loss: 0.2740 - accuracy: 0.8838 - val_loss: 0.3031 - val_accuracy: 0.8789
Epoch 428/500
16/16 [=====] - ETA: 0s - loss: 0.2668 - accuracy: 0.8927
Epoch 00428: val_loss did not improve from 0.28314
16/16 [=====] - 8s 519ms/step - loss: 0.2668 - accuracy: 0.8927 - val_loss: 0.3212 - val_accuracy: 0.8594
Epoch 429/500
16/16 [=====] - ETA: 0s - loss: 0.2598 - accuracy: 0.8952
Epoch 00429: val_loss did not improve from 0.28314
16/16 [=====] - 8s 513ms/step - loss: 0.2598 - accuracy: 0.8952 - val_loss: 0.2954 - val_accuracy: 0.8730
Epoch 430/500
16/16 [=====] - ETA: 0s - loss: 0.2655 - accuracy: 0.8852
Epoch 00430: val_loss did not improve from 0.28314
16/16 [=====] - 8s 508ms/step - loss: 0.2655 - accuracy: 0.8852 - val_loss: 0.3263 - val_accuracy: 0.8613
Epoch 431/500
16/16 [=====] - ETA: 0s - loss: 0.2611 - accuracy: 0.8937
Epoch 00431: val_loss did not improve from 0.28314
16/16 [=====] - 8s 507ms/step - loss: 0.2611 - accuracy: 0.8937 - val_loss: 0.3064 - val_accuracy: 0.8711
Epoch 432/500
16/16 [=====] - ETA: 0s - loss: 0.2705 - accuracy: 0.8848
Epoch 00432: val_loss did not improve from 0.28314
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16/16 [=====] - 8s 510ms/step - loss: 0.2705 - accuracy: 0.8848 - val_loss: 0.3351 - val_accuracy: 0.8652
Epoch 433/500
16/16 [=====] - ETA: 0s - loss: 0.2634 - accuracy: 0.8987
Epoch 00433: val_loss did not improve from 0.28314
16/16 [=====] - 8s 518ms/step - loss: 0.2634 - accuracy: 0.8987 - val_loss: 0.3221 - val_accuracy: 0.8574
Epoch 434/500
16/16 [=====] - ETA: 0s - loss: 0.2739 - accuracy: 0.8838
Epoch 00434: val_loss did not improve from 0.28314
16/16 [=====] - 8s 509ms/step - loss: 0.2739 - accuracy: 0.8838 - val_loss: 0.3036 - val_accuracy: 0.8809
Epoch 435/500
16/16 [=====] - ETA: 0s - loss: 0.2735 - accuracy: 0.8877
Epoch 00435: val_loss did not improve from 0.28314
16/16 [=====] - 8s 511ms/step - loss: 0.2735 - accuracy: 0.8877 - val_loss: 0.3089 - val_accuracy: 0.8750
Epoch 436/500
16/16 [=====] - ETA: 0s - loss: 0.2603 - accuracy: 0.8982
Epoch 00436: val_loss did not improve from 0.28314
16/16 [=====] - 8s 510ms/step - loss: 0.2603 - accuracy: 0.8982 - val_loss: 0.2865 - val_accuracy: 0.8906
Epoch 437/500
16/16 [=====] - ETA: 0s - loss: 0.2708 - accuracy: 0.8922
Epoch 00437: val_loss did not improve from 0.28314
16/16 [=====] - 8s 509ms/step - loss: 0.2708 - accuracy: 0.8922 - val_loss: 0.3126 - val_accuracy: 0.8750
Epoch 438/500
16/16 [=====] - ETA: 0s - loss: 0.2644 - accuracy: 0.8952
Epoch 00438: val_loss did not improve from 0.28314
16/16 [=====] - 8s 514ms/step - loss: 0.2644 - accuracy: 0.8952 - val_loss: 0.3210 - val_accuracy: 0.8613
Epoch 439/500
16/16 [=====] - ETA: 0s - loss: 0.2882 - accuracy: 0.8907
Epoch 00439: val_loss did not improve from 0.28314
16/16 [=====] - 8s 510ms/step - loss: 0.2882 - accuracy: 0.8907 - val_loss: 0.2945 - val_accuracy: 0.8711
Epoch 440/500
16/16 [=====] - ETA: 0s - loss: 0.2671 - accuracy: 0.8892
Epoch 00440: val_loss did not improve from 0.28314
16/16 [=====] - 8s 508ms/step - loss: 0.2671 - accuracy: 0.8892 - val_loss: 0.2951 - val_accuracy: 0.8789
Epoch 441/500
16/16 [=====] - ETA: 0s - loss: 0.2914 - accuracy: 0.8798
Epoch 00441: val_loss did not improve from 0.28314
16/16 [=====] - 8s 524ms/step - loss: 0.2914 - accuracy: 0.8798 - val_loss: 0.3078 - val_accuracy: 0.8672
Epoch 442/500
```

