

Training the data on CNN

In [1]:

```
from sklearn.model_selection import KFold, StratifiedKFold
from tensorflow.keras.utils import to_categorical
from tensorflow.keras.models import Sequential, load_model
from tensorflow.keras.layers import Conv2D, Dropout, RandomFlip, RandomRotation, RandomZoom, RandomContrast, RandomCrop,
from tensorflow.keras.losses import SparseCategoricalCrossentropy
from tensorflow.keras.optimizers import SGD, Adam
from sklearn.model_selection import train_test_split, GridSearchCV
from keras.wrappers.scikit_learn import KerasClassifier
from sklearn.metrics import accuracy_score, confusion_matrix
from tensorflow.keras.layers import BatchNormalization
from numpy import mean, std
from matplotlib import pyplot as plt
import tensorflow as tf
import numpy as np
import pandas as pd
import numpy.random as npr
import matplotlib.pyplot as plt
%matplotlib inline
plt.style.use('bmh')

# Loading Data
data_train = np.load('data_train.npy')
labels_train = np.load('new_labels_train.npy')

print(data_train.shape, labels_train.shape)

# Counting number samples per class
vals, counts = np.unique(labels_train, return_counts=True)

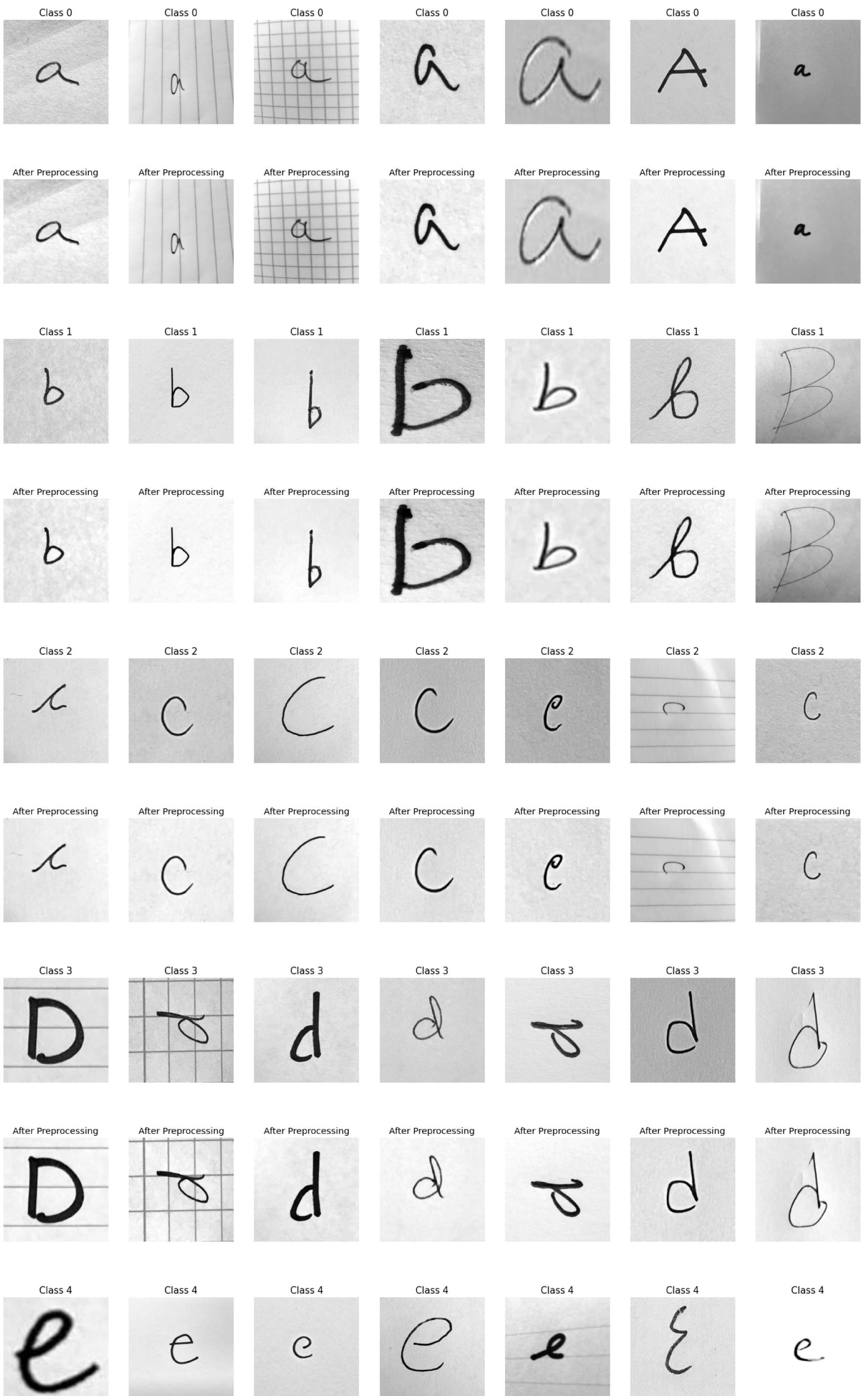
plt.bar(vals, counts)
plt.xticks(range(10), range(10))
plt.xlabel('Classes', size=20)
plt.ylabel('# Samples per Class', size=20)
plt.title('Training Data (Total = '+str(data_train.shape[1])+' samples)', size=15);
```

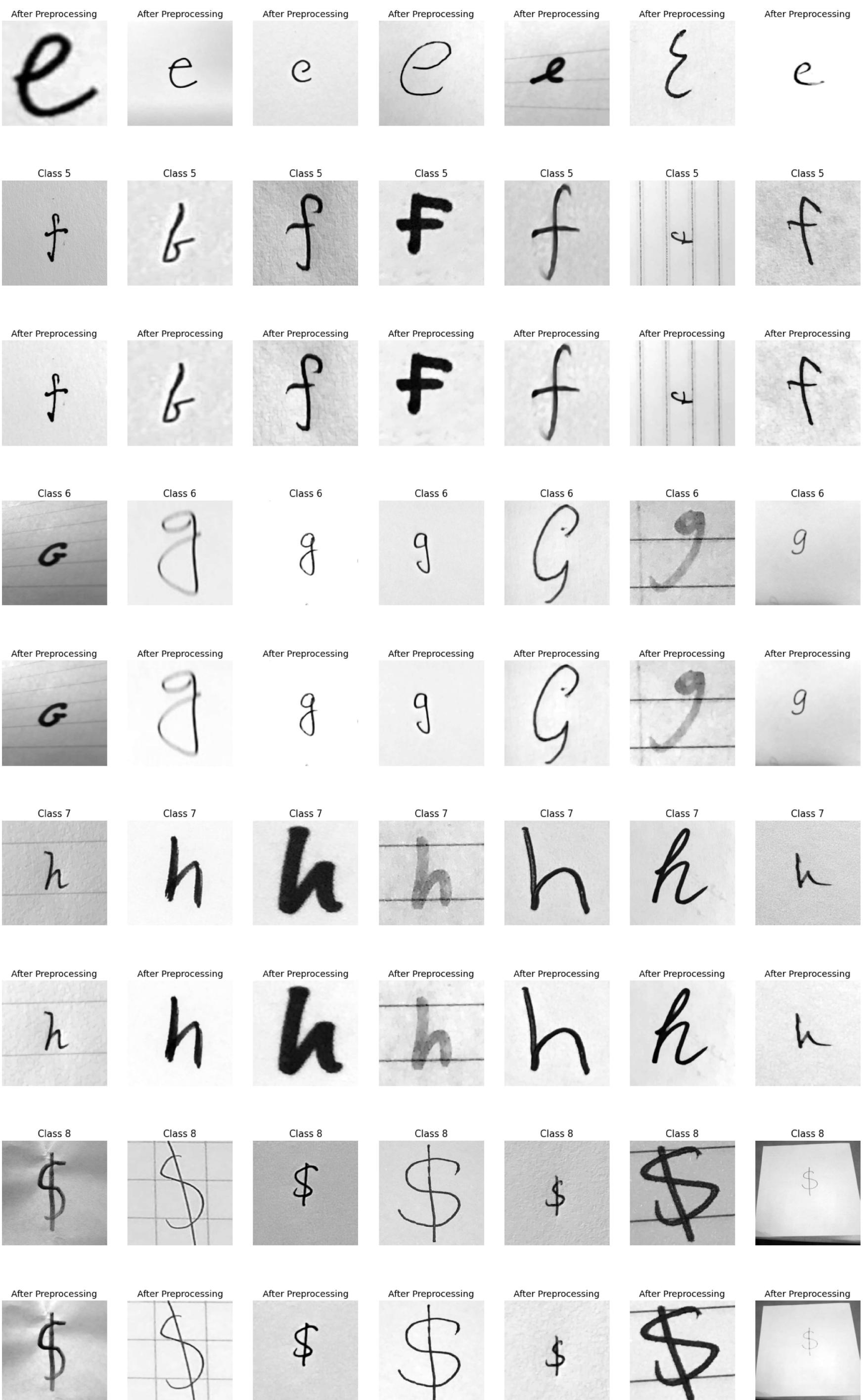


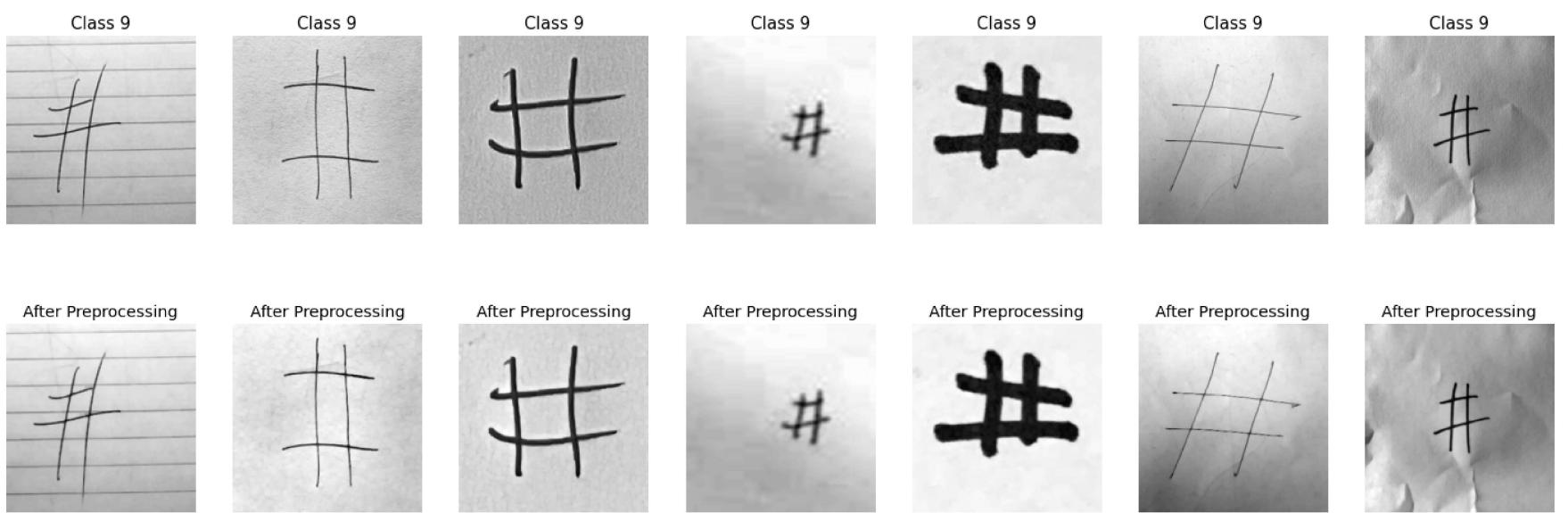
Visualising some images after and before preprocessing

In [2]:

```
import cv2
kernel = np.ones((5,5),np.uint8)
for i in range(0,10):
    rnd_sample = npr.permutation(np.where(labels_train==i)[0])
    fig1=plt.figure(figsize=(25,20))
    for j in range(7):
        fig1.add_subplot(5,7,j+1)
        plt.imshow(data_train[:,rnd_sample[j]].reshape((300,300)),cmap='gray')
        plt.axis('off');plt.title('Class '+str(int(labels_train[rnd_sample[j]])),size=15)
    plt.show()
    print('\n\n')
    j = 0
    fig=plt.figure(figsize=(25,20))
    dt = []
    k=0
    for j in range(7):
        fig.add_subplot(5,7,j+1)
        dt.append(cv2.medianBlur((data_train[:,rnd_sample[j]].reshape((300,300))), 3))
        dt[j] = cv2.morphologyEx(dt[j], cv2.MORPH_OPEN, kernel)
        plt.imshow(dt[j],cmap='gray')
        k = k + 1
        plt.axis('off');plt.title('After Preprocessing')
    plt.show()
    print('\n\n')
```







```
In [3]:
import argparse
import skimage as sk
from skimage import transform
from skimage import util
import cv2
train_data_length = data_train.shape[1]
# Initial function for Loading training set and preprocess dataset
def load_dataset():
    # Load dataset
    data_rgb = []
    kernel = np.ones((4,4),np.uint8)
    for i in range(train_data_length):
        data_rgb.append(data_train[:,i].reshape(300,300))
        data_rgb[i] = cv2.medianBlur(data_rgb[i], 3)
        data_rgb[i] = cv2.morphologyEx(data_rgb[i], cv2.MORPH_OPEN, kernel)
        data_rgb[i] = cv2.resize(data_rgb[i], (50,50), interpolation=cv2.INTER_AREA)
    data_rgb = np.array(data_rgb)
    print(data_rgb.shape)

    # Using 80-20 split
    trainX, testX, trainY, testY = train_test_split(data_rgb, labels_train, test_size = 0.2, stratify=labels_train)

    # reshape dataset to have a single channel
    trainX = trainX.reshape((trainX.shape[0], 50,50, 1))
    testX = testX.reshape((testX.shape[0], 50,50, 1))

    # one hot encode target values
    trainY = to_categorical(trainY)
    testY = to_categorical(testY)
    print(trainX.shape, trainY.shape, testX.shape, testY.shape)
    return trainX, trainY, testX, testY
```

```
In [4]:
# scale pixels
def prep_pixels(train, test):
    # convert from integers to floats
    train_norm = train.astype('float32')
    test_norm = test.astype('float32')

    # he_uniformize to range 0-1
    train_norm = (train_norm) / 255.0
    test_norm = (test_norm) / 255.0

    # return he_uniformized images
    return train_norm, test_norm
```

```
In [5]:
# define cnn model
def define_model(learn_rate = '0.007'):
    model = Sequential()
    model.add(RandomContrast((0,0.3),input_shape=(50,50,1)))
    model.add(RandomRotation(0.1, fill_mode='reflect', interpolation='bilinear'))
    model.add(Conv2D(32, (5, 5), activation='relu', kernel_initializer='he_uniform', input_shape=(50,50, 1)))
    model.add(Conv2D(32, (5, 5), activation='relu', kernel_initializer='he_uniform'))
    model.add(BatchNormalization())
    model.add(MaxPooling2D((2, 2)))
    model.add(Dropout(0.5))
    model.add(Conv2D(32, (3,3),activation='relu', kernel_initializer='he_uniform'))
    model.add(Conv2D(64, (3,3),activation='relu', kernel_initializer='he_uniform'))
    model.add(BatchNormalization())
    model.add(MaxPooling2D((2, 2)))
    model.add(Dropout(0.5))
    model.add(Conv2D(64,(3,3), activation='relu', kernel_initializer='he_uniform'))
    model.add(Conv2D(64,(3,3), activation='relu', kernel_initializer='he_uniform'))
    model.add(BatchNormalization())
    model.add(MaxPooling2D((2, 2)))
    model.add(Dropout(0.5))
    model.add(Flatten())
    model.add(Dense(256, activation='relu', kernel_initializer='he_uniform'))
    model.add(Dropout(0.4))
    model.add(Dense(128, activation='relu', kernel_initializer='he_uniform'))
    model.add(Dropout(0.4))
    model.add(Dense(10, activation='softmax'))
```

```
# compile model
opt = Adam(learning_rate = learn_rate , epsilon=1e-5)
model.compile(optimizer=opt, loss='categorical_crossentropy', metrics=['accuracy'])
return model
```

In [6]:

```
# Function for Finding best parameters using GRID CV
def training(dataX, dataY, tes_X, tes_y):
    parameters = {'epochs':[800], 'batch_size':[32, 128], 'learn_rate':[0.001, 0.0007]}
    model = KerasClassifier(build_fn = define_model, epochs = 800, batch_size = 32)
    grid = GridSearchCV(estimator = model, param_grid = parameters, n_jobs = 1, cv = 3, verbose = 2, return_train_score =
grid_result = grid.fit(dataX, dataY)

    # summarize results
    print("Best: %f using %s" % (grid_result.best_score_, grid_result.best_params_))
    means = grid_result.cv_results_['mean_test_score']
    stds = grid_result.cv_results_['std_test_score']
    params = grid_result.cv_results_['params']
    for mean, stdev, param in zip(means, stds, params):
        print("%f (%f) with: %r" % (mean, stdev, param))
    return grid_result.best_estimator_
```

Code for GRID Search and Best estimator in comments below, you don't have to run these 2 cells below as we know our best parameters now.

In [13]:

```
# def Load_and_train():
#     # Load dataset
#     trainX, trainY, testX, testY = Load_dataset()

#     # prepare pixel data
#     trainX, testX = prep_pixels(trainX, testX)

#     # evaluate model
#     best_estimator = training(trainX, trainY, testX, testY)
#     return best_estimator
# best_estimator = Load_and_train()
```

In [10]:

```
# print(best_estimator.get_params())
{'epochs': 800, 'batch_size': 32, 'learn_rate': 0.0007, 'build_fn': <function define_model at 0x2b6665dff5e0>}
```

We can see from above what the best parameters are, so we will train our model now on these parameters.

In [7]:

```
def final_training(dataX, dataY, testX, testY):
    model = define_model(learn_rate = 0.0007)
    print(model.summary())
    trainX, trainY, testX, testY = dataX, dataY, testX, testY
    # fit model
    history = model.fit(trainX, trainY, epochs = 800, batch_size = 32, validation_data = (testX, testY), verbose=1)
    print("Model Fitted")
    return model, history
```

In [8]:

```
# plot diagnostic Learning curves
def summarize_diagnostics(histories):
    plt.figure(figsize=(12,7))
    plt.plot(history.history['accuracy'])
    plt.plot(history.history['val_accuracy'])
    plt.title('Training and validation Accuracy')
    plt.ylabel('Accuracy')
    plt.xlabel('epoch')
    plt.legend(['Accuracy', 'Val Accuracy'], loc='lower right')
    plt.show()
    plt.figure(figsize=(12,7))
    plt.plot(history.history['loss'])
    plt.plot(history.history['val_loss'])
    plt.title('Training and validation Loss')
    plt.ylabel('Loss')
    plt.xlabel('Epochs')
    plt.legend(['Loss', 'Val Loss'], loc='upper right')
    plt.show()
```

This below cell is where we call 3 functions to split and preprocess the dataset, Normalize the images and finally train on 80% data.