```
16/16 [=====] - ETA: 0s - loss: 0.2624 - accuracy: 0.9006
Epoch 00442: val_loss did not improve from 0.28314
16/16 [=====] - 8s 514ms/step - loss: 0.2624 - accuracy: 0.9006 - val_loss: 0.3003 - val_accuracy: 0.8809
Epoch 443/500
16/16 [=====] - ETA: 0s - loss: 0.2778 - accuracy: 0.8897
Epoch 00443: val_loss did not improve from 0.28314
16/16 [=====] - 8s 507ms/step - loss: 0.2778 - accuracy: 0.8897 - val_loss: 0.3090 - val_accuracy: 0.8574
Epoch 444/500
16/16 [=====] - ETA: 0s - loss: 0.2633 - accuracy: 0.8992
Epoch 00444: val_loss did not improve from 0.28314
16/16 [=====] - 8s 512ms/step - loss: 0.2633 - accuracy: 0.8992 - val_loss: 0.3156 - val_accuracy: 0.8730
Epoch 445/500
16/16 [=====] - ETA: 0s - loss: 0.2703 - accuracy: 0.8987
Epoch 00445: val_loss did not improve from 0.28314
16/16 [=====] - 8s 517ms/step - loss: 0.2703 - accuracy: 0.8987 - val_loss: 0.2941 - val_accuracy: 0.8711
Epoch 446/500
16/16 [=====] - ETA: 0s - loss: 0.2647 - accuracy: 0.8972
Epoch 00446: val_loss did not improve from 0.28314
16/16 [=====] - 8s 511ms/step - loss: 0.2647 - accuracy: 0.8972 - val_loss: 0.3074 - val_accuracy: 0.8652
Epoch 447/500
16/16 [=====] - ETA: 0s - loss: 0.2768 - accuracy: 0.8902
Epoch 00447: val_loss did not improve from 0.28314
16/16 [=====] - 8s 512ms/step - loss: 0.2768 - accuracy: 0.8902 - val_loss: 0.3217 - val_accuracy: 0.8652
Epoch 448/500
16/16 [=====] - ETA: 0s - loss: 0.2833 - accuracy: 0.8823
Epoch 00448: val_loss did not improve from 0.28314
16/16 [=====] - 8s 519ms/step - loss: 0.2833 - accuracy: 0.8823 - val_loss: 0.2912 - val_accuracy: 0.8770
Epoch 449/500
16/16 [=====] - ETA: 0s - loss: 0.2719 - accuracy: 0.8906
Epoch 00449: val_loss did not improve from 0.28314
16/16 [=====] - 8s 508ms/step - loss: 0.2719 - accuracy: 0.8906 - val_loss: 0.2999 - val_accuracy: 0.8789
Epoch 450/500
16/16 [=====] - ETA: 0s - loss: 0.2790 - accuracy: 0.8818
Epoch 00450: val_loss did not improve from 0.28314
16/16 [=====] - 8s 517ms/step - loss: 0.2790 - accuracy: 0.8818 - val_loss: 0.2960 - val_accuracy: 0.8730
Epoch 451/500
16/16 [=====] - ETA: 0s - loss: 0.2729 - accuracy: 0.8942
Epoch 00451: val_loss did not improve from 0.28314
```

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16/16 [=====] - 8s 510ms/step - loss: 0.2729 - accuracy: 0.8942 - val_loss: 0.3064 - val_accuracy: 0.8770
Epoch 452/500
16/16 [=====] - ETA: 0s - loss: 0.2692 - accuracy: 0.8887
Epoch 00452: val_loss did not improve from 0.28314
16/16 [=====] - 8s 516ms/step - loss: 0.2692 - accuracy: 0.8887 - val_loss: 0.2992 - val_accuracy: 0.8770
Epoch 453/500
16/16 [=====] - ETA: 0s - loss: 0.2471 - accuracy: 0.8987
Epoch 00453: val_loss did not improve from 0.28314
16/16 [=====] - 8s 513ms/step - loss: 0.2471 - accuracy: 0.8987 - val_loss: 0.2850 - val_accuracy: 0.8809
Epoch 454/500
16/16 [=====] - ETA: 0s - loss: 0.2759 - accuracy: 0.8887
Epoch 00454: val_loss did not improve from 0.28314
16/16 [=====] - 8s 512ms/step - loss: 0.2759 - accuracy: 0.8887 - val_loss: 0.3174 - val_accuracy: 0.8613
Epoch 455/500
16/16 [=====] - ETA: 0s - loss: 0.2689 - accuracy: 0.9021
Epoch 00455: val_loss did not improve from 0.28314
16/16 [=====] - 8s 511ms/step - loss: 0.2689 - accuracy: 0.9021 - val_loss: 0.3067 - val_accuracy: 0.8730
Epoch 456/500
16/16 [=====] - ETA: 0s - loss: 0.2580 - accuracy: 0.8967
Epoch 00456: val_loss did not improve from 0.28314
16/16 [=====] - 8s 513ms/step - loss: 0.2580 - accuracy: 0.8967 - val_loss: 0.2982 - val_accuracy: 0.8809
Epoch 457/500
16/16 [=====] - ETA: 0s - loss: 0.2675 - accuracy: 0.8917
Epoch 00457: val_loss improved from 0.28314 to 0.28011, saving model to siamese_best.h5
16/16 [=====] - 8s 522ms/step - loss: 0.2675 - accuracy: 0.8917 - val_loss: 0.2801 - val_accuracy: 0.8848
Epoch 458/500
16/16 [=====] - ETA: 0s - loss: 0.2467 - accuracy: 0.9001
Epoch 00458: val_loss did not improve from 0.28011
16/16 [=====] - 8s 515ms/step - loss: 0.2467 - accuracy: 0.9001 - val_loss: 0.2885 - val_accuracy: 0.8750
Epoch 459/500
16/16 [=====] - ETA: 0s - loss: 0.2715 - accuracy: 0.8892
Epoch 00459: val_loss did not improve from 0.28011
16/16 [=====] - 8s 512ms/step - loss: 0.2715 - accuracy: 0.8892 - val_loss: 0.3183 - val_accuracy: 0.8730
Epoch 460/500
16/16 [=====] - ETA: 0s - loss: 0.2618 - accuracy: 0.8957
Epoch 00460: val_loss did not improve from 0.28011
16/16 [=====] - 8s 511ms/step - loss: 0.2618 - accuracy: 0.8957 - val_loss: 0.2846 - val_accuracy: 0.8848
```

```
Epoch 461/500
16/16 [=====] - ETA: 0s - loss: 0.2472 - accuracy: 0.8882
Epoch 00461: val_loss did not improve from 0.28011
16/16 [=====] - 8s 508ms/step - loss: 0.2472 - accuracy: 0.8882 - val_loss: 0.2950 - val_accuracy: 0.8809
Epoch 462/500
16/16 [=====] - ETA: 0s - loss: 0.2416 - accuracy: 0.9051
Epoch 00462: val_loss did not improve from 0.28011
16/16 [=====] - 8s 508ms/step - loss: 0.2416 - accuracy: 0.9051 - val_loss: 0.3174 - val_accuracy: 0.8750
Epoch 463/500
16/16 [=====] - ETA: 0s - loss: 0.2654 - accuracy: 0.8922
Epoch 00463: val_loss did not improve from 0.28011
16/16 [=====] - 8s 507ms/step - loss: 0.2654 - accuracy: 0.8922 - val_loss: 0.2903 - val_accuracy: 0.8730
Epoch 464/500
16/16 [=====] - ETA: 0s - loss: 0.2509 - accuracy: 0.9041
Epoch 00464: val_loss did not improve from 0.28011
16/16 [=====] - 8s 520ms/step - loss: 0.2509 - accuracy: 0.9041 - val_loss: 0.3179 - val_accuracy: 0.8730
Epoch 465/500
16/16 [=====] - ETA: 0s - loss: 0.2676 - accuracy: 0.8917
Epoch 00465: val_loss did not improve from 0.28011