In [9]:

```
trainX, trainY, testX, testY = load_dataset()

# prepare pixel data
trainX, testX = prep_pixels(trainX, testX)

# training the model
model, history = final_training(trainX, trainY, testX, testY)
```

(6720, 50, 50)

(5376, 50, 50, 1) (5376, 10) (1344, 50, 50, 1) (1344, 10)
2022-04-20 13:56:29.748779: I tensorflow/core/platform/cpu_feature_guard.cc:142] This TensorFlow binary is optimized with oneAPI Deep Neural Network Library (oneDNN) to use the following CPU instructions in performance-critical operations: SS E4.1 SSE4.2 AVX AVX2 FMA
To enable them in other operations, rebuild TensorFlow with the appropriate compiler flags.
2022-04-20 13:56:30.252276: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1510] Created device /job:localhost/replica:0/task:0/device:GPU:0 with 79125 MB memory: -> device: 0, name: NVIDIA A100-SXM4-80GB, pci bus id: 0000:47:00.0, compute capability: 8.0
Model: "sequential"

Layer (type)	Output Shape	Param #
=====		
random_contrast (RandomContrast)	(None, 50, 50, 1)	0
random_rotation (RandomRotation)	(None, 50, 50, 1)	0
conv2d (Conv2D)	(None, 46, 46, 32)	832
conv2d_1 (Conv2D)	(None, 42, 42, 32)	25632
batch_normalization (BatchNormalization)	(None, 42, 42, 32)	128
max_pooling2d (MaxPooling2D)	(None, 21, 21, 32)	0
dropout (Dropout)	(None, 21, 21, 32)	0
conv2d_2 (Conv2D)	(None, 19, 19, 32)	9248
conv2d_3 (Conv2D)	(None, 17, 17, 64)	18496
batch_normalization_1 (BatchNormalization)	(None, 17, 17, 64)	256
max_pooling2d_1 (MaxPooling2D)	(None, 8, 8, 64)	0
dropout_1 (Dropout)	(None, 8, 8, 64)	0
conv2d_4 (Conv2D)	(None, 6, 6, 64)	36928
conv2d_5 (Conv2D)	(None, 4, 4, 64)	36928
batch_normalization_2 (BatchNormalization)	(None, 4, 4, 64)	256
max_pooling2d_2 (MaxPooling2D)	(None, 2, 2, 64)	0
dropout_2 (Dropout)	(None, 2, 2, 64)	0
flatten (Flatten)	(None, 256)	0
dense (Dense)	(None, 256)	65792
dropout_3 (Dropout)	(None, 256)	0
dense_1 (Dense)	(None, 128)	32896
dropout_4 (Dropout)	(None, 128)	0
dense_2 (Dense)	(None, 10)	1290
=====		
Total params:	228,682	
Trainable params:	228,362	
Non-trainable params:	320	

None
2022-04-20 13:56:31.266568: I tensorflow/compiler/mlir/mlir_graph_optimization_pass.cc:185] None of the MLIR Optimization Passes are enabled (registered 2)
Epoch 1/800
2022-04-20 13:56:33.352678: I tensorflow/stream_executor/cuda/cuda_dnn.cc:369] Loaded cuDNN version 8201
2022-04-20 13:56:34.264488: W tensorflow/stream_executor/gpu/asm_compiler.cc:77] Couldn't get ptxas version string: Internal: Running ptxas --version returned 32512
2022-04-20 13:56:34.369035: W tensorflow/stream_executor/gpu/redzone_allocator.cc:314] Internal: ptxas exited with non-zero error code 32512, output:
Relying on driver to perform ptx compilation.
Modify \$PATH to customize ptxas location.
This message will be only logged once.
2022-04-20 13:56:35.782709: I tensorflow/stream_executor/cuda/cuda_blas.cc:1760] TensorFloat-32 will be used for the matrix multiplication. This will only be logged once.
168/168 [=====] - 6s 6ms/step - loss: 3.4276 - accuracy: 0.1025 - val_loss: 2.3224 - val_accuracy: 0.1079
Epoch 2/800
168/168 [=====] - 1s 5ms/step - loss: 2.4370 - accuracy: 0.1256 - val_loss: 2.2919 - val_accuracy: 0.1287
Epoch 3/800
168/168 [=====] - 1s 4ms/step - loss: 2.3497 - accuracy: 0.1198 - val_loss: 2.2682 - val_accuracy: 0.1659
Epoch 4/800
168/168 [=====] - 1s 5ms/step - loss: 2.2975 - accuracy: 0.1295 - val_loss: 2.2488 - val_accuracy: 0.1696
Epoch 5/800
168/168 [=====] - 1s 5ms/step - loss: 2.2669 - accuracy: 0.1479 - val_loss: 2.1815 - val_accuracy: 0.1927
Epoch 6/800
168/168 [=====] - 1s 5ms/step - loss: 2.2229 - accuracy: 0.1788 - val_loss: 2.1117 - val_accuracy: 0.2277
Epoch 7/800

168/168 [=====] - 1s 4ms/step - loss: 2.1738 - accuracy: 0.1970 - val_loss: 2.0937 - val_accuracy: 0.2455
Epoch 8/800
168/168 [=====] - 1s 5ms/step - loss: 2.1528 - accuracy: 0.2052 - val_loss: 2.0337 - val_accuracy: 0.2448
Epoch 9/800
168/168 [=====] - 1s 5ms/step - loss: 2.1084 - accuracy: 0.2108 - val_loss: 1.9826 - val_accuracy: 0.2805
Epoch 10/800
168/168 [=====] - 1s 4ms/step - loss: 2.0672 - accuracy: 0.2193 - val_loss: 1.8753 - val_accuracy: 0.3103
Epoch 11/800
168/168 [=====] - 1s 4ms/step - loss: 2.0255 - accuracy: 0.2461 - val_loss: 1.9378 - val_accuracy: 0.2969
Epoch 12/800
168/168 [=====] - 1s 4ms/step - loss: 1.9790 - accuracy: 0.2675 - val_loss: 1.8436 - val_accuracy: 0.3356
Epoch 13/800
168/168 [=====] - 1s 5ms/step - loss: 1.9527 - accuracy: 0.2673 - val_loss: 1.7890 - val_accuracy: 0.3497
Epoch 14/800
168/168 [=====] - 1s 5ms/step - loss: 1.9237 - accuracy: 0.2811 - val_loss: 1.6658 - val_accuracy: 0.3981
Epoch 15/800
168/168 [=====] - 1s 5ms/step - loss: 1.8854 - accuracy: 0.3136 - val_loss: 1.6574 - val_accuracy: 0.4204
Epoch 16/800
168/168 [=====] - 1s 4ms/step - loss: 1.8559 - accuracy: 0.3203 - val_loss: 1.5604 - val_accuracy: 0.4494
Epoch 17/800
168/168 [=====] - 1s 5ms/step - loss: 1.8001 - accuracy: 0.3432 - val_loss: 1.5853 - val_accuracy: 0.4397
Epoch 18/800
168/168 [=====] - 1s 5ms/step - loss: 1.7185 - accuracy: 0.3823 - val_loss: 1.3914 - val_accuracy: 0.5685
Epoch 19/800
168/168 [=====] - 1s 5ms/step - loss: 1.6457 - accuracy: 0.4131 - val_loss: 1.4740 - val_accuracy: 0.4635
Epoch 20/800
168/168 [=====] - 1s 4ms/step - loss: 1.5861 - accuracy: 0.4306 - val_loss: 1.4350 - val_accuracy: 0.4874
Epoch 21/800
168/168 [=====] - 1s 4ms/step - loss: 1.5362 - accuracy: 0.4554 - val_loss: 1.3044 - val_accuracy: 0.5655
Epoch 22/800
168/168 [=====] - 1s 5ms/step - loss: 1.4792 - accuracy: 0.4829 - val_loss: 1.4089 - val_accuracy: 0.5238
Epoch 23/800
168/168 [=====] - 1s 5ms/step - loss: 1.4204 - accuracy: 0.5123 - val_loss: 1.1664 - val_accuracy: 0.5781
Epoch 24/800
168/168 [=====] - 1s 4ms/step - loss: 1.3674 - accuracy: 0.5268 - val_loss: 1.0499 - val_accuracy: 0.6548
Epoch 25/800
168/168 [=====] - 1s 5ms/step - loss: 1.3174 - accuracy: 0.5463 - val_loss: 0.9300 - val_accuracy: 0.6882
Epoch 26/800
168/168 [=====] - 1s 5ms/step - loss: 1.2657 - accuracy: 0.5605 - val_loss: 0.9048 - val_accuracy: 0.6897
Epoch 27/800
168/168 [=====] - 1s 5ms/step - loss: 1.2483 - accuracy: 0.5711 - val_loss: 0.9503 - val_accuracy: 0.6763
Epoch 28/800
168/168 [=====] - 1s 5ms/step - loss: 1.1901 - accuracy: 0.5952 - val_loss: 0.8530 - val_accuracy: 0.7150
Epoch 29/800
168/168 [=====] - 1s 6ms/step - loss: 1.1623 - accuracy: 0.6044 - val_loss: 0.8687 - val_accuracy: 0.7173
Epoch 30/800
168/168 [=====] - 1s 5ms/step - loss: 1.1273 - accuracy: 0.6138 - val_loss: 0.8598 - val_accuracy: 0.7121
Epoch 31/800
168/168 [=====] - 1s 5ms/step - loss: 1.0953 - accuracy: 0.6300 - val_loss: 0.8026 - val_accuracy: 0.7277
Epoch 32/800
168/168 [=====] - 1s 5ms/step - loss: 1.0795 - accuracy: 0.6453 - val_loss: 0.7402 - val_accuracy: 0.7560
Epoch 33/800
168/168 [=====] - 1s 4ms/step - loss: 1.0098 - accuracy: 0.6628 - val_loss: 0.7267 - val_accuracy: 0.7485
Epoch 34/800
168/168 [=====] - 1s 4ms/step - loss: 1.0077 - accuracy: 0.6656 - val_loss: 0.7047 - val_accuracy: 0.7805
Epoch 35/800
168/168 [=====] - 1s 5ms/step - loss: 0.9852 - accuracy: 0.6782 - val_loss: 0.7622 - val_accuracy: 0.7411
Epoch 36/800
168/168 [=====] - 2s 11ms/step - loss: 0.9664 - accuracy: 0.6775 - val_loss: 0.6947 - val_accuracy: 0.7641
Epoch 37/800
168/168 [=====] - 1s 4ms/step - loss: 0.9167 - accuracy: 0.6936 - val_loss: 0.6373 - val_accuracy: 0.7932
Epoch 38/800
168/168 [=====] - 1s 4ms/step - loss: 0.9023 - accuracy: 0.7070 - val_loss: 0.6056 - val_accuracy: 0.8065

Epoch 39/800
168/168 [=====] - 1s 5ms/step - loss: 0.8859 - accuracy: 0.7096 - val_loss: 0.6947 - val_accuracy: 0.7790
Epoch 40/800
168/168 [=====] - 1s 5ms/step - loss: 0.8911 - accuracy: 0.7063 - val_loss: 0.7163 - val_accuracy: 0.7626
Epoch 41/800
168/168 [=====] - 1s 5ms/step - loss: 0.8608 - accuracy: 0.7160 - val_loss: 0.6201 - val_accuracy: 0.7865
Epoch 42/800
168/168 [=====] - 1s 4ms/step - loss: 0.8586 - accuracy: 0.7184 - val_loss: 0.7056 - val_accuracy: 0.7612
Epoch 43/800
168/168 [=====] - 1s 5ms/step - loss: 0.8082 - accuracy: 0.7307 - val_loss: 0.6105 - val_accuracy: 0.7902
Epoch 44/800
168/168 [=====] - 1s 5ms/step - loss: 0.7918 - accuracy: 0.7394 - val_loss: 0.6486 - val_accuracy: 0.7783
Epoch 45/800
168/168 [=====] - 1s 5ms/step - loss: 0.7865 - accuracy: 0.7372 - val_loss: 0.5711 - val_accuracy: 0.8222
Epoch 46/800
168/168 [=====] - 1s 4ms/step - loss: 0.7584 - accuracy: 0.7493 - val_loss: 0.4940 - val_accuracy: 0.8341
Epoch 47/800
168/168 [=====] - 1s 4ms/step - loss: 0.7589 - accuracy: 0.7500 - val_loss: 0.7121 - val_accuracy: 0.7746
Epoch 48/800
168/168 [=====] - 1s 5ms/step - loss: 0.7588 - accuracy: 0.7467 - val_loss: 0.5285 - val_accuracy: 0.8326
Epoch 49/800
168/168 [=====] - 1s 4ms/step - loss: 0.7295 - accuracy: 0.7599 - val_loss: 0.6696 - val_accuracy: 0.7954
Epoch 50/800
168/168 [=====] - 1s 4ms/step - loss: 0.7224 - accuracy: 0.7636 - val_loss: 0.5189 - val_accuracy: 0.8348
Epoch 51/800
168/168 [=====] - 1s 4ms/step - loss: 0.7113 - accuracy: 0.7706 - val_loss: 0.5149 - val_accuracy: 0.8318
Epoch 52/800
168/168 [=====] - 1s 5ms/step - loss: 0.7040 - accuracy: 0.7822 - val_loss: 0.4644 - val_accuracy: 0.8467
Epoch 53/800
168/168 [=====] - 1s 4ms/step - loss: 0.6747 - accuracy: 0.7760 - val_loss: 0.4953 - val_accuracy: 0.8296
Epoch 54/800
168/168 [=====] - 1s 4ms/step - loss: 0.6708 - accuracy: 0.7859 - val_loss: 0.4516 - val_accuracy: 0.8519
Epoch 55/800
168/168 [=====] - 1s 5ms/step - loss: 0.6672 - accuracy: 0.7835 - val_loss: 0.5157 - val_accuracy: 0.8356
Epoch 56/800
168/168 [=====] - 1s 4ms/step - loss: 0.6797 - accuracy: 0.7738 - val_loss: 0.5063 - val_accuracy: 0.8259
Epoch 57/800
168/168 [=====] - 1s 4ms/step - loss: 0.6529 - accuracy: 0.7831 - val_loss: 0.4404 - val_accuracy: 0.8564
Epoch 58/800
168/168 [=====] - 1s 4ms/step - loss: 0.6453 - accuracy: 0.7898 - val_loss: 0.6866 - val_accuracy: 0.7723
Epoch 59/800
168/168 [=====] - 1s 5ms/step - loss: 0.6697 - accuracy: 0.7844 - val_loss: 0.7575 - val_accuracy: 0.7812
Epoch 60/800
168/168 [=====] - 1s 4ms/step - loss: 0.6371 - accuracy: 0.7967 - val_loss: 0.5183 - val_accuracy: 0.8318
Epoch 61/800
168/168 [=====] - 1s 4ms/step - loss: 0.6327 - accuracy: 0.7930 - val_loss: 0.5575 - val_accuracy: 0.8155
Epoch 62/800
168/168 [=====] - 1s 5ms/step - loss: 0.6313 - accuracy: 0.8012 - val_loss: 0.6615 - val_accuracy: 0.7999
Epoch 63/800
168/168 [=====] - 1s 5ms/step - loss: 0.5993 - accuracy: 0.8052 - val_loss: 0.4122 - val_accuracy: 0.8676
Epoch 64/800
168/168 [=====] - 1s 5ms/step - loss: 0.6065 - accuracy: 0.8092 - val_loss: 0.4945 - val_accuracy: 0.8348
Epoch 65/800
168/168 [=====] - 1s 5ms/step - loss: 0.5875 - accuracy: 0.8088 - val_loss: 0.4826 - val_accuracy: 0.8527
Epoch 66/800
168/168 [=====] - 1s 4ms/step - loss: 0.5786 - accuracy: 0.8106 - val_loss: 0.4357 - val_accuracy: 0.8430
Epoch 67/800
168/168 [=====] - 1s 4ms/step - loss: 0.6017 - accuracy: 0.8067 - val_loss: 0.4859 - val_accuracy: 0.8504
Epoch 68/800
168/168 [=====] - 2s 11ms/step - loss: 0.5824 - accuracy: 0.8203 - val_loss: 0.4263 - val_accuracy: 0.8668
Epoch 69/800
168/168 [=====] - 1s 5ms/step - loss: 0.5884 - accuracy: 0.8166 - val_loss: 0.4160 - val_accuracy: 0.8757
Epoch 70/800
168/168 [=====] - 1s 4ms/step - loss: 0.5780 - accuracy: 0.8140 - val_loss: 0.5490 - val_accuracy:

y: 0.8304
Epoch 71/800
168/168 [=====] - 1s 4ms/step - loss: 0.5634 - accuracy: 0.8235 - val_loss: 0.3835 - val_accuracy: 0.8735
y: 0.8735
Epoch 72/800
168/168 [=====] - 1s 5ms/step - loss: 0.5479 - accuracy: 0.8250 - val_loss: 0.4911 - val_accuracy: 0.8333
y: 0.8333
Epoch 73/800
168/168 [=====] - 1s 4ms/step - loss: 0.5637 - accuracy: 0.8212 - val_loss: 0.4285 - val_accuracy: 0.8579
y: 0.8579
Epoch 74/800
168/168 [=====] - 1s 5ms/step - loss: 0.5567 - accuracy: 0.8251 - val_loss: 0.3736 - val_accuracy: 0.8780
y: 0.8780
Epoch 75/800
168/168 [=====] - 1s 4ms/step - loss: 0.5213 - accuracy: 0.8279 - val_loss: 0.3639 - val_accuracy: 0.8817
y: 0.8817
Epoch 76/800
168/168 [=====] - 1s 5ms/step - loss: 0.5514 - accuracy: 0.8235 - val_loss: 0.4410 - val_accuracy: 0.8542
y: 0.8542
Epoch 77/800
168/168 [=====] - 1s 5ms/step - loss: 0.5351 - accuracy: 0.8274 - val_loss: 0.4318 - val_accuracy: 0.8571
y: 0.8571
Epoch 78/800
168/168 [=====] - 1s 4ms/step - loss: 0.5232 - accuracy: 0.8358 - val_loss: 0.5192 - val_accuracy: 0.8467
y: 0.8467
Epoch 79/800
168/168 [=====] - 1s 5ms/step - loss: 0.5207 - accuracy: 0.8350 - val_loss: 0.3710 - val_accuracy: 0.8899
y: 0.8899
Epoch 80/800
168/168 [=====] - 1s 5ms/step - loss: 0.5231 - accuracy: 0.8346 - val_loss: 0.3568 - val_accuracy: 0.8862
y: 0.8862
Epoch 81/800
168/168 [=====] - 1s 5ms/step - loss: 0.5043 - accuracy: 0.8348 - val_loss: 0.5231 - val_accuracy: 0.8393
y: 0.8393
Epoch 82/800
168/168 [=====] - 1s 5ms/step - loss: 0.5217 - accuracy: 0.8363 - val_loss: 0.4040 - val_accuracy: 0.8757
y: 0.8757
Epoch 83/800
168/168 [=====] - 1s 4ms/step - loss: 0.5099 - accuracy: 0.8384 - val_loss: 0.4169 - val_accuracy: 0.8713
y: 0.8713
Epoch 84/800
168/168 [=====] - 1s 5ms/step - loss: 0.5017 - accuracy: 0.8337 - val_loss: 0.3528 - val_accuracy: 0.8824
y: 0.8824
Epoch 85/800
168/168 [=====] - 1s 5ms/step - loss: 0.4909 - accuracy: 0.8438 - val_loss: 0.3804 - val_accuracy: 0.8757
y: 0.8757
Epoch 86/800
168/168 [=====] - 1s 4ms/step - loss: 0.4719 - accuracy: 0.8464 - val_loss: 0.4284 - val_accuracy: 0.8661
y: 0.8661
Epoch 87/800
168/168 [=====] - 1s 5ms/step - loss: 0.4867 - accuracy: 0.8493 - val_loss: 0.3290 - val_accuracy: 0.8936
y: 0.8936
Epoch 88/800
168/168 [=====] - 1s 5ms/step - loss: 0.4935 - accuracy: 0.8451 - val_loss: 0.4223 - val_accuracy: 0.8616
y: 0.8616
Epoch 89/800
168/168 [=====] - 1s 4ms/step - loss: 0.4612 - accuracy: 0.8475 - val_loss: 0.3810 - val_accuracy: 0.8780
y: 0.8780
Epoch 90/800
168/168 [=====] - 1s 4ms/step - loss: 0.4637 - accuracy: 0.8516 - val_loss: 0.3933 - val_accuracy: 0.8854
y: 0.8854
Epoch 91/800
168/168 [=====] - 1s 4ms/step - loss: 0.4775 - accuracy: 0.8458 - val_loss: 0.3839 - val_accuracy: 0.8817
y: 0.8817
Epoch 92/800
168/168 [=====] - 1s 4ms/step - loss: 0.4611 - accuracy: 0.8480 - val_loss: 0.3437 - val_accuracy: 0.8951
y: 0.8951
Epoch 93/800
168/168 [=====] - 1s 4ms/step - loss: 0.4518 - accuracy: 0.8527 - val_loss: 0.3944 - val_accuracy: 0.8839
y: 0.8839
Epoch 94/800
168/168 [=====] - 1s 4ms/step - loss: 0.4442 - accuracy: 0.8581 - val_loss: 0.3973 - val_accuracy: 0.8795
y: 0.8795
Epoch 95/800
168/168 [=====] - 1s 5ms/step - loss: 0.4690 - accuracy: 0.8540 - val_loss: 0.4223 - val_accuracy: 0.8624
y: 0.8624
Epoch 96/800
168/168 [=====] - 1s 4ms/step - loss: 0.4367 - accuracy: 0.8544 - val_loss: 0.3291 - val_accuracy: 0.8981
y: 0.8981
Epoch 97/800
168/168 [=====] - 1s 5ms/step - loss: 0.4546 - accuracy: 0.8560 - val_loss: 0.3516 - val_accuracy: 0.8891
y: 0.8891
Epoch 98/800
168/168 [=====] - 1s 4ms/step - loss: 0.4303 - accuracy: 0.8624 - val_loss: 0.3255 - val_accuracy: 0.8951
y: 0.8951
Epoch 99/800
168/168 [=====] - 1s 5ms/step - loss: 0.4501 - accuracy: 0.8612 - val_loss: 0.3379 - val_accuracy: 0.9003
y: 0.9003
Epoch 100/800
168/168 [=====] - 1s 5ms/step - loss: 0.4159 - accuracy: 0.8679 - val_loss: 0.3347 - val_accuracy: 0.8936
y: 0.8936
Epoch 101/800
168/168 [=====] - 1s 4ms/step - loss: 0.4465 - accuracy: 0.8583 - val_loss: 0.3053 - val_accuracy: 0.9122
y: 0.9122
Epoch 102/800

168/168 [=====] - 1s 5ms/step - loss: 0.4197 - accuracy: 0.8661 - val_loss: 0.3033 - val_accuracy: 0.9144
Epoch 103/800
168/168 [=====] - 1s 4ms/step - loss: 0.4439 - accuracy: 0.8592 - val_loss: 0.3350 - val_accuracy: 0.8943
Epoch 104/800
168/168 [=====] - 1s 4ms/step - loss: 0.4198 - accuracy: 0.8624 - val_loss: 0.3241 - val_accuracy: 0.9025
Epoch 105/800
168/168 [=====] - 1s 5ms/step - loss: 0.4248 - accuracy: 0.8640 - val_loss: 0.3372 - val_accuracy: 0.8951
Epoch 106/800
168/168 [=====] - 1s 5ms/step - loss: 0.4143 - accuracy: 0.8676 - val_loss: 0.3743 - val_accuracy: 0.8891
Epoch 107/800
168/168 [=====] - 1s 4ms/step - loss: 0.4284 - accuracy: 0.8614 - val_loss: 0.3236 - val_accuracy: 0.8973
Epoch 108/800
168/168 [=====] - 1s 4ms/step - loss: 0.4145 - accuracy: 0.8653 - val_loss: 0.4156 - val_accuracy: 0.8839
Epoch 109/800
168/168 [=====] - 1s 5ms/step - loss: 0.4156 - accuracy: 0.8696 - val_loss: 0.2940 - val_accuracy: 0.9137
Epoch 110/800
168/168 [=====] - 1s 4ms/step - loss: 0.4140 - accuracy: 0.8616 - val_loss: 0.2996 - val_accuracy: 0.9189
Epoch 111/800
168/168 [=====] - 1s 5ms/step - loss: 0.4105 - accuracy: 0.8648 - val_loss: 0.3474 - val_accuracy: 0.8981
Epoch 112/800
168/168 [=====] - 2s 11ms/step - loss: 0.3992 - accuracy: 0.8692 - val_loss: 0.3312 - val_accuracy: 0.9003
Epoch 113/800
168/168 [=====] - 1s 4ms/step - loss: 0.4255 - accuracy: 0.8614 - val_loss: 0.3326 - val_accuracy: 0.8921
Epoch 114/800
168/168 [=====] - 1s 4ms/step - loss: 0.4099 - accuracy: 0.8681 - val_loss: 0.2954 - val_accuracy: 0.9144
Epoch 115/800
168/168 [=====] - 1s 5ms/step - loss: 0.3855 - accuracy: 0.8767 - val_loss: 0.3070 - val_accuracy: 0.9189
Epoch 116/800
168/168 [=====] - 1s 5ms/step - loss: 0.3791 - accuracy: 0.8722 - val_loss: 0.2790 - val_accuracy: 0.9152
Epoch 117/800
168/168 [=====] - 1s 4ms/step - loss: 0.4009 - accuracy: 0.8741 - val_loss: 0.3071 - val_accuracy: 0.9040
Epoch 118/800
168/168 [=====] - 1s 5ms/step - loss: 0.3878 - accuracy: 0.8793 - val_loss: 0.3111 - val_accuracy: 0.9033
Epoch 119/800
168/168 [=====] - 1s 4ms/step - loss: 0.3977 - accuracy: 0.8694 - val_loss: 0.3041 - val_accuracy: 0.9025
Epoch 120/800
168/168 [=====] - 1s 5ms/step - loss: 0.3978 - accuracy: 0.8748 - val_loss: 0.3144 - val_accuracy: 0.9085
Epoch 121/800
168/168 [=====] - 1s 4ms/step - loss: 0.3838 - accuracy: 0.8776 - val_loss: 0.2910 - val_accuracy: 0.9085
Epoch 122/800
168/168 [=====] - 1s 5ms/step - loss: 0.3701 - accuracy: 0.8826 - val_loss: 0.2697 - val_accuracy: 0.9189
Epoch 123/800
168/168 [=====] - 1s 5ms/step - loss: 0.3836 - accuracy: 0.8739 - val_loss: 0.2955 - val_accuracy: 0.9100
Epoch 124/800
168/168 [=====] - 1s 4ms/step - loss: 0.3948 - accuracy: 0.8735 - val_loss: 0.2846 - val_accuracy: 0.9211
Epoch 125/800
168/168 [=====] - 1s 5ms/step - loss: 0.3920 - accuracy: 0.8759 - val_loss: 0.2999 - val_accuracy: 0.9152
Epoch 126/800
168/168 [=====] - 1s 4ms/step - loss: 0.3660 - accuracy: 0.8834 - val_loss: 0.3079 - val_accuracy: 0.9085
Epoch 127/800
168/168 [=====] - 1s 5ms/step - loss: 0.3680 - accuracy: 0.8836 - val_loss: 0.2823 - val_accuracy: 0.9219
Epoch 128/800
168/168 [=====] - 1s 5ms/step - loss: 0.3703 - accuracy: 0.8850 - val_loss: 0.2811 - val_accuracy: 0.9167
Epoch 129/800
168/168 [=====] - 1s 5ms/step - loss: 0.3775 - accuracy: 0.8748 - val_loss: 0.2988 - val_accuracy: 0.9040
Epoch 130/800
168/168 [=====] - 1s 5ms/step - loss: 0.3695 - accuracy: 0.8834 - val_loss: 0.3076 - val_accuracy: 0.9107
Epoch 131/800
168/168 [=====] - 1s 5ms/step - loss: 0.3704 - accuracy: 0.8797 - val_loss: 0.2505 - val_accuracy: 0.9234
Epoch 132/800
168/168 [=====] - 1s 4ms/step - loss: 0.3602 - accuracy: 0.8849 - val_loss: 0.3207 - val_accuracy: 0.8966
Epoch 133/800
168/168 [=====] - 1s 5ms/step - loss: 0.3600 - accuracy: 0.8849 - val_loss: 0.2714 - val_accuracy: 0.9234

Epoch 134/800
168/168 [=====] - 1s 4ms/step - loss: 0.3571 - accuracy: 0.8880 - val_loss: 0.2970 - val_accuracy: 0.9122
Epoch 135/800
168/168 [=====] - 1s 5ms/step - loss: 0.3709 - accuracy: 0.8798 - val_loss: 0.2839 - val_accuracy: 0.9144
Epoch 136/800
168/168 [=====] - 1s 4ms/step - loss: 0.3345 - accuracy: 0.8927 - val_loss: 0.2790 - val_accuracy: 0.9219
Epoch 137/800
168/168 [=====] - 1s 4ms/step - loss: 0.3672 - accuracy: 0.8862 - val_loss: 0.3075 - val_accuracy: 0.9182
Epoch 138/800
168/168 [=====] - 1s 5ms/step - loss: 0.3400 - accuracy: 0.8942 - val_loss: 0.2902 - val_accuracy: 0.9167
Epoch 139/800
168/168 [=====] - 1s 5ms/step - loss: 0.3568 - accuracy: 0.8882 - val_loss: 0.2613 - val_accuracy: 0.9338
Epoch 140/800
168/168 [=====] - 1s 5ms/step - loss: 0.3522 - accuracy: 0.8830 - val_loss: 0.2747 - val_accuracy: 0.9256
Epoch 141/800
168/168 [=====] - 1s 5ms/step - loss: 0.3405 - accuracy: 0.8891 - val_loss: 0.2698 - val_accuracy: 0.9211
Epoch 142/800
168/168 [=====] - 1s 4ms/step - loss: 0.3535 - accuracy: 0.8901 - val_loss: 0.2920 - val_accuracy: 0.9092
Epoch 143/800
168/168 [=====] - 1s 4ms/step - loss: 0.3517 - accuracy: 0.8824 - val_loss: 0.2961 - val_accuracy: 0.9122
Epoch 144/800
168/168 [=====] - 1s 4ms/step - loss: 0.3299 - accuracy: 0.8962 - val_loss: 0.2623 - val_accuracy: 0.9293
Epoch 145/800
168/168 [=====] - 1s 4ms/step - loss: 0.3273 - accuracy: 0.8929 - val_loss: 0.2448 - val_accuracy: 0.9323
Epoch 146/800
168/168 [=====] - 1s 5ms/step - loss: 0.3300 - accuracy: 0.8955 - val_loss: 0.2939 - val_accuracy: 0.9100
Epoch 147/800
168/168 [=====] - 1s 4ms/step - loss: 0.3331 - accuracy: 0.8930 - val_loss: 0.2848 - val_accuracy: 0.9070
Epoch 148/800
168/168 [=====] - 1s 4ms/step - loss: 0.3235 - accuracy: 0.8981 - val_loss: 0.2991 - val_accuracy: 0.9048
Epoch 149/800
168/168 [=====] - 1s 5ms/step - loss: 0.3419 - accuracy: 0.8880 - val_loss: 0.2526 - val_accuracy: 0.9338
Epoch 150/800
168/168 [=====] - 2s 11ms/step - loss: 0.3362 - accuracy: 0.8930 - val_loss: 0.2684 - val_accuracy: 0.9182
Epoch 151/800
168/168 [=====] - 1s 5ms/step - loss: 0.3458 - accuracy: 0.8923 - val_loss: 0.2517 - val_accuracy: 0.9286
Epoch 152/800
168/168 [=====] - 1s 5ms/step - loss: 0.3147 - accuracy: 0.8988 - val_loss: 0.2611 - val_accuracy: 0.9219
Epoch 153/800
168/168 [=====] - 1s 5ms/step - loss: 0.3281 - accuracy: 0.8962 - val_loss: 0.3058 - val_accuracy: 0.9077
Epoch 154/800
168/168 [=====] - 1s 4ms/step - loss: 0.3222 - accuracy: 0.8940 - val_loss: 0.2863 - val_accuracy: 0.9211
Epoch 155/800
168/168 [=====] - 1s 4ms/step - loss: 0.3285 - accuracy: 0.9001 - val_loss: 0.2776 - val_accuracy: 0.9211
Epoch 156/800
168/168 [=====] - 1s 4ms/step - loss: 0.3279 - accuracy: 0.8942 - val_loss: 0.2606 - val_accuracy: 0.9256
Epoch 157/800
168/168 [=====] - 1s 4ms/step - loss: 0.3174 - accuracy: 0.8999 - val_loss: 0.2534 - val_accuracy: 0.9226
Epoch 158/800
168/168 [=====] - 1s 4ms/step - loss: 0.3090 - accuracy: 0.9029 - val_loss: 0.2603 - val_accuracy: 0.9219
Epoch 159/800
168/168 [=====] - 1s 4ms/step - loss: 0.3149 - accuracy: 0.9023 - val_loss: 0.2379 - val_accuracy: 0.9375
Epoch 160/800
168/168 [=====] - 1s 5ms/step - loss: 0.2946 - accuracy: 0.9033 - val_loss: 0.3093 - val_accuracy: 0.9115
Epoch 161/800
168/168 [=====] - 1s 5ms/step - loss: 0.3249 - accuracy: 0.8964 - val_loss: 0.2555 - val_accuracy: 0.9286
Epoch 162/800
168/168 [=====] - 1s 4ms/step - loss: 0.3243 - accuracy: 0.9042 - val_loss: 0.3449 - val_accuracy: 0.8973
Epoch 163/800
168/168 [=====] - 1s 5ms/step - loss: 0.3126 - accuracy: 0.9009 - val_loss: 0.2299 - val_accuracy: 0.9368
Epoch 164/800
168/168 [=====] - 1s 5ms/step - loss: 0.3074 - accuracy: 0.9025 - val_loss: 0.2427 - val_accuracy: 0.9241
Epoch 165/800
168/168 [=====] - 1s 5ms/step - loss: 0.3049 - accuracy: 0.9022 - val_loss: 0.2347 - val_accuracy:

y: 0.9249
Epoch 166/800
168/168 [=====] - 1s 5ms/step - loss: 0.2921 - accuracy: 0.9111 - val_loss: 0.2639 - val_accuracy: 0.9219
y: 0.9219
Epoch 167/800
168/168 [=====] - 1s 4ms/step - loss: 0.3386 - accuracy: 0.8960 - val_loss: 0.3042 - val_accuracy: 0.9070
y: 0.9070
Epoch 168/800
168/168 [=====] - 1s 5ms/step - loss: 0.3124 - accuracy: 0.8977 - val_loss: 0.2641 - val_accuracy: 0.9241
y: 0.9241
Epoch 169/800
168/168 [=====] - 1s 5ms/step - loss: 0.2858 - accuracy: 0.9068 - val_loss: 0.2322 - val_accuracy: 0.9390
y: 0.9390
Epoch 170/800
168/168 [=====] - 1s 5ms/step - loss: 0.2902 - accuracy: 0.9066 - val_loss: 0.2512 - val_accuracy: 0.9315
y: 0.9315
Epoch 171/800
168/168 [=====] - 1s 5ms/step - loss: 0.3118 - accuracy: 0.9036 - val_loss: 0.3389 - val_accuracy: 0.9055
y: 0.9055
Epoch 172/800
168/168 [=====] - 1s 5ms/step - loss: 0.3070 - accuracy: 0.9042 - val_loss: 0.2450 - val_accuracy: 0.9360
y: 0.9360
Epoch 173/800
168/168 [=====] - 1s 4ms/step - loss: 0.3122 - accuracy: 0.8990 - val_loss: 0.2490 - val_accuracy: 0.9278
y: 0.9278
Epoch 174/800
168/168 [=====] - 1s 4ms/step - loss: 0.2987 - accuracy: 0.9029 - val_loss: 0.2367 - val_accuracy: 0.9368
y: 0.9368
Epoch 175/800
168/168 [=====] - 1s 4ms/step - loss: 0.2854 - accuracy: 0.9055 - val_loss: 0.2790 - val_accuracy: 0.9204
y: 0.9204
Epoch 176/800
168/168 [=====] - 1s 5ms/step - loss: 0.2924 - accuracy: 0.9077 - val_loss: 0.2548 - val_accuracy: 0.9271
y: 0.9271
Epoch 177/800
168/168 [=====] - 1s 5ms/step - loss: 0.2813 - accuracy: 0.9059 - val_loss: 0.2311 - val_accuracy: 0.9308
y: 0.9308
Epoch 178/800
168/168 [=====] - 1s 4ms/step - loss: 0.2903 - accuracy: 0.9020 - val_loss: 0.2312 - val_accuracy: 0.9338
y: 0.9338
Epoch 179/800
168/168 [=====] - 1s 5ms/step - loss: 0.2809 - accuracy: 0.9085 - val_loss: 0.2463 - val_accuracy: 0.9293
y: 0.9293
Epoch 180/800
168/168 [=====] - 1s 4ms/step - loss: 0.2838 - accuracy: 0.9096 - val_loss: 0.2643 - val_accuracy: 0.9249
y: 0.9249
Epoch 181/800
168/168 [=====] - 1s 4ms/step - loss: 0.2958 - accuracy: 0.9061 - val_loss: 0.2249 - val_accuracy: 0.9375
y: 0.9375
Epoch 182/800
168/168 [=====] - 1s 5ms/step - loss: 0.2831 - accuracy: 0.9074 - val_loss: 0.2450 - val_accuracy: 0.9278
y: 0.9278
Epoch 183/800
168/168 [=====] - 1s 4ms/step - loss: 0.2858 - accuracy: 0.9107 - val_loss: 0.2611 - val_accuracy: 0.9278
y: 0.9278
Epoch 184/800
168/168 [=====] - 1s 5ms/step - loss: 0.2937 - accuracy: 0.9081 - val_loss: 0.2375 - val_accuracy: 0.9397
y: 0.9397
Epoch 185/800
168/168 [=====] - 1s 5ms/step - loss: 0.2797 - accuracy: 0.9048 - val_loss: 0.2151 - val_accuracy: 0.9472
y: 0.9472
Epoch 186/800
168/168 [=====] - 1s 4ms/step - loss: 0.2788 - accuracy: 0.9144 - val_loss: 0.2462 - val_accuracy: 0.9338
y: 0.9338
Epoch 187/800
168/168 [=====] - 1s 5ms/step - loss: 0.2816 - accuracy: 0.9085 - val_loss: 0.2585 - val_accuracy: 0.9249
y: 0.9249
Epoch 188/800
168/168 [=====] - 2s 11ms/step - loss: 0.2946 - accuracy: 0.9087 - val_loss: 0.2260 - val_accuracy: 0.9382
y: 0.9382
Epoch 189/800
168/168 [=====] - 1s 4ms/step - loss: 0.2810 - accuracy: 0.9116 - val_loss: 0.2215 - val_accuracy: 0.9397
y: 0.9397
Epoch 190/800
168/168 [=====] - 1s 5ms/step - loss: 0.2931 - accuracy: 0.9072 - val_loss: 0.2365 - val_accuracy: 0.9345
y: 0.9345
Epoch 191/800
168/168 [=====] - 1s 5ms/step - loss: 0.2750 - accuracy: 0.9133 - val_loss: 0.2283 - val_accuracy: 0.9412
y: 0.9412
Epoch 192/800
168/168 [=====] - 1s 4ms/step - loss: 0.2770 - accuracy: 0.9094 - val_loss: 0.2360 - val_accuracy: 0.9375
y: 0.9375
Epoch 193/800
168/168 [=====] - 1s 4ms/step - loss: 0.2835 - accuracy: 0.9068 - val_loss: 0.2375 - val_accuracy: 0.9353
y: 0.9353
Epoch 194/800
168/168 [=====] - 1s 5ms/step - loss: 0.2763 - accuracy: 0.9141 - val_loss: 0.2374 - val_accuracy: 0.9308
y: 0.9308
Epoch 195/800
168/168 [=====] - 1s 4ms/step - loss: 0.2677 - accuracy: 0.9126 - val_loss: 0.2314 - val_accuracy: 0.9397
y: 0.9397
Epoch 196/800
168/168 [=====] - 1s 5ms/step - loss: 0.2704 - accuracy: 0.9178 - val_loss: 0.2300 - val_accuracy: 0.9353
y: 0.9353
Epoch 197/800