16/16 [=====] - 8s 506ms/step - loss: 0.2676 - accuracy: 0.8917 - val_loss: 0.3076 - val_accuracy: 0.8848
Epoch 466/500
16/16 [=====] - ETA: 0s - loss: 0.2539 - accuracy: 0.8916
Epoch 00466: val_loss did not improve from 0.28011
16/16 [=====] - 8s 505ms/step - loss: 0.2539 - accuracy: 0.8916 - val_loss: 0.2908 - val_accuracy: 0.8789
Epoch 467/500
16/16 [=====] - ETA: 0s - loss: 0.2484 - accuracy: 0.9056
Epoch 00467: val_loss did not improve from 0.28011
16/16 [=====] - 8s 522ms/step - loss: 0.2484 - accuracy: 0.9056 - val_loss: 0.3202 - val_accuracy: 0.8770
Epoch 468/500
16/16 [=====] - ETA: 0s - loss: 0.2596 - accuracy: 0.8828
Epoch 00468: val_loss did not improve from 0.28011
16/16 [=====] - 8s 509ms/step - loss: 0.2596 - accuracy: 0.8828 - val_loss: 0.2895 - val_accuracy: 0.8672
Epoch 469/500
16/16 [=====] - ETA: 0s - loss: 0.2599 - accuracy: 0.8897
Epoch 00469: val_loss did not improve from 0.28011
16/16 [=====] - 8s 510ms/step - loss: 0.2599 - accuracy: 0.8897 - val_loss: 0.3262 - val_accuracy: 0.8789
Epoch 470/500
16/16 [=====] - ETA: 0s - loss: 0.2592 - accuracy: 0.8892
```

```
Epoch 00470: val_loss did not improve from 0.28011
16/16 [=====] - 8s 511ms/step - loss: 0.2592 - accuracy: 0.8892 - val_loss: 0.2815 - val_accuracy: 0.8789
Epoch 471/500
16/16 [=====] - ETA: 0s - loss: 0.2331 - accuracy: 0.9131
Epoch 00471: val_loss did not improve from 0.28011
16/16 [=====] - 8s 511ms/step - loss: 0.2331 - accuracy: 0.9131 - val_loss: 0.2898 - val_accuracy: 0.8809
Epoch 472/500
16/16 [=====] - ETA: 0s - loss: 0.2595 - accuracy: 0.8852
Epoch 00472: val_loss did not improve from 0.28011
16/16 [=====] - 8s 507ms/step - loss: 0.2595 - accuracy: 0.8852 - val_loss: 0.3125 - val_accuracy: 0.8809
Epoch 473/500
16/16 [=====] - ETA: 0s - loss: 0.2543 - accuracy: 0.8942
Epoch 00473: val_loss did not improve from 0.28011
16/16 [=====] - 8s 505ms/step - loss: 0.2543 - accuracy: 0.8942 - val_loss: 0.2984 - val_accuracy: 0.8770
Epoch 474/500
16/16 [=====] - ETA: 0s - loss: 0.2624 - accuracy: 0.8962
Epoch 00474: val_loss did not improve from 0.28011
16/16 [=====] - 8s 506ms/step - loss: 0.2624 - accuracy: 0.8962 - val_loss: 0.2971 - val_accuracy: 0.8789
Epoch 475/500
16/16 [=====] - ETA: 0s - loss: 0.2384 - accuracy: 0.9001
Epoch 00475: val_loss did not improve from 0.28011
16/16 [=====] - 8s 510ms/step - loss: 0.2384 - accuracy: 0.9001 - val_loss: 0.2930 - val_accuracy: 0.8711
Epoch 476/500
16/16 [=====] - ETA: 0s - loss: 0.2346 - accuracy: 0.9026
Epoch 00476: val_loss did not improve from 0.28011
16/16 [=====] - 8s 511ms/step - loss: 0.2346 - accuracy: 0.9026 - val_loss: 0.3232 - val_accuracy: 0.8691
Epoch 477/500
16/16 [=====] - ETA: 0s - loss: 0.2485 - accuracy: 0.8962
Epoch 00477: val_loss did not improve from 0.28011
16/16 [=====] - 8s 511ms/step - loss: 0.2485 - accuracy: 0.8962 - val_loss: 0.3059 - val_accuracy: 0.8789
Epoch 478/500
16/16 [=====] - ETA: 0s - loss: 0.2449 - accuracy: 0.8997
Epoch 00478: val_loss did not improve from 0.28011
16/16 [=====] - 8s 519ms/step - loss: 0.2449 - accuracy: 0.8997 - val_loss: 0.2907 - val_accuracy: 0.8809
Epoch 479/500
16/16 [=====] - ETA: 0s - loss: 0.2694 - accuracy: 0.8907
Epoch 00479: val_loss did not improve from 0.28011
16/16 [=====] - 8s 513ms/step - loss: 0.2694 - accuracy: 0.8907 - val_loss: 0.3045 - val_accuracy: 0.8730
```

```
Epoch 480/500
16/16 [=====] - ETA: 0s - loss: 0.2539 - accuracy: 0.8982
Epoch 00480: val_loss did not improve from 0.28011
16/16 [=====] - 8s 508ms/step - loss: 0.2539 - accuracy: 0.8982 - val_loss: 0.3063 - val_accuracy: 0.8770
Epoch 481/500
16/16 [=====] - ETA: 0s - loss: 0.2496 - accuracy: 0.8987
Epoch 00481: val_loss did not improve from 0.28011
16/16 [=====] - 8s 516ms/step - loss: 0.2496 - accuracy: 0.8987 - val_loss: 0.2826 - val_accuracy: 0.8887
Epoch 482/500
16/16 [=====] - ETA: 0s - loss: 0.2605 - accuracy: 0.8987
Epoch 00482: val_loss did not improve from 0.28011
16/16 [=====] - 8s 509ms/step - loss: 0.2605 - accuracy: 0.8987 - val_loss: 0.2860 - val_accuracy: 0.8887
Epoch 483/500
16/16 [=====] - ETA: 0s - loss: 0.2458 - accuracy: 0.9053
Epoch 00483: val_loss did not improve from 0.28011
16/16 [=====] - 8s 511ms/step - loss: 0.2458 - accuracy: 0.9053 - val_loss: 0.3013 - val_accuracy: 0.8555
Epoch 484/500
16/16 [=====] - ETA: 0s - loss: 0.2482 - accuracy: 0.8987
Epoch 00484: val_loss improved from 0.28011 to 0.27958, saving model to siamese_best.h5
16/16 [=====] - 8s 520ms/step - loss: 0.2482 - accuracy: 0.8987 - val_loss: 0.2796 - val_accuracy: 0.8730
Epoch 485/500
16/16 [=====] - ETA: 0s - loss: 0.2450 - accuracy: 0.9056
Epoch 00485: val_loss did not improve from 0.27958
16/16 [=====] - 8s 507ms/step - loss: 0.2450 - accuracy: 0.9056 - val_loss: 0.3113 - val_accuracy: 0.8770
Epoch 486/500
16/16 [=====] - ETA: 0s - loss: 0.2607 - accuracy: 0.8997
Epoch 00486: val_loss did not improve from 0.27958
16/16 [=====] - 8s 517ms/step - loss: 0.2607 - accuracy: 0.8997 - val_loss: 0.3543 - val_accuracy: 0.8672
Epoch 487/500
16/16 [=====] - ETA: 0s - loss: 0.2658 - accuracy: 0.8892
Epoch 00487: val_loss did not improve from 0.27958
16/16 [=====] - 8s 516ms/step - loss: 0.2658 - accuracy: 0.8892 - val_loss: 0.2956 - val_accuracy: 0.8828
Epoch 488/500
16/16 [=====] - ETA: 0s - loss: 0.2618 - accuracy: 0.8882
Epoch 00488: val_loss did not improve from 0.27958
16/16 [=====] - 8s 508ms/step - loss: 0.2618 - accuracy: 0.8882 - val_loss: 0.2891 - val_accuracy: 0.8828
Epoch 489/500
16/16 [=====] - ETA: 0s - loss: 0.2203 - accuracy:
```