168/168 [=====] - 1s 4ms/step - loss: 0.2771 - accuracy: 0.9122 - val_loss: 0.2229 - val_accuracy: 0.9368
Epoch 198/800
168/168 [=====] - 1s 5ms/step - loss: 0.2726 - accuracy: 0.9126 - val_loss: 0.2458 - val_accuracy: 0.9375
Epoch 199/800
168/168 [=====] - 1s 5ms/step - loss: 0.2662 - accuracy: 0.9144 - val_loss: 0.2322 - val_accuracy: 0.9420
Epoch 200/800
168/168 [=====] - 1s 4ms/step - loss: 0.2839 - accuracy: 0.9126 - val_loss: 0.2101 - val_accuracy: 0.9457
Epoch 201/800
168/168 [=====] - 1s 4ms/step - loss: 0.2557 - accuracy: 0.9195 - val_loss: 0.2345 - val_accuracy: 0.9435
Epoch 202/800
168/168 [=====] - 1s 5ms/step - loss: 0.2739 - accuracy: 0.9142 - val_loss: 0.2645 - val_accuracy: 0.9211
Epoch 203/800
168/168 [=====] - 1s 4ms/step - loss: 0.2430 - accuracy: 0.9185 - val_loss: 0.2740 - val_accuracy: 0.9278
Epoch 204/800
168/168 [=====] - 1s 5ms/step - loss: 0.2595 - accuracy: 0.9152 - val_loss: 0.2455 - val_accuracy: 0.9405
Epoch 205/800
168/168 [=====] - 1s 5ms/step - loss: 0.2522 - accuracy: 0.9150 - val_loss: 0.2336 - val_accuracy: 0.9405
Epoch 206/800
168/168 [=====] - 1s 5ms/step - loss: 0.2698 - accuracy: 0.9122 - val_loss: 0.2310 - val_accuracy: 0.9397
Epoch 207/800
168/168 [=====] - 1s 4ms/step - loss: 0.2764 - accuracy: 0.9139 - val_loss: 0.2395 - val_accuracy: 0.9293
Epoch 208/800
168/168 [=====] - 1s 5ms/step - loss: 0.2555 - accuracy: 0.9178 - val_loss: 0.2395 - val_accuracy: 0.9278
Epoch 209/800
168/168 [=====] - 1s 4ms/step - loss: 0.2439 - accuracy: 0.9204 - val_loss: 0.2445 - val_accuracy: 0.9338
Epoch 210/800
168/168 [=====] - 1s 4ms/step - loss: 0.2801 - accuracy: 0.9129 - val_loss: 0.2172 - val_accuracy: 0.9420
Epoch 211/800
168/168 [=====] - 1s 4ms/step - loss: 0.2521 - accuracy: 0.9187 - val_loss: 0.2130 - val_accuracy: 0.9420
Epoch 212/800
168/168 [=====] - 1s 4ms/step - loss: 0.2642 - accuracy: 0.9232 - val_loss: 0.2231 - val_accuracy: 0.9397
Epoch 213/800
168/168 [=====] - 1s 4ms/step - loss: 0.2387 - accuracy: 0.9275 - val_loss: 0.2400 - val_accuracy: 0.9323
Epoch 214/800
168/168 [=====] - 1s 4ms/step - loss: 0.2946 - accuracy: 0.9139 - val_loss: 0.2276 - val_accuracy: 0.9375
Epoch 215/800
168/168 [=====] - 1s 4ms/step - loss: 0.2484 - accuracy: 0.9213 - val_loss: 0.2137 - val_accuracy: 0.9427
Epoch 216/800
168/168 [=====] - 1s 5ms/step - loss: 0.2400 - accuracy: 0.9221 - val_loss: 0.2255 - val_accuracy: 0.9420
Epoch 217/800
168/168 [=====] - 1s 4ms/step - loss: 0.2617 - accuracy: 0.9169 - val_loss: 0.2150 - val_accuracy: 0.9435
Epoch 218/800
168/168 [=====] - 1s 4ms/step - loss: 0.2450 - accuracy: 0.9243 - val_loss: 0.2227 - val_accuracy: 0.9390
Epoch 219/800
168/168 [=====] - 1s 5ms/step - loss: 0.2531 - accuracy: 0.9200 - val_loss: 0.2039 - val_accuracy: 0.9457
Epoch 220/800
168/168 [=====] - 1s 5ms/step - loss: 0.2449 - accuracy: 0.9226 - val_loss: 0.2164 - val_accuracy: 0.9420
Epoch 221/800
168/168 [=====] - 1s 4ms/step - loss: 0.2633 - accuracy: 0.9232 - val_loss: 0.2379 - val_accuracy: 0.9390
Epoch 222/800
168/168 [=====] - 1s 4ms/step - loss: 0.2467 - accuracy: 0.9226 - val_loss: 0.2272 - val_accuracy: 0.9435
Epoch 223/800
168/168 [=====] - 1s 4ms/step - loss: 0.2580 - accuracy: 0.9206 - val_loss: 0.2673 - val_accuracy: 0.9301
Epoch 224/800
168/168 [=====] - 1s 4ms/step - loss: 0.2557 - accuracy: 0.9237 - val_loss: 0.2265 - val_accuracy: 0.9345
Epoch 225/800
168/168 [=====] - 2s 11ms/step - loss: 0.2370 - accuracy: 0.9195 - val_loss: 0.2174 - val_accuracy: 0.9457
Epoch 226/800
168/168 [=====] - 1s 5ms/step - loss: 0.2447 - accuracy: 0.9209 - val_loss: 0.2111 - val_accuracy: 0.9397
Epoch 227/800
168/168 [=====] - 1s 5ms/step - loss: 0.2475 - accuracy: 0.9232 - val_loss: 0.2217 - val_accuracy: 0.9390
Epoch 228/800
168/168 [=====] - 1s 5ms/step - loss: 0.2327 - accuracy: 0.9273 - val_loss: 0.2223 - val_accuracy: 0.9449

Epoch 229/800
168/168 [=====] - 1s 5ms/step - loss: 0.2481 - accuracy: 0.9219 - val_loss: 0.2786 - val_accuracy: 0.9286
Epoch 230/800
168/168 [=====] - 1s 4ms/step - loss: 0.2363 - accuracy: 0.9249 - val_loss: 0.2384 - val_accuracy: 0.9323
Epoch 231/800
168/168 [=====] - 1s 4ms/step - loss: 0.2444 - accuracy: 0.9230 - val_loss: 0.2273 - val_accuracy: 0.9442
Epoch 232/800
168/168 [=====] - 1s 4ms/step - loss: 0.2359 - accuracy: 0.9211 - val_loss: 0.2142 - val_accuracy: 0.9479
Epoch 233/800
168/168 [=====] - 1s 4ms/step - loss: 0.2225 - accuracy: 0.9289 - val_loss: 0.2141 - val_accuracy: 0.9449
Epoch 234/800
168/168 [=====] - 1s 4ms/step - loss: 0.2371 - accuracy: 0.9263 - val_loss: 0.2115 - val_accuracy: 0.9449
Epoch 235/800
168/168 [=====] - 1s 4ms/step - loss: 0.2216 - accuracy: 0.9310 - val_loss: 0.2057 - val_accuracy: 0.9435
Epoch 236/800
168/168 [=====] - 1s 5ms/step - loss: 0.2317 - accuracy: 0.9234 - val_loss: 0.2079 - val_accuracy: 0.9427
Epoch 237/800
168/168 [=====] - 1s 5ms/step - loss: 0.2500 - accuracy: 0.9196 - val_loss: 0.2210 - val_accuracy: 0.9390
Epoch 238/800
168/168 [=====] - 1s 4ms/step - loss: 0.2461 - accuracy: 0.9243 - val_loss: 0.2260 - val_accuracy: 0.9397
Epoch 239/800
168/168 [=====] - 1s 5ms/step - loss: 0.2127 - accuracy: 0.9293 - val_loss: 0.2304 - val_accuracy: 0.9397
Epoch 240/800
168/168 [=====] - 1s 5ms/step - loss: 0.2395 - accuracy: 0.9258 - val_loss: 0.2278 - val_accuracy: 0.9397
Epoch 241/800
168/168 [=====] - 1s 4ms/step - loss: 0.2439 - accuracy: 0.9228 - val_loss: 0.1928 - val_accuracy: 0.9487
Epoch 242/800
168/168 [=====] - 1s 5ms/step - loss: 0.2351 - accuracy: 0.9282 - val_loss: 0.1842 - val_accuracy: 0.9546
Epoch 243/800
168/168 [=====] - 1s 4ms/step - loss: 0.2268 - accuracy: 0.9265 - val_loss: 0.2151 - val_accuracy: 0.9442
Epoch 244/800
168/168 [=====] - 1s 6ms/step - loss: 0.2366 - accuracy: 0.9284 - val_loss: 0.1928 - val_accuracy: 0.9449
Epoch 245/800
168/168 [=====] - 1s 5ms/step - loss: 0.2396 - accuracy: 0.9269 - val_loss: 0.2343 - val_accuracy: 0.9375
Epoch 246/800
168/168 [=====] - 1s 5ms/step - loss: 0.2391 - accuracy: 0.9249 - val_loss: 0.2062 - val_accuracy: 0.9457
Epoch 247/800
168/168 [=====] - 1s 5ms/step - loss: 0.2424 - accuracy: 0.9196 - val_loss: 0.2158 - val_accuracy: 0.9464
Epoch 248/800
168/168 [=====] - 1s 5ms/step - loss: 0.2472 - accuracy: 0.9243 - val_loss: 0.2189 - val_accuracy: 0.9435
Epoch 249/800
168/168 [=====] - 1s 5ms/step - loss: 0.2183 - accuracy: 0.9278 - val_loss: 0.2032 - val_accuracy: 0.9479
Epoch 250/800
168/168 [=====] - 1s 4ms/step - loss: 0.2302 - accuracy: 0.9301 - val_loss: 0.2051 - val_accuracy: 0.9516
Epoch 251/800
168/168 [=====] - 1s 5ms/step - loss: 0.2416 - accuracy: 0.9226 - val_loss: 0.2127 - val_accuracy: 0.9472
Epoch 252/800
168/168 [=====] - 1s 4ms/step - loss: 0.2236 - accuracy: 0.9258 - val_loss: 0.2067 - val_accuracy: 0.9449
Epoch 253/800
168/168 [=====] - 1s 5ms/step - loss: 0.2173 - accuracy: 0.9312 - val_loss: 0.2043 - val_accuracy: 0.9472
Epoch 254/800
168/168 [=====] - 1s 4ms/step - loss: 0.2346 - accuracy: 0.9297 - val_loss: 0.2405 - val_accuracy: 0.9368
Epoch 255/800
168/168 [=====] - 1s 4ms/step - loss: 0.2094 - accuracy: 0.9334 - val_loss: 0.2048 - val_accuracy: 0.9494
Epoch 256/800
168/168 [=====] - 1s 5ms/step - loss: 0.2267 - accuracy: 0.9276 - val_loss: 0.2199 - val_accuracy: 0.9405
Epoch 257/800
168/168 [=====] - 1s 5ms/step - loss: 0.2196 - accuracy: 0.9342 - val_loss: 0.2101 - val_accuracy: 0.9464
Epoch 258/800
168/168 [=====] - 1s 4ms/step - loss: 0.2327 - accuracy: 0.9280 - val_loss: 0.2069 - val_accuracy: 0.9435
Epoch 259/800
168/168 [=====] - 1s 5ms/step - loss: 0.2280 - accuracy: 0.9302 - val_loss: 0.2028 - val_accuracy: 0.9509
Epoch 260/800
168/168 [=====] - 1s 4ms/step - loss: 0.2233 - accuracy: 0.9252 - val_loss: 0.1986 - val_accuracy:

y: 0.9516
Epoch 261/800
168/168 [=====] - 1s 4ms/step - loss: 0.2359 - accuracy: 0.9245 - val_loss: 0.1857 - val_accuracy: 0.9516
Epoch 262/800
168/168 [=====] - 2s 11ms/step - loss: 0.2154 - accuracy: 0.9343 - val_loss: 0.2211 - val_accuracy: 0.9412
Epoch 263/800
168/168 [=====] - 1s 4ms/step - loss: 0.2101 - accuracy: 0.9308 - val_loss: 0.2236 - val_accuracy: 0.9464
Epoch 264/800
168/168 [=====] - 1s 5ms/step - loss: 0.2228 - accuracy: 0.9301 - val_loss: 0.2291 - val_accuracy: 0.9427
Epoch 265/800
168/168 [=====] - 1s 4ms/step - loss: 0.2274 - accuracy: 0.9280 - val_loss: 0.2010 - val_accuracy: 0.9494
Epoch 266/800
168/168 [=====] - 1s 4ms/step - loss: 0.2062 - accuracy: 0.9343 - val_loss: 0.1974 - val_accuracy: 0.9531
Epoch 267/800
168/168 [=====] - 1s 5ms/step - loss: 0.2188 - accuracy: 0.9314 - val_loss: 0.2756 - val_accuracy: 0.9278
Epoch 268/800
168/168 [=====] - 1s 4ms/step - loss: 0.2147 - accuracy: 0.9319 - val_loss: 0.2155 - val_accuracy: 0.9442
Epoch 269/800
168/168 [=====] - 1s 5ms/step - loss: 0.2246 - accuracy: 0.9284 - val_loss: 0.2330 - val_accuracy: 0.9368
Epoch 270/800
168/168 [=====] - 1s 5ms/step - loss: 0.2214 - accuracy: 0.9276 - val_loss: 0.2293 - val_accuracy: 0.9390
Epoch 271/800
168/168 [=====] - 1s 5ms/step - loss: 0.2338 - accuracy: 0.9263 - val_loss: 0.2133 - val_accuracy: 0.9464
Epoch 272/800
168/168 [=====] - 1s 5ms/step - loss: 0.2237 - accuracy: 0.9308 - val_loss: 0.2123 - val_accuracy: 0.9501
Epoch 273/800
168/168 [=====] - 1s 5ms/step - loss: 0.2130 - accuracy: 0.9323 - val_loss: 0.2135 - val_accuracy: 0.9501
Epoch 274/800
168/168 [=====] - 1s 4ms/step - loss: 0.2046 - accuracy: 0.9325 - val_loss: 0.2159 - val_accuracy: 0.9472
Epoch 275/800
168/168 [=====] - 1s 4ms/step - loss: 0.2109 - accuracy: 0.9312 - val_loss: 0.2333 - val_accuracy: 0.9390
Epoch 276/800
168/168 [=====] - 1s 4ms/step - loss: 0.2428 - accuracy: 0.9187 - val_loss: 0.2246 - val_accuracy: 0.9420
Epoch 277/800
168/168 [=====] - 1s 4ms/step - loss: 0.2278 - accuracy: 0.9271 - val_loss: 0.2151 - val_accuracy: 0.9487
Epoch 278/800
168/168 [=====] - 1s 4ms/step - loss: 0.2100 - accuracy: 0.9338 - val_loss: 0.2076 - val_accuracy: 0.9501
Epoch 279/800
168/168 [=====] - 1s 5ms/step - loss: 0.2086 - accuracy: 0.9302 - val_loss: 0.1984 - val_accuracy: 0.9539
Epoch 280/800
168/168 [=====] - 1s 5ms/step - loss: 0.2296 - accuracy: 0.9265 - val_loss: 0.2098 - val_accuracy: 0.9479
Epoch 281/800
168/168 [=====] - 1s 5ms/step - loss: 0.2199 - accuracy: 0.9304 - val_loss: 0.2254 - val_accuracy: 0.9405
Epoch 282/800
168/168 [=====] - 1s 5ms/step - loss: 0.2181 - accuracy: 0.9312 - val_loss: 0.1869 - val_accuracy: 0.9516
Epoch 283/800
168/168 [=====] - 1s 5ms/step - loss: 0.2055 - accuracy: 0.9386 - val_loss: 0.1970 - val_accuracy: 0.9509
Epoch 284/800
168/168 [=====] - 1s 5ms/step - loss: 0.2015 - accuracy: 0.9347 - val_loss: 0.2208 - val_accuracy: 0.9494
Epoch 285/800
168/168 [=====] - 1s 4ms/step - loss: 0.2100 - accuracy: 0.9358 - val_loss: 0.2210 - val_accuracy: 0.9412
Epoch 286/800
168/168 [=====] - 1s 4ms/step - loss: 0.2109 - accuracy: 0.9323 - val_loss: 0.2059 - val_accuracy: 0.9472
Epoch 287/800
168/168 [=====] - 1s 4ms/step - loss: 0.2259 - accuracy: 0.9293 - val_loss: 0.2156 - val_accuracy: 0.9420
Epoch 288/800
168/168 [=====] - 1s 5ms/step - loss: 0.2316 - accuracy: 0.9275 - val_loss: 0.2038 - val_accuracy: 0.9442
Epoch 289/800
168/168 [=====] - 1s 4ms/step - loss: 0.2028 - accuracy: 0.9353 - val_loss: 0.2145 - val_accuracy: 0.9420
Epoch 290/800
168/168 [=====] - 1s 4ms/step - loss: 0.2020 - accuracy: 0.9308 - val_loss: 0.2124 - val_accuracy: 0.9472
Epoch 291/800
168/168 [=====] - 1s 5ms/step - loss: 0.2077 - accuracy: 0.9366 - val_loss: 0.1867 - val_accuracy: 0.9531
Epoch 292/800

168/168 [=====] - 1s 4ms/step - loss: 0.1965 - accuracy: 0.9366 - val_loss: 0.2114 - val_accuracy: 0.9516
Epoch 293/800
168/168 [=====] - 1s 5ms/step - loss: 0.2077 - accuracy: 0.9343 - val_loss: 0.2547 - val_accuracy: 0.9278
Epoch 294/800
168/168 [=====] - 1s 4ms/step - loss: 0.1966 - accuracy: 0.9377 - val_loss: 0.2079 - val_accuracy: 0.9479
Epoch 295/800
168/168 [=====] - 1s 4ms/step - loss: 0.2105 - accuracy: 0.9312 - val_loss: 0.1871 - val_accuracy: 0.9576
Epoch 296/800
168/168 [=====] - 1s 5ms/step - loss: 0.2010 - accuracy: 0.9379 - val_loss: 0.2182 - val_accuracy: 0.9390
Epoch 297/800
168/168 [=====] - 2s 11ms/step - loss: 0.2145 - accuracy: 0.9360 - val_loss: 0.2107 - val_accuracy: 0.9479
Epoch 298/800
168/168 [=====] - 1s 4ms/step - loss: 0.1994 - accuracy: 0.9381 - val_loss: 0.1860 - val_accuracy: 0.9554
Epoch 299/800
168/168 [=====] - 1s 4ms/step - loss: 0.1950 - accuracy: 0.9410 - val_loss: 0.2341 - val_accuracy: 0.9427
Epoch 300/800
168/168 [=====] - 1s 5ms/step - loss: 0.2033 - accuracy: 0.9349 - val_loss: 0.2046 - val_accuracy: 0.9501
Epoch 301/800
168/168 [=====] - 1s 4ms/step - loss: 0.2113 - accuracy: 0.9366 - val_loss: 0.2018 - val_accuracy: 0.9509
Epoch 302/800
168/168 [=====] - 1s 4ms/step - loss: 0.2148 - accuracy: 0.9327 - val_loss: 0.2005 - val_accuracy: 0.9442
Epoch 303/800
168/168 [=====] - 1s 4ms/step - loss: 0.2016 - accuracy: 0.9394 - val_loss: 0.2138 - val_accuracy: 0.9457
Epoch 304/800
168/168 [=====] - 1s 4ms/step - loss: 0.2114 - accuracy: 0.9349 - val_loss: 0.2150 - val_accuracy: 0.9524
Epoch 305/800
168/168 [=====] - 1s 5ms/step - loss: 0.1880 - accuracy: 0.9399 - val_loss: 0.2207 - val_accuracy: 0.9405
Epoch 306/800
168/168 [=====] - 1s 4ms/step - loss: 0.2028 - accuracy: 0.9338 - val_loss: 0.2322 - val_accuracy: 0.9435
Epoch 307/800
168/168 [=====] - 1s 5ms/step - loss: 0.1992 - accuracy: 0.9338 - val_loss: 0.2269 - val_accuracy: 0.9472
Epoch 308/800
168/168 [=====] - 1s 5ms/step - loss: 0.1919 - accuracy: 0.9399 - val_loss: 0.2140 - val_accuracy: 0.9412
Epoch 309/800
168/168 [=====] - 1s 4ms/step - loss: 0.2088 - accuracy: 0.9369 - val_loss: 0.2274 - val_accuracy: 0.9479
Epoch 310/800
168/168 [=====] - 1s 4ms/step - loss: 0.2032 - accuracy: 0.9355 - val_loss: 0.1990 - val_accuracy: 0.9494
Epoch 311/800
168/168 [=====] - 1s 4ms/step - loss: 0.1941 - accuracy: 0.9399 - val_loss: 0.2320 - val_accuracy: 0.9435
Epoch 312/800
168/168 [=====] - 1s 5ms/step - loss: 0.1962 - accuracy: 0.9384 - val_loss: 0.2002 - val_accuracy: 0.9464
Epoch 313/800
168/168 [=====] - 1s 5ms/step - loss: 0.2030 - accuracy: 0.9394 - val_loss: 0.2000 - val_accuracy: 0.9479
Epoch 314/800
168/168 [=====] - 1s 4ms/step - loss: 0.2051 - accuracy: 0.9345 - val_loss: 0.2052 - val_accuracy: 0.9457
Epoch 315/800
168/168 [=====] - 1s 5ms/step - loss: 0.1802 - accuracy: 0.9423 - val_loss: 0.1723 - val_accuracy: 0.9583
Epoch 316/800
168/168 [=====] - 1s 5ms/step - loss: 0.1867 - accuracy: 0.9435 - val_loss: 0.2480 - val_accuracy: 0.9368
Epoch 317/800
168/168 [=====] - 1s 4ms/step - loss: 0.1943 - accuracy: 0.9382 - val_loss: 0.1910 - val_accuracy: 0.9516
Epoch 318/800
168/168 [=====] - 1s 4ms/step - loss: 0.1854 - accuracy: 0.9427 - val_loss: 0.1844 - val_accuracy: 0.9561
Epoch 319/800
168/168 [=====] - 1s 4ms/step - loss: 0.2024 - accuracy: 0.9390 - val_loss: 0.1978 - val_accuracy: 0.9546
Epoch 320/800
168/168 [=====] - 1s 4ms/step - loss: 0.2088 - accuracy: 0.9353 - val_loss: 0.1952 - val_accuracy: 0.9524
Epoch 321/800
168/168 [=====] - 1s 5ms/step - loss: 0.1785 - accuracy: 0.9448 - val_loss: 0.2029 - val_accuracy: 0.9524
Epoch 322/800
168/168 [=====] - 1s 4ms/step - loss: 0.1867 - accuracy: 0.9392 - val_loss: 0.2006 - val_accuracy: 0.9561
Epoch 323/800
168/168 [=====] - 1s 5ms/step - loss: 0.1855 - accuracy: 0.9412 - val_loss: 0.2157 - val_accuracy: 0.9472

Epoch 324/800
168/168 [=====] - 1s 5ms/step - loss: 0.2017 - accuracy: 0.9362 - val_loss: 0.2131 - val_accuracy: 0.9494
Epoch 325/800
168/168 [=====] - 1s 5ms/step - loss: 0.1844 - accuracy: 0.9431 - val_loss: 0.2072 - val_accuracy: 0.9516
Epoch 326/800
168/168 [=====] - 1s 5ms/step - loss: 0.1962 - accuracy: 0.9360 - val_loss: 0.1939 - val_accuracy: 0.9583
Epoch 327/800
168/168 [=====] - 1s 4ms/step - loss: 0.1922 - accuracy: 0.9401 - val_loss: 0.2067 - val_accuracy: 0.9524
Epoch 328/800
168/168 [=====] - 1s 4ms/step - loss: 0.1893 - accuracy: 0.9422 - val_loss: 0.2023 - val_accuracy: 0.9546
Epoch 329/800
168/168 [=====] - 1s 4ms/step - loss: 0.1791 - accuracy: 0.9449 - val_loss: 0.2092 - val_accuracy: 0.9516
Epoch 330/800
168/168 [=====] - 1s 4ms/step - loss: 0.1943 - accuracy: 0.9407 - val_loss: 0.2118 - val_accuracy: 0.9487
Epoch 331/800
168/168 [=====] - 1s 5ms/step - loss: 0.2044 - accuracy: 0.9349 - val_loss: 0.2299 - val_accuracy: 0.9412
Epoch 332/800
168/168 [=====] - 1s 5ms/step - loss: 0.1835 - accuracy: 0.9422 - val_loss: 0.1991 - val_accuracy: 0.9554
Epoch 333/800
168/168 [=====] - 1s 5ms/step - loss: 0.1944 - accuracy: 0.9382 - val_loss: 0.2261 - val_accuracy: 0.9472
Epoch 334/800
168/168 [=====] - 2s 11ms/step - loss: 0.1735 - accuracy: 0.9431 - val_loss: 0.2322 - val_accuracy: 0.9405
Epoch 335/800
168/168 [=====] - 1s 4ms/step - loss: 0.1987 - accuracy: 0.9371 - val_loss: 0.2040 - val_accuracy: 0.9509
Epoch 336/800
168/168 [=====] - 1s 5ms/step - loss: 0.1864 - accuracy: 0.9422 - val_loss: 0.2134 - val_accuracy: 0.9449
Epoch 337/800
168/168 [=====] - 1s 5ms/step - loss: 0.1943 - accuracy: 0.9384 - val_loss: 0.2001 - val_accuracy: 0.9524
Epoch 338/800
168/168 [=====] - 1s 4ms/step - loss: 0.1977 - accuracy: 0.9403 - val_loss: 0.1930 - val_accuracy: 0.9494
Epoch 339/800
168/168 [=====] - 1s 5ms/step - loss: 0.1938 - accuracy: 0.9412 - val_loss: 0.1875 - val_accuracy: 0.9472
Epoch 340/800
168/168 [=====] - 1s 4ms/step - loss: 0.1665 - accuracy: 0.9466 - val_loss: 0.2360 - val_accuracy: 0.9330
Epoch 341/800
168/168 [=====] - 1s 4ms/step - loss: 0.1842 - accuracy: 0.9449 - val_loss: 0.2093 - val_accuracy: 0.9472
Epoch 342/800
168/168 [=====] - 1s 5ms/step - loss: 0.1857 - accuracy: 0.9397 - val_loss: 0.2045 - val_accuracy: 0.9501
Epoch 343/800
168/168 [=====] - 1s 4ms/step - loss: 0.1619 - accuracy: 0.9518 - val_loss: 0.2449 - val_accuracy: 0.9464
Epoch 344/800
168/168 [=====] - 1s 5ms/step - loss: 0.1734 - accuracy: 0.9457 - val_loss: 0.1949 - val_accuracy: 0.9509
Epoch 345/800
168/168 [=====] - 1s 4ms/step - loss: 0.1751 - accuracy: 0.9436 - val_loss: 0.1843 - val_accuracy: 0.9531
Epoch 346/800
168/168 [=====] - 1s 5ms/step - loss: 0.1683 - accuracy: 0.9474 - val_loss: 0.2142 - val_accuracy: 0.9531
Epoch 347/800
168/168 [=====] - 1s 5ms/step - loss: 0.1709 - accuracy: 0.9438 - val_loss: 0.2009 - val_accuracy: 0.9554
Epoch 348/800
168/168 [=====] - 1s 4ms/step - loss: 0.1778 - accuracy: 0.9433 - val_loss: 0.1889 - val_accuracy: 0.9524
Epoch 349/800
168/168 [=====] - 1s 4ms/step - loss: 0.1810 - accuracy: 0.9455 - val_loss: 0.2068 - val_accuracy: 0.9501
Epoch 350/800
168/168 [=====] - 1s 5ms/step - loss: 0.1837 - accuracy: 0.9468 - val_loss: 0.2130 - val_accuracy: 0.9449
Epoch 351/800
168/168 [=====] - 1s 4ms/step - loss: 0.2052 - accuracy: 0.9371 - val_loss: 0.1940 - val_accuracy: 0.9472
Epoch 352/800
168/168 [=====] - 1s 5ms/step - loss: 0.1884 - accuracy: 0.9397 - val_loss: 0.2105 - val_accuracy: 0.9509
Epoch 353/800
168/168 [=====] - 1s 4ms/step - loss: 0.1863 - accuracy: 0.9390 - val_loss: 0.1835 - val_accuracy: 0.9539
Epoch 354/800
168/168 [=====] - 1s 4ms/step - loss: 0.1760 - accuracy: 0.9464 - val_loss: 0.1941 - val_accuracy: 0.9539
Epoch 355/800
168/168 [=====] - 1s 4ms/step - loss: 0.1545 - accuracy: 0.9511 - val_loss: 0.2222 - val_accuracy:

y: 0.9516
Epoch 356/800
168/168 [=====] - 1s 4ms/step - loss: 0.1806 - accuracy: 0.9438 - val_loss: 0.1949 - val_accuracy: 0.9576
y: 0.9576
Epoch 357/800
168/168 [=====] - 1s 4ms/step - loss: 0.1840 - accuracy: 0.9399 - val_loss: 0.2705 - val_accuracy: 0.9286
y: 0.9286
Epoch 358/800
168/168 [=====] - 1s 4ms/step - loss: 0.1695 - accuracy: 0.9461 - val_loss: 0.1936 - val_accuracy: 0.9524
y: 0.9524
Epoch 359/800
168/168 [=====] - 1s 4ms/step - loss: 0.1746 - accuracy: 0.9477 - val_loss: 0.2187 - val_accuracy: 0.9487
y: 0.9487
Epoch 360/800
168/168 [=====] - 1s 5ms/step - loss: 0.1786 - accuracy: 0.9451 - val_loss: 0.1769 - val_accuracy: 0.9628
y: 0.9628
Epoch 361/800
168/168 [=====] - 1s 4ms/step - loss: 0.1754 - accuracy: 0.9487 - val_loss: 0.1922 - val_accuracy: 0.9591
y: 0.9591
Epoch 362/800
168/168 [=====] - 1s 4ms/step - loss: 0.1762 - accuracy: 0.9446 - val_loss: 0.1851 - val_accuracy: 0.9554
y: 0.9554
Epoch 363/800
168/168 [=====] - 1s 4ms/step - loss: 0.1739 - accuracy: 0.9453 - val_loss: 0.1811 - val_accuracy: 0.9554
y: 0.9554
Epoch 364/800
168/168 [=====] - 1s 4ms/step - loss: 0.1719 - accuracy: 0.9475 - val_loss: 0.1849 - val_accuracy: 0.9546
y: 0.9546
Epoch 365/800
168/168 [=====] - 1s 5ms/step - loss: 0.1621 - accuracy: 0.9488 - val_loss: 0.2032 - val_accuracy: 0.9554
y: 0.9554
Epoch 366/800
168/168 [=====] - 1s 5ms/step - loss: 0.1808 - accuracy: 0.9427 - val_loss: 0.2481 - val_accuracy: 0.9345
y: 0.9345
Epoch 367/800
168/168 [=====] - 1s 5ms/step - loss: 0.1697 - accuracy: 0.9470 - val_loss: 0.1861 - val_accuracy: 0.9583
y: 0.9583
Epoch 368/800
168/168 [=====] - 1s 4ms/step - loss: 0.1873 - accuracy: 0.9429 - val_loss: 0.1926 - val_accuracy: 0.9546
y: 0.9546
Epoch 369/800
168/168 [=====] - 1s 4ms/step - loss: 0.1736 - accuracy: 0.9433 - val_loss: 0.2054 - val_accuracy: 0.9531
y: 0.9531
Epoch 370/800
168/168 [=====] - 1s 5ms/step - loss: 0.1786 - accuracy: 0.9429 - val_loss: 0.2053 - val_accuracy: 0.9546
y: 0.9546
Epoch 371/800
168/168 [=====] - 1s 4ms/step - loss: 0.1991 - accuracy: 0.9407 - val_loss: 0.2201 - val_accuracy: 0.9412
y: 0.9412
Epoch 372/800
168/168 [=====] - 1s 5ms/step - loss: 0.1763 - accuracy: 0.9479 - val_loss: 0.2087 - val_accuracy: 0.9509
y: 0.9509
Epoch 373/800
168/168 [=====] - 1s 5ms/step - loss: 0.1739 - accuracy: 0.9475 - val_loss: 0.1914 - val_accuracy: 0.9531
y: 0.9531
Epoch 374/800
168/168 [=====] - 1s 4ms/step - loss: 0.1768 - accuracy: 0.9448 - val_loss: 0.1936 - val_accuracy: 0.9606
y: 0.9606
Epoch 375/800
168/168 [=====] - 2s 11ms/step - loss: 0.1612 - accuracy: 0.9490 - val_loss: 0.1965 - val_accuracy: 0.9487
y: 0.9487
Epoch 376/800
168/168 [=====] - 1s 4ms/step - loss: 0.1737 - accuracy: 0.9462 - val_loss: 0.1986 - val_accuracy: 0.9494
y: 0.9494
Epoch 377/800
168/168 [=====] - 1s 5ms/step - loss: 0.1759 - accuracy: 0.9459 - val_loss: 0.1822 - val_accuracy: 0.9561
y: 0.9561
Epoch 378/800
168/168 [=====] - 1s 5ms/step - loss: 0.1710 - accuracy: 0.9479 - val_loss: 0.1747 - val_accuracy: 0.9591
y: 0.9591
Epoch 379/800
168/168 [=====] - 1s 4ms/step - loss: 0.1584 - accuracy: 0.9485 - val_loss: 0.1796 - val_accuracy: 0.9576
y: 0.9576
Epoch 380/800
168/168 [=====] - 1s 4ms/step - loss: 0.1566 - accuracy: 0.9533 - val_loss: 0.1749 - val_accuracy: 0.9576
y: 0.9576
Epoch 381/800
168/168 [=====] - 1s 4ms/step - loss: 0.1759 - accuracy: 0.9479 - val_loss: 0.1774 - val_accuracy: 0.9621
y: 0.9621
Epoch 382/800
168/168 [=====] - 1s 4ms/step - loss: 0.1682 - accuracy: 0.9446 - val_loss: 0.1837 - val_accuracy: 0.9561
y: 0.9561
Epoch 383/800
168/168 [=====] - 1s 5ms/step - loss: 0.1793 - accuracy: 0.9410 - val_loss: 0.1878 - val_accuracy: 0.9583
y: 0.9583
Epoch 384/800
168/168 [=====] - 1s 4ms/step - loss: 0.1754 - accuracy: 0.9477 - val_loss: 0.1911 - val_accuracy: 0.9561
y: 0.9561
Epoch 385/800
168/168 [=====] - 1s 4ms/step - loss: 0.1656 - accuracy: 0.9481 - val_loss: 0.1886 - val_accuracy: 0.9568
y: 0.9568
Epoch 386/800
168/168 [=====] - 1s 5ms/step - loss: 0.1618 - accuracy: 0.9496 - val_loss: 0.1831 - val_accuracy: 0.9606
y: 0.9606
Epoch 387/800