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0.9155
Epoch 00489: val_loss did not improve from 0.27958
16/16 [=====] - 8s 507ms/step - loss: 0.2203 - accuracy: 0.9155 - val_loss: 0.3034 - val_accuracy: 0.8730
Epoch 490/500
16/16 [=====] - ETA: 0s - loss: 0.2668 - accuracy: 0.8957
Epoch 00490: val_loss did not improve from 0.27958
16/16 [=====] - 8s 508ms/step - loss: 0.2668 - accuracy: 0.8957 - val_loss: 0.3010 - val_accuracy: 0.8828
Epoch 491/500
16/16 [=====] - ETA: 0s - loss: 0.2683 - accuracy: 0.8962
Epoch 00491: val_loss did not improve from 0.27958
16/16 [=====] - 8s 506ms/step - loss: 0.2683 - accuracy: 0.8962 - val_loss: 0.2971 - val_accuracy: 0.8809
Epoch 492/500
16/16 [=====] - ETA: 0s - loss: 0.2494 - accuracy: 0.9016
Epoch 00492: val_loss did not improve from 0.27958
16/16 [=====] - 8s 506ms/step - loss: 0.2494 - accuracy: 0.9016 - val_loss: 0.2946 - val_accuracy: 0.8730
Epoch 493/500
16/16 [=====] - ETA: 0s - loss: 0.2665 - accuracy: 0.8907
Epoch 00493: val_loss did not improve from 0.27958
16/16 [=====] - 8s 509ms/step - loss: 0.2665 - accuracy: 0.8907 - val_loss: 0.3023 - val_accuracy: 0.8809
Epoch 494/500
16/16 [=====] - ETA: 0s - loss: 0.2588 - accuracy: 0.8972
Epoch 00494: val_loss did not improve from 0.27958
16/16 [=====] - 8s 507ms/step - loss: 0.2588 - accuracy: 0.8972 - val_loss: 0.2944 - val_accuracy: 0.8867
Epoch 495/500
16/16 [=====] - ETA: 0s - loss: 0.2557 - accuracy: 0.8977
Epoch 00495: val_loss did not improve from 0.27958
16/16 [=====] - 8s 505ms/step - loss: 0.2557 - accuracy: 0.8977 - val_loss: 0.3207 - val_accuracy: 0.8613
Epoch 496/500
16/16 [=====] - ETA: 0s - loss: 0.2672 - accuracy: 0.8907
Epoch 00496: val_loss did not improve from 0.27958
16/16 [=====] - 8s 514ms/step - loss: 0.2672 - accuracy: 0.8907 - val_loss: 0.3032 - val_accuracy: 0.8730
Epoch 497/500
16/16 [=====] - ETA: 0s - loss: 0.2448 - accuracy: 0.8962
Epoch 00497: val_loss did not improve from 0.27958
16/16 [=====] - 8s 513ms/step - loss: 0.2448 - accuracy: 0.8962 - val_loss: 0.3118 - val_accuracy: 0.8809
Epoch 498/500
16/16 [=====] - ETA: 0s - loss: 0.2578 - accuracy: 0.8992
Epoch 00498: val_loss did not improve from 0.27958
16/16 [=====] - 8s 514ms/step - loss: 0.2578 - accuracy:
```

```
acy: 0.8992 - val_loss: 0.2909 - val_accuracy: 0.8848
Epoch 499/500
16/16 [=====] - ETA: 0s - loss: 0.2611 - accuracy: 0.8957
Epoch 00499: val_loss did not improve from 0.27958
16/16 [=====] - 8s 509ms/step - loss: 0.2611 - accuracy: 0.8957 - val_loss: 0.3171 - val_accuracy: 0.8691
Epoch 500/500
16/16 [=====] - ETA: 0s - loss: 0.2624 - accuracy: 0.8984
Epoch 00500: val_loss did not improve from 0.27958
16/16 [=====] - 8s 520ms/step - loss: 0.2624 - accuracy: 0.8984 - val_loss: 0.2799 - val_accuracy: 0.8848
cp: cannot stat '/root/siamese_best.h5': No such file or directory
```

## Evaluate Model

```
In [21]: # History of accuracy and loss
training_loss = history_siamese.history['loss']
training_accuracy = history_siamese.history['accuracy']
validation_loss = history_siamese.history['val_loss']
validation_accuracy = history_siamese.history['val_accuracy']

# Total number of epochs training
epochs = range(1, len(training_accuracy)+1)
end_epoch = len(training_accuracy)

# Validation Loss minimum epoch(optimal)
optimal_epoch = validation_loss.index(min(validation_loss)) + 1

# Loss and accuracy on the validation set
end_validation_loss = validation_loss[-1]
end_validation_accuracy = validation_accuracy[-1]
optimal_validation_loss = validation_loss[optimal_epoch-1]
optimal_validation_accuracy = validation_accuracy[optimal_epoch-1]

# Loss and accuracy on the test set
optimal_siamese = models.load_model('siamese_best.h5')
test_loss, test_accuracy = siamese.evaluate([test_abn_images, test_base_images],
                                            test_labels, verbose=False)
optimal_test_loss, optimal_test_accuracy = optimal_siamese.evaluate([test_abn_images,
                                                                    test_base_images], test_labels, verbose=False)

print("Siamese Network\n")