168/168 [=====] - 1s 5ms/step - loss: 0.1568 - accuracy: 0.9472 - val_loss: 0.2037 - val_accuracy: 0.9539
Epoch 388/800
168/168 [=====] - 1s 5ms/step - loss: 0.1757 - accuracy: 0.9470 - val_loss: 0.2017 - val_accuracy: 0.9494
Epoch 389/800
168/168 [=====] - 1s 4ms/step - loss: 0.1927 - accuracy: 0.9403 - val_loss: 0.1920 - val_accuracy: 0.9591
Epoch 390/800
168/168 [=====] - 1s 5ms/step - loss: 0.1755 - accuracy: 0.9457 - val_loss: 0.1907 - val_accuracy: 0.9554
Epoch 391/800
168/168 [=====] - 1s 4ms/step - loss: 0.1697 - accuracy: 0.9451 - val_loss: 0.1961 - val_accuracy: 0.9561
Epoch 392/800
168/168 [=====] - 1s 4ms/step - loss: 0.1616 - accuracy: 0.9477 - val_loss: 0.2052 - val_accuracy: 0.9516
Epoch 393/800
168/168 [=====] - 1s 4ms/step - loss: 0.1863 - accuracy: 0.9375 - val_loss: 0.1812 - val_accuracy: 0.9568
Epoch 394/800
168/168 [=====] - 1s 4ms/step - loss: 0.1828 - accuracy: 0.9423 - val_loss: 0.1827 - val_accuracy: 0.9561
Epoch 395/800
168/168 [=====] - 1s 4ms/step - loss: 0.1710 - accuracy: 0.9487 - val_loss: 0.1992 - val_accuracy: 0.9516
Epoch 396/800
168/168 [=====] - 1s 5ms/step - loss: 0.1539 - accuracy: 0.9477 - val_loss: 0.1978 - val_accuracy: 0.9524
Epoch 397/800
168/168 [=====] - 1s 4ms/step - loss: 0.1532 - accuracy: 0.9524 - val_loss: 0.1964 - val_accuracy: 0.9576
Epoch 398/800
168/168 [=====] - 1s 4ms/step - loss: 0.1500 - accuracy: 0.9522 - val_loss: 0.1882 - val_accuracy: 0.9583
Epoch 399/800
168/168 [=====] - 1s 4ms/step - loss: 0.1752 - accuracy: 0.9481 - val_loss: 0.2068 - val_accuracy: 0.9561
Epoch 400/800
168/168 [=====] - 1s 4ms/step - loss: 0.1763 - accuracy: 0.9464 - val_loss: 0.1860 - val_accuracy: 0.9576
Epoch 401/800
168/168 [=====] - 1s 4ms/step - loss: 0.1676 - accuracy: 0.9455 - val_loss: 0.1799 - val_accuracy: 0.9606
Epoch 402/800
168/168 [=====] - 1s 5ms/step - loss: 0.1543 - accuracy: 0.9533 - val_loss: 0.1953 - val_accuracy: 0.9591
Epoch 403/800
168/168 [=====] - 1s 4ms/step - loss: 0.1628 - accuracy: 0.9479 - val_loss: 0.1860 - val_accuracy: 0.9628
Epoch 404/800
168/168 [=====] - 1s 5ms/step - loss: 0.1645 - accuracy: 0.9468 - val_loss: 0.1982 - val_accuracy: 0.9606
Epoch 405/800
168/168 [=====] - 1s 4ms/step - loss: 0.1623 - accuracy: 0.9496 - val_loss: 0.2205 - val_accuracy: 0.9516
Epoch 406/800
168/168 [=====] - 1s 4ms/step - loss: 0.1598 - accuracy: 0.9509 - val_loss: 0.1850 - val_accuracy: 0.9621
Epoch 407/800
168/168 [=====] - 1s 4ms/step - loss: 0.1567 - accuracy: 0.9511 - val_loss: 0.3575 - val_accuracy: 0.9070
Epoch 408/800
168/168 [=====] - 1s 4ms/step - loss: 0.1781 - accuracy: 0.9461 - val_loss: 0.1819 - val_accuracy: 0.9635
Epoch 409/800
168/168 [=====] - 1s 4ms/step - loss: 0.1629 - accuracy: 0.9494 - val_loss: 0.1796 - val_accuracy: 0.9606
Epoch 410/800
168/168 [=====] - 1s 5ms/step - loss: 0.1666 - accuracy: 0.9468 - val_loss: 0.2274 - val_accuracy: 0.9464
Epoch 411/800
168/168 [=====] - 1s 4ms/step - loss: 0.1700 - accuracy: 0.9475 - val_loss: 0.1816 - val_accuracy: 0.9583
Epoch 412/800
168/168 [=====] - 1s 5ms/step - loss: 0.1588 - accuracy: 0.9507 - val_loss: 0.2081 - val_accuracy: 0.9568
Epoch 413/800
168/168 [=====] - 1s 5ms/step - loss: 0.1685 - accuracy: 0.9483 - val_loss: 0.1808 - val_accuracy: 0.9576
Epoch 414/800
168/168 [=====] - 2s 11ms/step - loss: 0.1876 - accuracy: 0.9448 - val_loss: 0.2000 - val_accuracy: 0.9561
Epoch 415/800
168/168 [=====] - 1s 5ms/step - loss: 0.1659 - accuracy: 0.9490 - val_loss: 0.1769 - val_accuracy: 0.9606
Epoch 416/800
168/168 [=====] - 1s 4ms/step - loss: 0.1724 - accuracy: 0.9474 - val_loss: 0.1837 - val_accuracy: 0.9561
Epoch 417/800
168/168 [=====] - 1s 4ms/step - loss: 0.1667 - accuracy: 0.9488 - val_loss: 0.1884 - val_accuracy: 0.9554
Epoch 418/800
168/168 [=====] - 1s 4ms/step - loss: 0.1576 - accuracy: 0.9501 - val_loss: 0.1906 - val_accuracy: 0.9576

Epoch 419/800
168/168 [=====] - 1s 5ms/step - loss: 0.1656 - accuracy: 0.9496 - val_loss: 0.1909 - val_accuracy: 0.9568
Epoch 420/800
168/168 [=====] - 1s 4ms/step - loss: 0.1801 - accuracy: 0.9438 - val_loss: 0.2066 - val_accuracy: 0.9524
Epoch 421/800
168/168 [=====] - 1s 4ms/step - loss: 0.1698 - accuracy: 0.9466 - val_loss: 0.1810 - val_accuracy: 0.9598
Epoch 422/800
168/168 [=====] - 1s 5ms/step - loss: 0.1617 - accuracy: 0.9494 - val_loss: 0.1772 - val_accuracy: 0.9613
Epoch 423/800
168/168 [=====] - 1s 4ms/step - loss: 0.1500 - accuracy: 0.9561 - val_loss: 0.1918 - val_accuracy: 0.9598
Epoch 424/800
168/168 [=====] - 1s 5ms/step - loss: 0.1495 - accuracy: 0.9544 - val_loss: 0.1817 - val_accuracy: 0.9568
Epoch 425/800
168/168 [=====] - 1s 5ms/step - loss: 0.1688 - accuracy: 0.9453 - val_loss: 0.1691 - val_accuracy: 0.9621
Epoch 426/800
168/168 [=====] - 1s 5ms/step - loss: 0.1590 - accuracy: 0.9485 - val_loss: 0.1813 - val_accuracy: 0.9591
Epoch 427/800
168/168 [=====] - 1s 5ms/step - loss: 0.1426 - accuracy: 0.9544 - val_loss: 0.1997 - val_accuracy: 0.9583
Epoch 428/800
168/168 [=====] - 1s 4ms/step - loss: 0.1408 - accuracy: 0.9574 - val_loss: 0.1931 - val_accuracy: 0.9568
Epoch 429/800
168/168 [=====] - 1s 4ms/step - loss: 0.1462 - accuracy: 0.9531 - val_loss: 0.1776 - val_accuracy: 0.9576
Epoch 430/800
168/168 [=====] - 1s 5ms/step - loss: 0.1577 - accuracy: 0.9516 - val_loss: 0.1805 - val_accuracy: 0.9554
Epoch 431/800
168/168 [=====] - 1s 4ms/step - loss: 0.1537 - accuracy: 0.9526 - val_loss: 0.1949 - val_accuracy: 0.9583
Epoch 432/800
168/168 [=====] - 1s 5ms/step - loss: 0.1684 - accuracy: 0.9477 - val_loss: 0.1631 - val_accuracy: 0.9628
Epoch 433/800
168/168 [=====] - 1s 5ms/step - loss: 0.1615 - accuracy: 0.9501 - val_loss: 0.1779 - val_accuracy: 0.9568
Epoch 434/800
168/168 [=====] - 1s 4ms/step - loss: 0.1721 - accuracy: 0.9470 - val_loss: 0.1834 - val_accuracy: 0.9568
Epoch 435/800
168/168 [=====] - 1s 5ms/step - loss: 0.1453 - accuracy: 0.9548 - val_loss: 0.1764 - val_accuracy: 0.9606
Epoch 436/800
168/168 [=====] - 1s 4ms/step - loss: 0.1541 - accuracy: 0.9505 - val_loss: 0.2053 - val_accuracy: 0.9524
Epoch 437/800
168/168 [=====] - 1s 5ms/step - loss: 0.1673 - accuracy: 0.9483 - val_loss: 0.1800 - val_accuracy: 0.9606
Epoch 438/800
168/168 [=====] - 1s 4ms/step - loss: 0.1481 - accuracy: 0.9537 - val_loss: 0.1760 - val_accuracy: 0.9613
Epoch 439/800
168/168 [=====] - 1s 5ms/step - loss: 0.1460 - accuracy: 0.9552 - val_loss: 0.1829 - val_accuracy: 0.9561
Epoch 440/800
168/168 [=====] - 1s 4ms/step - loss: 0.1483 - accuracy: 0.9554 - val_loss: 0.1903 - val_accuracy: 0.9546
Epoch 441/800
168/168 [=====] - 1s 4ms/step - loss: 0.1511 - accuracy: 0.9498 - val_loss: 0.1655 - val_accuracy: 0.9613
Epoch 442/800
168/168 [=====] - 1s 4ms/step - loss: 0.1583 - accuracy: 0.9500 - val_loss: 0.2075 - val_accuracy: 0.9546
Epoch 443/800
168/168 [=====] - 1s 4ms/step - loss: 0.1547 - accuracy: 0.9487 - val_loss: 0.1813 - val_accuracy: 0.9583
Epoch 444/800
168/168 [=====] - 1s 4ms/step - loss: 0.1496 - accuracy: 0.9500 - val_loss: 0.1820 - val_accuracy: 0.9606
Epoch 445/800
168/168 [=====] - 1s 4ms/step - loss: 0.1513 - accuracy: 0.9526 - val_loss: 0.1828 - val_accuracy: 0.9561
Epoch 446/800
168/168 [=====] - 1s 4ms/step - loss: 0.1530 - accuracy: 0.9520 - val_loss: 0.1903 - val_accuracy: 0.9554
Epoch 447/800
168/168 [=====] - 1s 5ms/step - loss: 0.1524 - accuracy: 0.9485 - val_loss: 0.1812 - val_accuracy: 0.9635
Epoch 448/800
168/168 [=====] - 1s 4ms/step - loss: 0.1465 - accuracy: 0.9615 - val_loss: 0.1788 - val_accuracy: 0.9635
Epoch 449/800
168/168 [=====] - 1s 4ms/step - loss: 0.1374 - accuracy: 0.9546 - val_loss: 0.2078 - val_accuracy: 0.9531
Epoch 450/800
168/168 [=====] - 1s 4ms/step - loss: 0.1669 - accuracy: 0.9455 - val_loss: 0.1870 - val_accuracy:

y: 0.9583
Epoch 451/800
168/168 [=====] - 1s 5ms/step - loss: 0.1395 - accuracy: 0.9557 - val_loss: 0.1917 - val_accuracy: 0.9554
Epoch 452/800
168/168 [=====] - 2s 11ms/step - loss: 0.1513 - accuracy: 0.9474 - val_loss: 0.1887 - val_accuracy: 0.9583
Epoch 453/800
168/168 [=====] - 1s 6ms/step - loss: 0.1414 - accuracy: 0.9544 - val_loss: 0.1890 - val_accuracy: 0.9568
Epoch 454/800
168/168 [=====] - 1s 5ms/step - loss: 0.1480 - accuracy: 0.9500 - val_loss: 0.1879 - val_accuracy: 0.9606
Epoch 455/800
168/168 [=====] - 1s 5ms/step - loss: 0.1540 - accuracy: 0.9533 - val_loss: 0.1886 - val_accuracy: 0.9576
Epoch 456/800
168/168 [=====] - 1s 5ms/step - loss: 0.1512 - accuracy: 0.9542 - val_loss: 0.1780 - val_accuracy: 0.9650
Epoch 457/800
168/168 [=====] - 1s 5ms/step - loss: 0.1480 - accuracy: 0.9548 - val_loss: 0.1704 - val_accuracy: 0.9606
Epoch 458/800
168/168 [=====] - 1s 5ms/step - loss: 0.1563 - accuracy: 0.9548 - val_loss: 0.1817 - val_accuracy: 0.9568
Epoch 459/800
168/168 [=====] - 1s 4ms/step - loss: 0.1525 - accuracy: 0.9537 - val_loss: 0.1782 - val_accuracy: 0.9576
Epoch 460/800
168/168 [=====] - 1s 4ms/step - loss: 0.1543 - accuracy: 0.9524 - val_loss: 0.1582 - val_accuracy: 0.9621
Epoch 461/800
168/168 [=====] - 1s 4ms/step - loss: 0.1598 - accuracy: 0.9505 - val_loss: 0.1906 - val_accuracy: 0.9546
Epoch 462/800
168/168 [=====] - 1s 4ms/step - loss: 0.1514 - accuracy: 0.9533 - val_loss: 0.1850 - val_accuracy: 0.9598
Epoch 463/800
168/168 [=====] - 1s 5ms/step - loss: 0.1381 - accuracy: 0.9557 - val_loss: 0.2004 - val_accuracy: 0.9539
Epoch 464/800
168/168 [=====] - 1s 4ms/step - loss: 0.1496 - accuracy: 0.9516 - val_loss: 0.1901 - val_accuracy: 0.9546
Epoch 465/800
168/168 [=====] - 1s 5ms/step - loss: 0.1505 - accuracy: 0.9546 - val_loss: 0.1859 - val_accuracy: 0.9613
Epoch 466/800
168/168 [=====] - 1s 5ms/step - loss: 0.1596 - accuracy: 0.9507 - val_loss: 0.1841 - val_accuracy: 0.9613
Epoch 467/800
168/168 [=====] - 1s 4ms/step - loss: 0.1335 - accuracy: 0.9529 - val_loss: 0.2009 - val_accuracy: 0.9554
Epoch 468/800
168/168 [=====] - 1s 5ms/step - loss: 0.1594 - accuracy: 0.9496 - val_loss: 0.1887 - val_accuracy: 0.9524
Epoch 469/800
168/168 [=====] - 1s 4ms/step - loss: 0.1643 - accuracy: 0.9481 - val_loss: 0.1945 - val_accuracy: 0.9531
Epoch 470/800
168/168 [=====] - 1s 4ms/step - loss: 0.1452 - accuracy: 0.9567 - val_loss: 0.1999 - val_accuracy: 0.9524
Epoch 471/800
168/168 [=====] - 1s 4ms/step - loss: 0.1440 - accuracy: 0.9552 - val_loss: 0.1960 - val_accuracy: 0.9546
Epoch 472/800
168/168 [=====] - 1s 5ms/step - loss: 0.1227 - accuracy: 0.9621 - val_loss: 0.2006 - val_accuracy: 0.9561
Epoch 473/800
168/168 [=====] - 1s 5ms/step - loss: 0.1467 - accuracy: 0.9526 - val_loss: 0.1979 - val_accuracy: 0.9583
Epoch 474/800
168/168 [=====] - 1s 4ms/step - loss: 0.1457 - accuracy: 0.9565 - val_loss: 0.1752 - val_accuracy: 0.9606
Epoch 475/800
168/168 [=====] - 1s 5ms/step - loss: 0.1432 - accuracy: 0.9522 - val_loss: 0.2008 - val_accuracy: 0.9576
Epoch 476/800
168/168 [=====] - 1s 4ms/step - loss: 0.1558 - accuracy: 0.9522 - val_loss: 0.1815 - val_accuracy: 0.9598
Epoch 477/800
168/168 [=====] - 1s 4ms/step - loss: 0.1382 - accuracy: 0.9598 - val_loss: 0.2135 - val_accuracy: 0.9464
Epoch 478/800
168/168 [=====] - 1s 4ms/step - loss: 0.1551 - accuracy: 0.9513 - val_loss: 0.2371 - val_accuracy: 0.9457
Epoch 479/800
168/168 [=====] - 1s 5ms/step - loss: 0.1647 - accuracy: 0.9472 - val_loss: 0.1813 - val_accuracy: 0.9568
Epoch 480/800
168/168 [=====] - 1s 5ms/step - loss: 0.1313 - accuracy: 0.9585 - val_loss: 0.2090 - val_accuracy: 0.9554
Epoch 481/800
168/168 [=====] - 1s 5ms/step - loss: 0.1397 - accuracy: 0.9555 - val_loss: 0.1966 - val_accuracy: 0.9583
Epoch 482/800