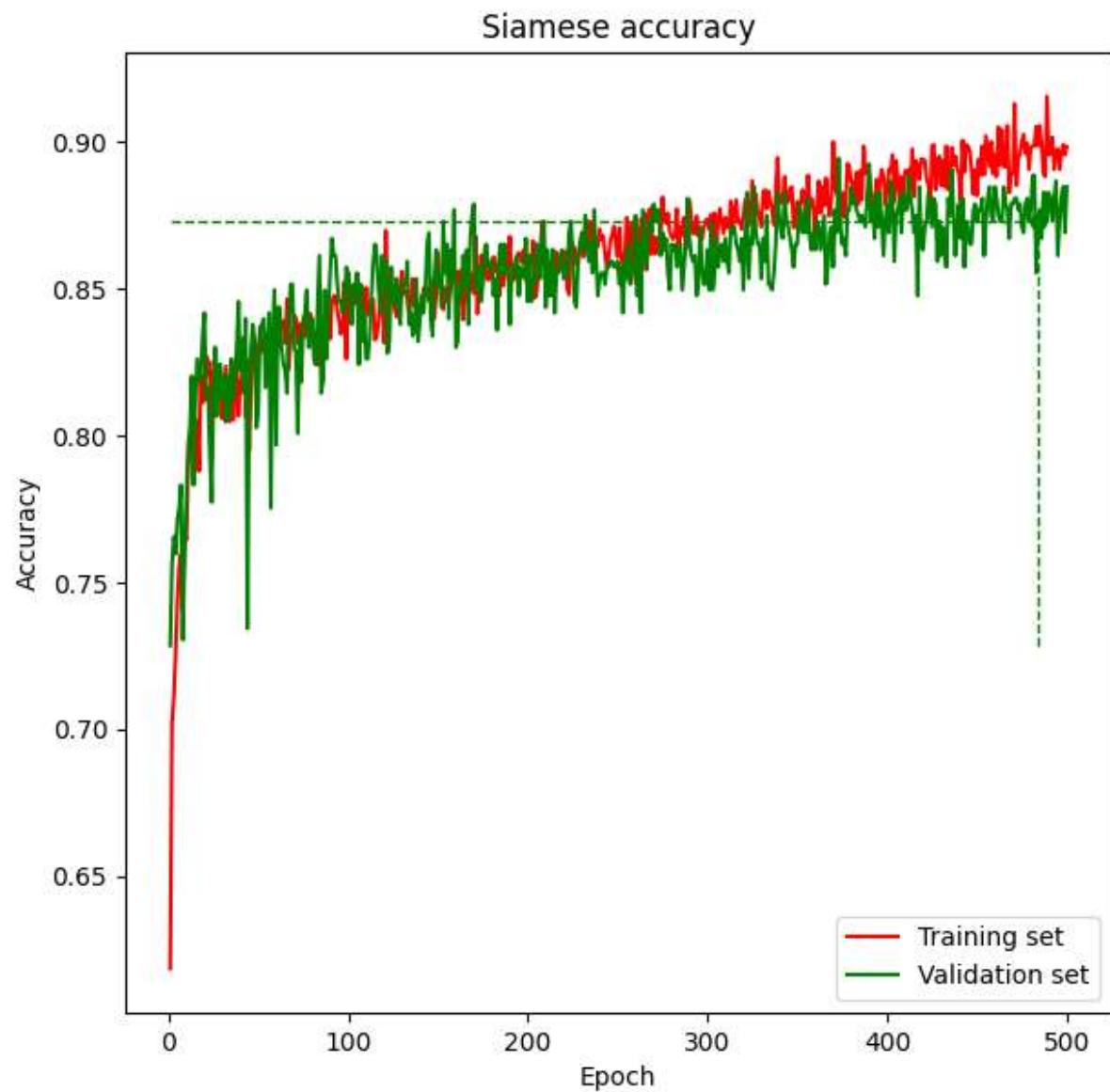
print("Epoch [end]: %d" % end_epoch)
print("Epoch [opt]: %d" % optimal_epoch)
print("Valid accuracy [end]: %.4f" % end_validation_accuracy)
print("Valid accuracy [opt]: %.4f" % optimal_validation_accuracy)
print("Test accuracy [end]: %.4f" % test_accuracy)
print("Test accuracy [opt]: %.4f" % optimal_test_accuracy)
print("Valid loss [end]: %.4f" % end_validation_loss)
print("Valid loss [opt]: %.4f" % optimal_validation_loss)
print("Test loss [end]: %.4f" % test_loss)
print("Test loss [opt]: %.4f" % optimal_test_loss)
```

## Siamese Network

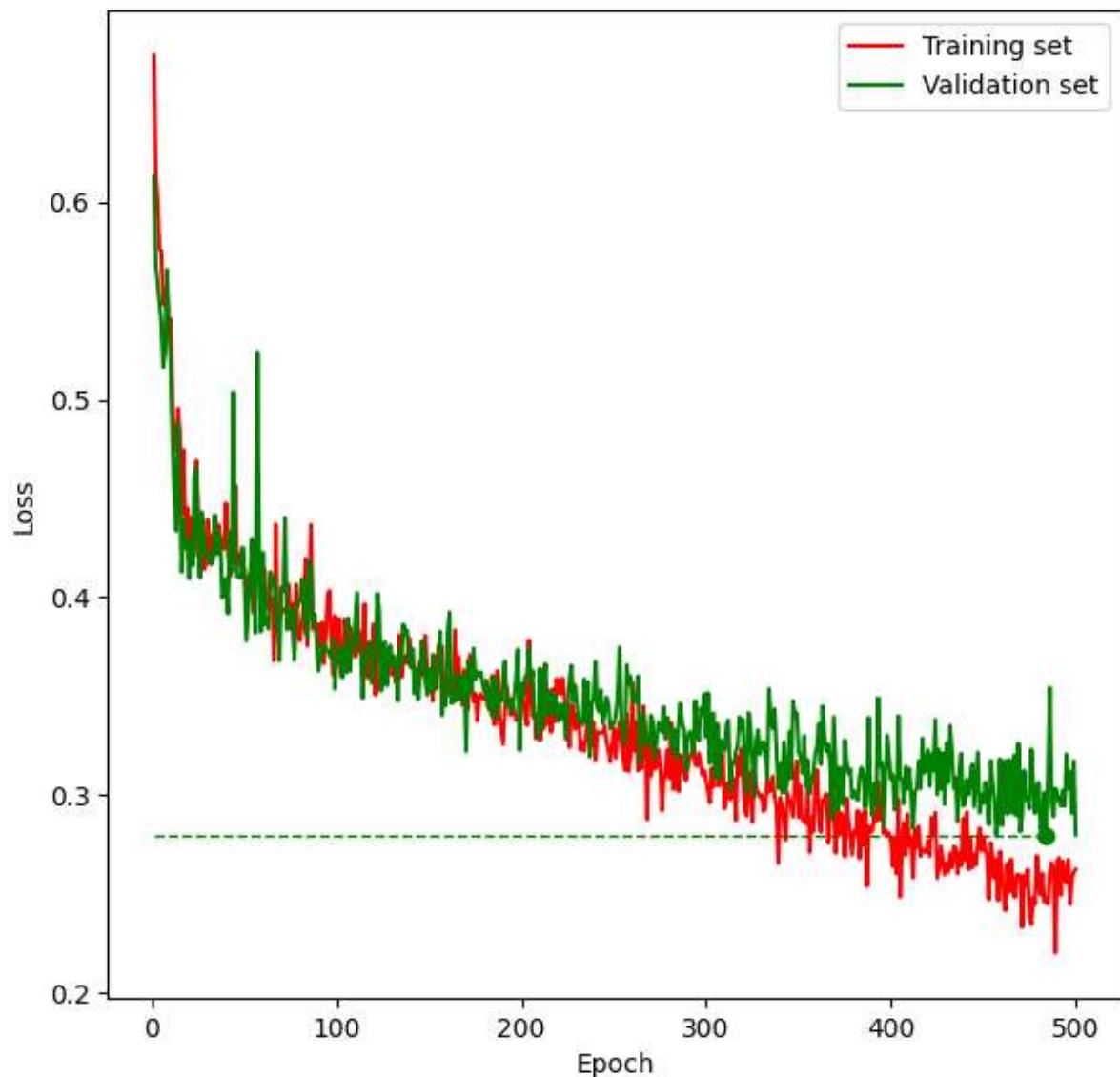
```
Epoch [end]: 500
Epoch [opt]: 484
Valid accuracy [end]: 0.8848
Valid accuracy [opt]: 0.8730
Test accuracy [end]: 0.8810
Test accuracy [opt]: 0.8661
Valid loss [end]: 0.2799
Valid loss [opt]: 0.2796
Test loss [end]: 0.3010
Test loss [opt]: 0.3180
```

```
In [25]: # Model accuracy
plt.figure(figsize=(7, 7), dpi=100, facecolor='w', edgecolor='k')
plt.title('Siamese accuracy')
plt.ylabel('Accuracy')
plt.xlabel('Epoch')
plt.plot(epochs, training_accuracy, 'r', label='Training set')
plt.plot(epochs, validation_accuracy, 'g', label='Validation set')
plt.plot(optimal_epoch, validation_accuracy[optimal_epoch-1], 'go')
plt.vlines(optimal_epoch, min(validation_accuracy), optimal_validation_accuracy, linestyle="dashed", color='g', linewidth=1)
plt.hlines(optimal_validation_accuracy, 1, optimal_epoch, linestyle="dashed", color='g', linewidth=1)
plt.legend(loc='lower right')

# Model loss
plt.figure(figsize=(7, 7), dpi=100, facecolor='w', edgecolor='k')
plt.title('Siamese loss')
plt.ylabel('Loss')
plt.xlabel('Epoch')
plt.plot(epochs, training_loss, 'r', label='Training set')
plt.plot(epochs, validation_loss, 'g', label='Validation set')
plt.plot(optimal_epoch, validation_loss[optimal_epoch-1], 'go')
plt.vlines(optimal_epoch, min(validation_loss), optimal_validation_loss, linestyle="dashed", color='g', linewidth=1)
plt.hlines(optimal_validation_loss, 1, optimal_epoch, linestyle="dashed", color='g', linewidth=1)
plt.legend();
```



## Siamese loss



```
In [15]: def plot_confusion_matrix(cm, classes, normalize=True, title='Confusion matrix',
                                cmap=plt.cm.Blues):

    plt.imshow(cm, interpolation='nearest', cmap=cmap)
    plt.title(title)
    plt.colorbar()
    tick_marks = np.arange(len(classes))
    plt.xticks(tick_marks, classes, rotation=45)
    plt.yticks(tick_marks, classes)

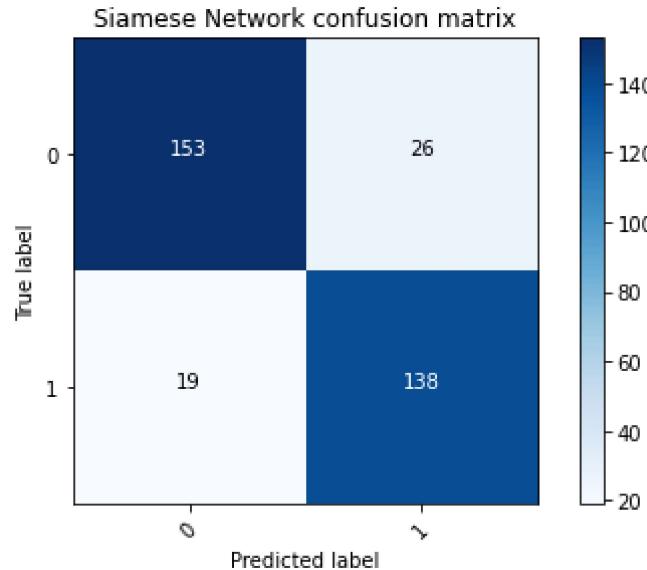
    if normalize:
        cm = cm.astype('float') / cm.sum(axis=1)[:, np.newaxis]