168/168 [=====] - 1s 4ms/step - loss: 0.1465 - accuracy: 0.9505 - val_loss: 0.1966 - val_accuracy: 0.9516
Epoch 483/800
168/168 [=====] - 1s 4ms/step - loss: 0.1482 - accuracy: 0.9498 - val_loss: 0.1868 - val_accuracy: 0.9598
Epoch 484/800
168/168 [=====] - 1s 5ms/step - loss: 0.1488 - accuracy: 0.9524 - val_loss: 0.2373 - val_accuracy: 0.9501
Epoch 485/800
168/168 [=====] - 1s 4ms/step - loss: 0.1459 - accuracy: 0.9533 - val_loss: 0.1972 - val_accuracy: 0.9598
Epoch 486/800
168/168 [=====] - 1s 5ms/step - loss: 0.1425 - accuracy: 0.9578 - val_loss: 0.1865 - val_accuracy: 0.9643
Epoch 487/800
168/168 [=====] - 2s 11ms/step - loss: 0.1595 - accuracy: 0.9520 - val_loss: 0.1864 - val_accuracy: 0.9576
Epoch 488/800
168/168 [=====] - 1s 4ms/step - loss: 0.1489 - accuracy: 0.9539 - val_loss: 0.2037 - val_accuracy: 0.9509
Epoch 489/800
168/168 [=====] - 1s 4ms/step - loss: 0.1277 - accuracy: 0.9585 - val_loss: 0.1840 - val_accuracy: 0.9591
Epoch 490/800
168/168 [=====] - 1s 5ms/step - loss: 0.1403 - accuracy: 0.9542 - val_loss: 0.2020 - val_accuracy: 0.9546
Epoch 491/800
168/168 [=====] - 1s 5ms/step - loss: 0.1412 - accuracy: 0.9539 - val_loss: 0.1860 - val_accuracy: 0.9576
Epoch 492/800
168/168 [=====] - 1s 5ms/step - loss: 0.1407 - accuracy: 0.9561 - val_loss: 0.1813 - val_accuracy: 0.9591
Epoch 493/800
168/168 [=====] - 1s 5ms/step - loss: 0.1331 - accuracy: 0.9568 - val_loss: 0.1843 - val_accuracy: 0.9531
Epoch 494/800
168/168 [=====] - 1s 4ms/step - loss: 0.1432 - accuracy: 0.9552 - val_loss: 0.2196 - val_accuracy: 0.9524
Epoch 495/800
168/168 [=====] - 1s 5ms/step - loss: 0.1291 - accuracy: 0.9613 - val_loss: 0.1931 - val_accuracy: 0.9613
Epoch 496/800
168/168 [=====] - 1s 5ms/step - loss: 0.1546 - accuracy: 0.9524 - val_loss: 0.1890 - val_accuracy: 0.9568
Epoch 497/800
168/168 [=====] - 1s 4ms/step - loss: 0.1384 - accuracy: 0.9591 - val_loss: 0.1880 - val_accuracy: 0.9524
Epoch 498/800
168/168 [=====] - 1s 5ms/step - loss: 0.1429 - accuracy: 0.9555 - val_loss: 0.1911 - val_accuracy: 0.9576
Epoch 499/800
168/168 [=====] - 1s 4ms/step - loss: 0.1334 - accuracy: 0.9598 - val_loss: 0.1837 - val_accuracy: 0.9568
Epoch 500/800
168/168 [=====] - 1s 4ms/step - loss: 0.1409 - accuracy: 0.9557 - val_loss: 0.1754 - val_accuracy: 0.9635
Epoch 501/800
168/168 [=====] - 1s 4ms/step - loss: 0.1489 - accuracy: 0.9550 - val_loss: 0.1844 - val_accuracy: 0.9598
Epoch 502/800
168/168 [=====] - 1s 4ms/step - loss: 0.1410 - accuracy: 0.9570 - val_loss: 0.1881 - val_accuracy: 0.9598
Epoch 503/800
168/168 [=====] - 1s 4ms/step - loss: 0.1323 - accuracy: 0.9600 - val_loss: 0.1840 - val_accuracy: 0.9628
Epoch 504/800
168/168 [=====] - 1s 5ms/step - loss: 0.1394 - accuracy: 0.9576 - val_loss: 0.1934 - val_accuracy: 0.9591
Epoch 505/800
168/168 [=====] - 1s 4ms/step - loss: 0.1372 - accuracy: 0.9557 - val_loss: 0.1991 - val_accuracy: 0.9561
Epoch 506/800
168/168 [=====] - 1s 5ms/step - loss: 0.1305 - accuracy: 0.9619 - val_loss: 0.1888 - val_accuracy: 0.9613
Epoch 507/800
168/168 [=====] - 1s 4ms/step - loss: 0.1277 - accuracy: 0.9600 - val_loss: 0.2073 - val_accuracy: 0.9539
Epoch 508/800
168/168 [=====] - 1s 4ms/step - loss: 0.1310 - accuracy: 0.9576 - val_loss: 0.1843 - val_accuracy: 0.9598
Epoch 509/800
168/168 [=====] - 1s 5ms/step - loss: 0.1493 - accuracy: 0.9544 - val_loss: 0.1760 - val_accuracy: 0.9606
Epoch 510/800
168/168 [=====] - 1s 5ms/step - loss: 0.1450 - accuracy: 0.9570 - val_loss: 0.2286 - val_accuracy: 0.9524
Epoch 511/800
168/168 [=====] - 1s 4ms/step - loss: 0.1496 - accuracy: 0.9505 - val_loss: 0.1766 - val_accuracy: 0.9613
Epoch 512/800
168/168 [=====] - 1s 5ms/step - loss: 0.1295 - accuracy: 0.9576 - val_loss: 0.1870 - val_accuracy: 0.9583
Epoch 513/800
168/168 [=====] - 1s 4ms/step - loss: 0.1455 - accuracy: 0.9529 - val_loss: 0.1793 - val_accuracy: 0.9628

Epoch 514/800
168/168 [=====] - 1s 5ms/step - loss: 0.1318 - accuracy: 0.9563 - val_loss: 0.1829 - val_accuracy: 0.9591
Epoch 515/800
168/168 [=====] - 1s 5ms/step - loss: 0.1321 - accuracy: 0.9602 - val_loss: 0.1693 - val_accuracy: 0.9628
Epoch 516/800
168/168 [=====] - 1s 4ms/step - loss: 0.1448 - accuracy: 0.9552 - val_loss: 0.1886 - val_accuracy: 0.9561
Epoch 517/800
168/168 [=====] - 1s 5ms/step - loss: 0.1483 - accuracy: 0.9537 - val_loss: 0.2034 - val_accuracy: 0.9501
Epoch 518/800
168/168 [=====] - 1s 4ms/step - loss: 0.1414 - accuracy: 0.9585 - val_loss: 0.1844 - val_accuracy: 0.9598
Epoch 519/800
168/168 [=====] - 1s 4ms/step - loss: 0.1450 - accuracy: 0.9546 - val_loss: 0.1959 - val_accuracy: 0.9561
Epoch 520/800
168/168 [=====] - 1s 5ms/step - loss: 0.1416 - accuracy: 0.9591 - val_loss: 0.1765 - val_accuracy: 0.9628
Epoch 521/800
168/168 [=====] - 1s 4ms/step - loss: 0.1433 - accuracy: 0.9541 - val_loss: 0.1848 - val_accuracy: 0.9613
Epoch 522/800
168/168 [=====] - 1s 5ms/step - loss: 0.1356 - accuracy: 0.9606 - val_loss: 0.1856 - val_accuracy: 0.9598
Epoch 523/800
168/168 [=====] - 1s 4ms/step - loss: 0.1372 - accuracy: 0.9546 - val_loss: 0.1966 - val_accuracy: 0.9516
Epoch 524/800
168/168 [=====] - 1s 5ms/step - loss: 0.1332 - accuracy: 0.9572 - val_loss: 0.2116 - val_accuracy: 0.9501
Epoch 525/800
168/168 [=====] - 1s 5ms/step - loss: 0.1496 - accuracy: 0.9513 - val_loss: 0.1733 - val_accuracy: 0.9576
Epoch 526/800
168/168 [=====] - 1s 4ms/step - loss: 0.1381 - accuracy: 0.9583 - val_loss: 0.1835 - val_accuracy: 0.9613
Epoch 527/800
168/168 [=====] - 1s 4ms/step - loss: 0.1299 - accuracy: 0.9580 - val_loss: 0.1858 - val_accuracy: 0.9576
Epoch 528/800
168/168 [=====] - 1s 5ms/step - loss: 0.1295 - accuracy: 0.9583 - val_loss: 0.1780 - val_accuracy: 0.9598
Epoch 529/800
168/168 [=====] - 2s 11ms/step - loss: 0.1396 - accuracy: 0.9555 - val_loss: 0.1845 - val_accuracy: 0.9635
Epoch 530/800
168/168 [=====] - 1s 4ms/step - loss: 0.1264 - accuracy: 0.9585 - val_loss: 0.1882 - val_accuracy: 0.9539
Epoch 531/800
168/168 [=====] - 1s 4ms/step - loss: 0.1396 - accuracy: 0.9570 - val_loss: 0.1770 - val_accuracy: 0.9591
Epoch 532/800
168/168 [=====] - 1s 5ms/step - loss: 0.1497 - accuracy: 0.9581 - val_loss: 0.1885 - val_accuracy: 0.9591
Epoch 533/800
168/168 [=====] - 1s 5ms/step - loss: 0.1240 - accuracy: 0.9622 - val_loss: 0.1867 - val_accuracy: 0.9598
Epoch 534/800
168/168 [=====] - 1s 5ms/step - loss: 0.1253 - accuracy: 0.9604 - val_loss: 0.2040 - val_accuracy: 0.9621
Epoch 535/800
168/168 [=====] - 1s 4ms/step - loss: 0.1394 - accuracy: 0.9604 - val_loss: 0.1861 - val_accuracy: 0.9561
Epoch 536/800
168/168 [=====] - 1s 4ms/step - loss: 0.1453 - accuracy: 0.9533 - val_loss: 0.1991 - val_accuracy: 0.9464
Epoch 537/800
168/168 [=====] - 1s 5ms/step - loss: 0.1377 - accuracy: 0.9563 - val_loss: 0.1835 - val_accuracy: 0.9583
Epoch 538/800
168/168 [=====] - 1s 4ms/step - loss: 0.1281 - accuracy: 0.9593 - val_loss: 0.1822 - val_accuracy: 0.9606
Epoch 539/800
168/168 [=====] - 1s 4ms/step - loss: 0.1360 - accuracy: 0.9574 - val_loss: 0.1833 - val_accuracy: 0.9628
Epoch 540/800
168/168 [=====] - 1s 5ms/step - loss: 0.1218 - accuracy: 0.9622 - val_loss: 0.1728 - val_accuracy: 0.9621
Epoch 541/800
168/168 [=====] - 1s 5ms/step - loss: 0.1343 - accuracy: 0.9604 - val_loss: 0.1925 - val_accuracy: 0.9576
Epoch 542/800
168/168 [=====] - 1s 5ms/step - loss: 0.1253 - accuracy: 0.9581 - val_loss: 0.2055 - val_accuracy: 0.9516
Epoch 543/800
168/168 [=====] - 1s 4ms/step - loss: 0.1398 - accuracy: 0.9587 - val_loss: 0.1757 - val_accuracy: 0.9598
Epoch 544/800
168/168 [=====] - 1s 4ms/step - loss: 0.1374 - accuracy: 0.9593 - val_loss: 0.1813 - val_accuracy: 0.9598
Epoch 545/800
168/168 [=====] - 1s 5ms/step - loss: 0.1343 - accuracy: 0.9602 - val_loss: 0.1633 - val_accuracy:

y: 0.9643
Epoch 546/800
168/168 [=====] - 1s 5ms/step - loss: 0.1364 - accuracy: 0.9561 - val_loss: 0.1750 - val_accuracy: 0.9598
y: 0.9598
Epoch 547/800
168/168 [=====] - 1s 5ms/step - loss: 0.1218 - accuracy: 0.9598 - val_loss: 0.1964 - val_accuracy: 0.9509
y: 0.9509
Epoch 548/800
168/168 [=====] - 1s 5ms/step - loss: 0.1417 - accuracy: 0.9561 - val_loss: 0.1856 - val_accuracy: 0.9554
y: 0.9554
Epoch 549/800
168/168 [=====] - 1s 5ms/step - loss: 0.1329 - accuracy: 0.9613 - val_loss: 0.1800 - val_accuracy: 0.9568
y: 0.9568
Epoch 550/800
168/168 [=====] - 1s 5ms/step - loss: 0.1355 - accuracy: 0.9574 - val_loss: 0.2007 - val_accuracy: 0.9516
y: 0.9516
Epoch 551/800
168/168 [=====] - 1s 5ms/step - loss: 0.1268 - accuracy: 0.9585 - val_loss: 0.1791 - val_accuracy: 0.9568
y: 0.9568
Epoch 552/800
168/168 [=====] - 1s 4ms/step - loss: 0.1414 - accuracy: 0.9574 - val_loss: 0.1908 - val_accuracy: 0.9546
y: 0.9546
Epoch 553/800
168/168 [=====] - 1s 5ms/step - loss: 0.1382 - accuracy: 0.9559 - val_loss: 0.1788 - val_accuracy: 0.9561
y: 0.9561
Epoch 554/800
168/168 [=====] - 1s 4ms/step - loss: 0.1332 - accuracy: 0.9557 - val_loss: 0.1750 - val_accuracy: 0.9591
y: 0.9591
Epoch 555/800
168/168 [=====] - 1s 5ms/step - loss: 0.1407 - accuracy: 0.9567 - val_loss: 0.1738 - val_accuracy: 0.9643
y: 0.9643
Epoch 556/800
168/168 [=====] - 1s 5ms/step - loss: 0.1354 - accuracy: 0.9552 - val_loss: 0.1756 - val_accuracy: 0.9598
y: 0.9598
Epoch 557/800
168/168 [=====] - 1s 4ms/step - loss: 0.1249 - accuracy: 0.9570 - val_loss: 0.1665 - val_accuracy: 0.9650
y: 0.9650
Epoch 558/800
168/168 [=====] - 1s 5ms/step - loss: 0.1326 - accuracy: 0.9583 - val_loss: 0.2096 - val_accuracy: 0.9472
y: 0.9472
Epoch 559/800
168/168 [=====] - 1s 5ms/step - loss: 0.1417 - accuracy: 0.9555 - val_loss: 0.1868 - val_accuracy: 0.9501
y: 0.9501
Epoch 560/800
168/168 [=====] - 1s 4ms/step - loss: 0.1335 - accuracy: 0.9593 - val_loss: 0.1774 - val_accuracy: 0.9613
y: 0.9613
Epoch 561/800
168/168 [=====] - 1s 4ms/step - loss: 0.1303 - accuracy: 0.9580 - val_loss: 0.1642 - val_accuracy: 0.9598
y: 0.9598
Epoch 562/800
168/168 [=====] - 1s 4ms/step - loss: 0.1480 - accuracy: 0.9528 - val_loss: 0.1861 - val_accuracy: 0.9554
y: 0.9554
Epoch 563/800
168/168 [=====] - 1s 5ms/step - loss: 0.1282 - accuracy: 0.9593 - val_loss: 0.1941 - val_accuracy: 0.9554
y: 0.9554
Epoch 564/800
168/168 [=====] - 1s 5ms/step - loss: 0.1268 - accuracy: 0.9565 - val_loss: 0.1832 - val_accuracy: 0.9591
y: 0.9591
Epoch 565/800
168/168 [=====] - 1s 4ms/step - loss: 0.1378 - accuracy: 0.9548 - val_loss: 0.1651 - val_accuracy: 0.9650
y: 0.9650
Epoch 566/800
168/168 [=====] - 1s 4ms/step - loss: 0.1288 - accuracy: 0.9606 - val_loss: 0.1661 - val_accuracy: 0.9650
y: 0.9650
Epoch 567/800
168/168 [=====] - 1s 5ms/step - loss: 0.1383 - accuracy: 0.9583 - val_loss: 0.1748 - val_accuracy: 0.9583
y: 0.9583
Epoch 568/800
168/168 [=====] - 2s 11ms/step - loss: 0.1135 - accuracy: 0.9648 - val_loss: 0.1934 - val_accuracy: 0.9568
y: 0.9568
Epoch 569/800
168/168 [=====] - 1s 4ms/step - loss: 0.1287 - accuracy: 0.9600 - val_loss: 0.1842 - val_accuracy: 0.9576
y: 0.9576
Epoch 570/800
168/168 [=====] - 1s 4ms/step - loss: 0.1226 - accuracy: 0.9630 - val_loss: 0.1937 - val_accuracy: 0.9546
y: 0.9546
Epoch 571/800
168/168 [=====] - 1s 5ms/step - loss: 0.1271 - accuracy: 0.9635 - val_loss: 0.1893 - val_accuracy: 0.9598
y: 0.9598
Epoch 572/800
168/168 [=====] - 1s 4ms/step - loss: 0.1292 - accuracy: 0.9602 - val_loss: 0.1895 - val_accuracy: 0.9568
y: 0.9568
Epoch 573/800
168/168 [=====] - 1s 5ms/step - loss: 0.1457 - accuracy: 0.9561 - val_loss: 0.1792 - val_accuracy: 0.9591
y: 0.9591
Epoch 574/800
168/168 [=====] - 2s 10ms/step - loss: 0.1328 - accuracy: 0.9570 - val_loss: 0.1726 - val_accuracy: 0.9591
y: 0.9591
Epoch 575/800
168/168 [=====] - 1s 9ms/step - loss: 0.1383 - accuracy: 0.9570 - val_loss: 0.1853 - val_accuracy: 0.9583
y: 0.9583
Epoch 576/800
168/168 [=====] - 2s 11ms/step - loss: 0.1377 - accuracy: 0.9567 - val_loss: 0.1968 - val_accuracy: 0.9576
y: 0.9576
Epoch 577/800

168/168 [=====] - 1s 5ms/step - loss: 0.1307 - accuracy: 0.9621 - val_loss: 0.1976 - val_accuracy: 0.9583
Epoch 578/800
168/168 [=====] - 1s 4ms/step - loss: 0.1373 - accuracy: 0.9568 - val_loss: 0.1845 - val_accuracy: 0.9591
Epoch 579/800
168/168 [=====] - 1s 4ms/step - loss: 0.1239 - accuracy: 0.9611 - val_loss: 0.1847 - val_accuracy: 0.9621
Epoch 580/800
168/168 [=====] - 1s 5ms/step - loss: 0.1226 - accuracy: 0.9622 - val_loss: 0.1897 - val_accuracy: 0.9583
Epoch 581/800
168/168 [=====] - 1s 5ms/step - loss: 0.1157 - accuracy: 0.9602 - val_loss: 0.1882 - val_accuracy: 0.9635
Epoch 582/800
168/168 [=====] - 1s 5ms/step - loss: 0.1253 - accuracy: 0.9621 - val_loss: 0.1954 - val_accuracy: 0.9635
Epoch 583/800
168/168 [=====] - 1s 5ms/step - loss: 0.1285 - accuracy: 0.9585 - val_loss: 0.1910 - val_accuracy: 0.9613
Epoch 584/800
168/168 [=====] - 1s 4ms/step - loss: 0.1282 - accuracy: 0.9589 - val_loss: 0.1811 - val_accuracy: 0.9621
Epoch 585/800
168/168 [=====] - 1s 4ms/step - loss: 0.1362 - accuracy: 0.9589 - val_loss: 0.1613 - val_accuracy: 0.9494
Epoch 586/800
168/168 [=====] - 1s 5ms/step - loss: 0.1303 - accuracy: 0.9604 - val_loss: 0.1760 - val_accuracy: 0.9591
Epoch 587/800
168/168 [=====] - 1s 5ms/step - loss: 0.1187 - accuracy: 0.9617 - val_loss: 0.1861 - val_accuracy: 0.9621
Epoch 588/800
168/168 [=====] - 1s 5ms/step - loss: 0.1159 - accuracy: 0.9658 - val_loss: 0.1773 - val_accuracy: 0.9673
Epoch 589/800
168/168 [=====] - 1s 5ms/step - loss: 0.1281 - accuracy: 0.9568 - val_loss: 0.1690 - val_accuracy: 0.9635
Epoch 590/800
168/168 [=====] - 1s 4ms/step - loss: 0.1374 - accuracy: 0.9568 - val_loss: 0.1922 - val_accuracy: 0.9583
Epoch 591/800
168/168 [=====] - 1s 5ms/step - loss: 0.1336 - accuracy: 0.9574 - val_loss: 0.1672 - val_accuracy: 0.9658
Epoch 592/800
168/168 [=====] - 1s 5ms/step - loss: 0.1310 - accuracy: 0.9574 - val_loss: 0.1735 - val_accuracy: 0.9628
Epoch 593/800
168/168 [=====] - 1s 5ms/step - loss: 0.1316 - accuracy: 0.9565 - val_loss: 0.2018 - val_accuracy: 0.9539
Epoch 594/800
168/168 [=====] - 1s 4ms/step - loss: 0.1285 - accuracy: 0.9596 - val_loss: 0.1941 - val_accuracy: 0.9531
Epoch 595/800
168/168 [=====] - 1s 4ms/step - loss: 0.1144 - accuracy: 0.9630 - val_loss: 0.1904 - val_accuracy: 0.9561
Epoch 596/800
168/168 [=====] - 1s 5ms/step - loss: 0.1233 - accuracy: 0.9613 - val_loss: 0.1659 - val_accuracy: 0.9643
Epoch 597/800
168/168 [=====] - 2s 11ms/step - loss: 0.1197 - accuracy: 0.9617 - val_loss: 0.1819 - val_accuracy: 0.9650
Epoch 598/800
168/168 [=====] - 1s 4ms/step - loss: 0.1148 - accuracy: 0.9643 - val_loss: 0.1978 - val_accuracy: 0.9576
Epoch 599/800
168/168 [=====] - 1s 4ms/step - loss: 0.1308 - accuracy: 0.9606 - val_loss: 0.1958 - val_accuracy: 0.9635
Epoch 600/800
168/168 [=====] - 1s 5ms/step - loss: 0.1305 - accuracy: 0.9574 - val_loss: 0.1872 - val_accuracy: 0.9598
Epoch 601/800
168/168 [=====] - 1s 4ms/step - loss: 0.1464 - accuracy: 0.9552 - val_loss: 0.1752 - val_accuracy: 0.9583
Epoch 602/800
168/168 [=====] - 1s 4ms/step - loss: 0.1233 - accuracy: 0.9624 - val_loss: 0.1659 - val_accuracy: 0.9658
Epoch 603/800
168/168 [=====] - 1s 5ms/step - loss: 0.1260 - accuracy: 0.9596 - val_loss: 0.1741 - val_accuracy: 0.9643
Epoch 604/800
168/168 [=====] - 1s 4ms/step - loss: 0.1148 - accuracy: 0.9654 - val_loss: 0.1814 - val_accuracy: 0.9606
Epoch 605/800
168/168 [=====] - 1s 5ms/step - loss: 0.1234 - accuracy: 0.9615 - val_loss: 0.1807 - val_accuracy: 0.9628
Epoch 606/800
168/168 [=====] - 1s 4ms/step - loss: 0.1116 - accuracy: 0.9641 - val_loss: 0.1674 - val_accuracy: 0.9680
Epoch 607/800
168/168 [=====] - 1s 5ms/step - loss: 0.1084 - accuracy: 0.9637 - val_loss: 0.1877 - val_accuracy: 0.9554