    thresh = cm.max() / 2.
    for i, j in itertools.product(range(cm.shape[0]), range(cm.shape[1])):
        plt.text(j, i, cm[i, j],
                 horizontalalignment="center",
                 color="white" if cm[i, j] > thresh else "black")

    plt.tight_layout()
    plt.ylabel('True label')
    plt.xlabel('Predicted label')
```

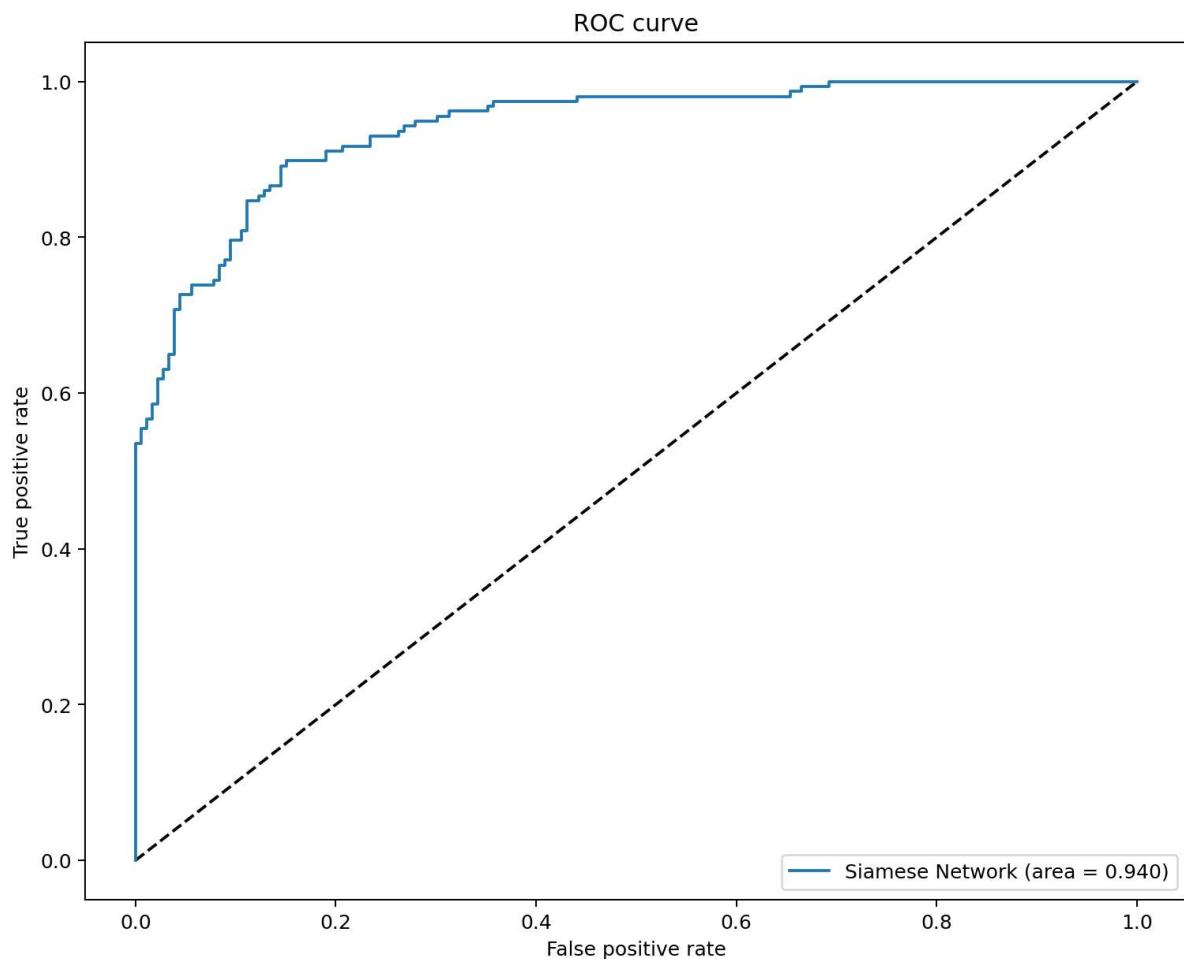
```
In [22]: pred = optimal_siamese.predict([test_abn_images, test_base_images])

pred_classes = np.rint(pred)
confusion_mtx = confusion_matrix(test_labels, pred_classes)
plot_confusion_matrix(confusion_mtx, classes=range(2), normalize=False, title=
'Siamese Network confusion matrix')
```



```
In [26]: def plot_roc(preds, names, titles='ROC curve'):
    plt.figure(figsize=(10, 8), dpi=180, facecolor='w', edgecolor='k')
    for pred, name in zip(preds, names):
        fpr, tpr, _ = roc_curve(test_labels, pred)
        auc_keras = auc(fpr, tpr)
        plt.plot([0, 1], [0, 1], 'k--')
        plt.plot(fpr, tpr, label=(name + ' (area = {:.3f})'.format(auc_keras)))
    plt.xlabel('False positive rate')
    plt.ylabel('True positive rate')
    plt.title('ROC curve')
    plt.legend(loc='lower right')
    plt.show()
```

```
In [27]: plot_roc([pred], names=['Siamese Network'])
```



```
In [24]: # Classification report
```

```
print(classification_report(test_labels, pred_classes, digits=4))
```

	precision	recall	f1-score	support
0	0.8895	0.8547	0.8718	179
1	0.8415	0.8790	0.8598	157
accuracy			0.8661	336
macro avg	0.8655	0.8669	0.8658	336
weighted avg	0.8671	0.8661	0.8662	336