Epoch 609/800
168/168 [=====] - 1s 5ms/step - loss: 0.1392 - accuracy: 0.9578 - val_loss: 0.2031 - val_accuracy: 0.9621
Epoch 610/800
168/168 [=====] - 1s 4ms/step - loss: 0.1195 - accuracy: 0.9643 - val_loss: 0.1852 - val_accuracy: 0.9554
Epoch 611/800
168/168 [=====] - 1s 4ms/step - loss: 0.1224 - accuracy: 0.9621 - val_loss: 0.1866 - val_accuracy: 0.9546
Epoch 612/800
168/168 [=====] - 1s 5ms/step - loss: 0.1418 - accuracy: 0.9563 - val_loss: 0.1926 - val_accuracy: 0.9591
Epoch 613/800
168/168 [=====] - 1s 4ms/step - loss: 0.1171 - accuracy: 0.9630 - val_loss: 0.2164 - val_accuracy: 0.9568
Epoch 614/800
168/168 [=====] - 1s 5ms/step - loss: 0.1193 - accuracy: 0.9604 - val_loss: 0.1790 - val_accuracy: 0.9613
Epoch 615/800
168/168 [=====] - 1s 4ms/step - loss: 0.1388 - accuracy: 0.9576 - val_loss: 0.1883 - val_accuracy: 0.9554
Epoch 616/800
168/168 [=====] - 1s 5ms/step - loss: 0.1350 - accuracy: 0.9578 - val_loss: 0.1912 - val_accuracy: 0.9576
Epoch 617/800
168/168 [=====] - 1s 4ms/step - loss: 0.1325 - accuracy: 0.9594 - val_loss: 0.2042 - val_accuracy: 0.9531
Epoch 618/800
168/168 [=====] - 1s 4ms/step - loss: 0.1179 - accuracy: 0.9617 - val_loss: 0.1907 - val_accuracy: 0.9591
Epoch 619/800
168/168 [=====] - 1s 4ms/step - loss: 0.1309 - accuracy: 0.9593 - val_loss: 0.1908 - val_accuracy: 0.9568
Epoch 620/800
168/168 [=====] - 1s 4ms/step - loss: 0.1285 - accuracy: 0.9613 - val_loss: 0.2020 - val_accuracy: 0.9568
Epoch 621/800
168/168 [=====] - 1s 4ms/step - loss: 0.1317 - accuracy: 0.9602 - val_loss: 0.1770 - val_accuracy: 0.9635
Epoch 622/800
168/168 [=====] - 1s 5ms/step - loss: 0.1228 - accuracy: 0.9600 - val_loss: 0.1754 - val_accuracy: 0.9650
Epoch 623/800
168/168 [=====] - 1s 5ms/step - loss: 0.1158 - accuracy: 0.9632 - val_loss: 0.1919 - val_accuracy: 0.9576
Epoch 624/800
168/168 [=====] - 1s 5ms/step - loss: 0.1266 - accuracy: 0.9568 - val_loss: 0.2036 - val_accuracy: 0.9591
Epoch 625/800
168/168 [=====] - 1s 4ms/step - loss: 0.1457 - accuracy: 0.9546 - val_loss: 0.1775 - val_accuracy: 0.9613
Epoch 626/800
168/168 [=====] - 1s 4ms/step - loss: 0.1098 - accuracy: 0.9654 - val_loss: 0.1803 - val_accuracy: 0.9665
Epoch 627/800
168/168 [=====] - 1s 5ms/step - loss: 0.1022 - accuracy: 0.9650 - val_loss: 0.2009 - val_accuracy: 0.9606
Epoch 628/800
168/168 [=====] - 1s 4ms/step - loss: 0.1240 - accuracy: 0.9634 - val_loss: 0.1743 - val_accuracy: 0.9613
Epoch 629/800
168/168 [=====] - 1s 4ms/step - loss: 0.1344 - accuracy: 0.9587 - val_loss: 0.1802 - val_accuracy: 0.9598
Epoch 630/800
168/168 [=====] - 1s 5ms/step - loss: 0.1267 - accuracy: 0.9613 - val_loss: 0.1887 - val_accuracy: 0.9598
Epoch 631/800
168/168 [=====] - 1s 5ms/step - loss: 0.1180 - accuracy: 0.9615 - val_loss: 0.1863 - val_accuracy: 0.9635
Epoch 632/800
168/168 [=====] - 1s 5ms/step - loss: 0.1226 - accuracy: 0.9602 - val_loss: 0.1767 - val_accuracy: 0.9621
Epoch 633/800
168/168 [=====] - 1s 5ms/step - loss: 0.1171 - accuracy: 0.9611 - val_loss: 0.1836 - val_accuracy: 0.9628
Epoch 634/800
168/168 [=====] - 1s 4ms/step - loss: 0.1119 - accuracy: 0.9637 - val_loss: 0.1763 - val_accuracy: 0.9606
Epoch 635/800
168/168 [=====] - 1s 5ms/step - loss: 0.1073 - accuracy: 0.9673 - val_loss: 0.1719 - val_accuracy: 0.9621
Epoch 636/800
168/168 [=====] - 1s 5ms/step - loss: 0.1327 - accuracy: 0.9613 - val_loss: 0.2114 - val_accuracy: 0.9524
Epoch 637/800
168/168 [=====] - 1s 5ms/step - loss: 0.1170 - accuracy: 0.9621 - val_loss: 0.1871 - val_accuracy: 0.9524
Epoch 638/800
168/168 [=====] - 2s 11ms/step - loss: 0.1281 - accuracy: 0.9613 - val_loss: 0.1750 - val_accuracy: 0.9598
Epoch 639/800
168/168 [=====] - 1s 5ms/step - loss: 0.1200 - accuracy: 0.9585 - val_loss: 0.2203 - val_accuracy: 0.9531
Epoch 640/800
168/168 [=====] - 1s 5ms/step - loss: 0.1311 - accuracy: 0.9602 - val_loss: 0.1854 - val_accuracy:

y: 0.9561
Epoch 641/800
168/168 [=====] - 1s 5ms/step - loss: 0.1136 - accuracy: 0.9635 - val_loss: 0.1707 - val_accuracy: 0.9621
Epoch 642/800
168/168 [=====] - 1s 4ms/step - loss: 0.1262 - accuracy: 0.9591 - val_loss: 0.1696 - val_accuracy: 0.9621
y: 0.9621
Epoch 643/800
168/168 [=====] - 1s 5ms/step - loss: 0.1127 - accuracy: 0.9648 - val_loss: 0.1700 - val_accuracy: 0.9658
y: 0.9658
Epoch 644/800
168/168 [=====] - 1s 5ms/step - loss: 0.1141 - accuracy: 0.9656 - val_loss: 0.1863 - val_accuracy: 0.9621
y: 0.9621
Epoch 645/800
168/168 [=====] - 1s 5ms/step - loss: 0.1021 - accuracy: 0.9669 - val_loss: 0.1814 - val_accuracy: 0.9561
y: 0.9561
Epoch 646/800
168/168 [=====] - 1s 5ms/step - loss: 0.1148 - accuracy: 0.9641 - val_loss: 0.1968 - val_accuracy: 0.9516
y: 0.9516
Epoch 647/800
168/168 [=====] - 1s 4ms/step - loss: 0.1329 - accuracy: 0.9598 - val_loss: 0.1664 - val_accuracy: 0.9613
y: 0.9613
Epoch 648/800
168/168 [=====] - 1s 5ms/step - loss: 0.1265 - accuracy: 0.9606 - val_loss: 0.1733 - val_accuracy: 0.9583
y: 0.9583
Epoch 649/800
168/168 [=====] - 1s 5ms/step - loss: 0.1322 - accuracy: 0.9583 - val_loss: 0.1589 - val_accuracy: 0.9673
y: 0.9673
Epoch 650/800
168/168 [=====] - 1s 4ms/step - loss: 0.1069 - accuracy: 0.9650 - val_loss: 0.1670 - val_accuracy: 0.9658
y: 0.9658
Epoch 651/800
168/168 [=====] - 1s 4ms/step - loss: 0.1120 - accuracy: 0.9643 - val_loss: 0.2021 - val_accuracy: 0.9591
y: 0.9591
Epoch 652/800
168/168 [=====] - 1s 5ms/step - loss: 0.1195 - accuracy: 0.9580 - val_loss: 0.1866 - val_accuracy: 0.9680
y: 0.9680
Epoch 653/800
168/168 [=====] - 1s 5ms/step - loss: 0.1272 - accuracy: 0.9613 - val_loss: 0.1715 - val_accuracy: 0.9680
y: 0.9680
Epoch 654/800
168/168 [=====] - 1s 5ms/step - loss: 0.1143 - accuracy: 0.9650 - val_loss: 0.1708 - val_accuracy: 0.9665
y: 0.9665
Epoch 655/800
168/168 [=====] - 1s 5ms/step - loss: 0.1099 - accuracy: 0.9661 - val_loss: 0.1812 - val_accuracy: 0.9606
y: 0.9606
Epoch 656/800
168/168 [=====] - 1s 4ms/step - loss: 0.1048 - accuracy: 0.9669 - val_loss: 0.1885 - val_accuracy: 0.9598
y: 0.9598
Epoch 657/800
168/168 [=====] - 1s 5ms/step - loss: 0.1197 - accuracy: 0.9643 - val_loss: 0.1753 - val_accuracy: 0.9613
y: 0.9613
Epoch 658/800
168/168 [=====] - 1s 4ms/step - loss: 0.1284 - accuracy: 0.9600 - val_loss: 0.1726 - val_accuracy: 0.9665
y: 0.9665
Epoch 659/800
168/168 [=====] - 1s 5ms/step - loss: 0.1156 - accuracy: 0.9645 - val_loss: 0.1694 - val_accuracy: 0.9621
y: 0.9621
Epoch 660/800
168/168 [=====] - 1s 4ms/step - loss: 0.1308 - accuracy: 0.9596 - val_loss: 0.1912 - val_accuracy: 0.9554
y: 0.9554
Epoch 661/800
168/168 [=====] - 1s 4ms/step - loss: 0.1247 - accuracy: 0.9596 - val_loss: 0.1730 - val_accuracy: 0.9628
y: 0.9628
Epoch 662/800
168/168 [=====] - 1s 4ms/step - loss: 0.1054 - accuracy: 0.9647 - val_loss: 0.1868 - val_accuracy: 0.9658
y: 0.9658
Epoch 663/800
168/168 [=====] - 1s 5ms/step - loss: 0.1073 - accuracy: 0.9643 - val_loss: 0.1910 - val_accuracy: 0.9606
y: 0.9606
Epoch 664/800
168/168 [=====] - 1s 5ms/step - loss: 0.1302 - accuracy: 0.9609 - val_loss: 0.1652 - val_accuracy: 0.9665
y: 0.9665
Epoch 665/800
168/168 [=====] - 1s 5ms/step - loss: 0.1152 - accuracy: 0.9639 - val_loss: 0.1890 - val_accuracy: 0.9628
y: 0.9628
Epoch 666/800
168/168 [=====] - 1s 5ms/step - loss: 0.1232 - accuracy: 0.9650 - val_loss: 0.1875 - val_accuracy: 0.9621
y: 0.9621
Epoch 667/800
168/168 [=====] - 1s 5ms/step - loss: 0.1084 - accuracy: 0.9647 - val_loss: 0.1812 - val_accuracy: 0.9621
y: 0.9621
Epoch 668/800
168/168 [=====] - 1s 4ms/step - loss: 0.1176 - accuracy: 0.9660 - val_loss: 0.1844 - val_accuracy: 0.9628
y: 0.9628
Epoch 669/800
168/168 [=====] - 1s 4ms/step - loss: 0.1024 - accuracy: 0.9647 - val_loss: 0.1731 - val_accuracy: 0.9643
y: 0.9643
Epoch 670/800
168/168 [=====] - 1s 5ms/step - loss: 0.1234 - accuracy: 0.9639 - val_loss: 0.1870 - val_accuracy: 0.9628
y: 0.9628
Epoch 671/800
168/168 [=====] - 1s 4ms/step - loss: 0.1155 - accuracy: 0.9643 - val_loss: 0.1830 - val_accuracy: 0.9635
y: 0.9635
Epoch 672/800

168/168 [=====] - 1s 4ms/step - loss: 0.1031 - accuracy: 0.9669 - val_loss: 0.1789 - val_accuracy: 0.9598
Epoch 673/800
168/168 [=====] - 2s 11ms/step - loss: 0.1221 - accuracy: 0.9617 - val_loss: 0.1813 - val_accuracy: 0.9613
Epoch 674/800
168/168 [=====] - 1s 6ms/step - loss: 0.1109 - accuracy: 0.9641 - val_loss: 0.1737 - val_accuracy: 0.9673
Epoch 675/800
168/168 [=====] - 1s 5ms/step - loss: 0.1149 - accuracy: 0.9654 - val_loss: 0.2047 - val_accuracy: 0.9546
Epoch 676/800
168/168 [=====] - 1s 5ms/step - loss: 0.1221 - accuracy: 0.9622 - val_loss: 0.1726 - val_accuracy: 0.9658
Epoch 677/800
168/168 [=====] - 1s 5ms/step - loss: 0.1157 - accuracy: 0.9602 - val_loss: 0.1830 - val_accuracy: 0.9665
Epoch 678/800
168/168 [=====] - 1s 5ms/step - loss: 0.1231 - accuracy: 0.9608 - val_loss: 0.2039 - val_accuracy: 0.9635
Epoch 679/800
168/168 [=====] - 1s 4ms/step - loss: 0.1033 - accuracy: 0.9678 - val_loss: 0.1889 - val_accuracy: 0.9635
Epoch 680/800
168/168 [=====] - 1s 5ms/step - loss: 0.1290 - accuracy: 0.9604 - val_loss: 0.1786 - val_accuracy: 0.9628
Epoch 681/800
168/168 [=====] - 1s 5ms/step - loss: 0.1018 - accuracy: 0.9667 - val_loss: 0.1768 - val_accuracy: 0.9635
Epoch 682/800
168/168 [=====] - 1s 5ms/step - loss: 0.1243 - accuracy: 0.9639 - val_loss: 0.1611 - val_accuracy: 0.9673
Epoch 683/800
168/168 [=====] - 1s 5ms/step - loss: 0.1050 - accuracy: 0.9684 - val_loss: 0.2017 - val_accuracy: 0.9635
Epoch 684/800
168/168 [=====] - 1s 4ms/step - loss: 0.1055 - accuracy: 0.9663 - val_loss: 0.1746 - val_accuracy: 0.9688
Epoch 685/800
168/168 [=====] - 1s 4ms/step - loss: 0.1257 - accuracy: 0.9598 - val_loss: 0.2280 - val_accuracy: 0.9479
Epoch 686/800
168/168 [=====] - 1s 4ms/step - loss: 0.1279 - accuracy: 0.9600 - val_loss: 0.1737 - val_accuracy: 0.9658
Epoch 687/800
168/168 [=====] - 1s 4ms/step - loss: 0.1123 - accuracy: 0.9661 - val_loss: 0.1788 - val_accuracy: 0.9643
Epoch 688/800
168/168 [=====] - 1s 5ms/step - loss: 0.1079 - accuracy: 0.9652 - val_loss: 0.2029 - val_accuracy: 0.9591
Epoch 689/800
168/168 [=====] - 1s 5ms/step - loss: 0.1169 - accuracy: 0.9641 - val_loss: 0.1781 - val_accuracy: 0.9628
Epoch 690/800
168/168 [=====] - 1s 4ms/step - loss: 0.1150 - accuracy: 0.9652 - val_loss: 0.1838 - val_accuracy: 0.9606
Epoch 691/800
168/168 [=====] - 1s 4ms/step - loss: 0.1047 - accuracy: 0.9706 - val_loss: 0.1653 - val_accuracy: 0.9650
Epoch 692/800
168/168 [=====] - 1s 4ms/step - loss: 0.1024 - accuracy: 0.9678 - val_loss: 0.1815 - val_accuracy: 0.9643
Epoch 693/800
168/168 [=====] - 1s 5ms/step - loss: 0.1039 - accuracy: 0.9674 - val_loss: 0.1739 - val_accuracy: 0.9665
Epoch 694/800
168/168 [=====] - 1s 5ms/step - loss: 0.1208 - accuracy: 0.9621 - val_loss: 0.1839 - val_accuracy: 0.9643
Epoch 695/800
168/168 [=====] - 1s 4ms/step - loss: 0.1068 - accuracy: 0.9678 - val_loss: 0.1926 - val_accuracy: 0.9635
Epoch 696/800
168/168 [=====] - 1s 4ms/step - loss: 0.1034 - accuracy: 0.9686 - val_loss: 0.2006 - val_accuracy: 0.9621
Epoch 697/800
168/168 [=====] - 1s 5ms/step - loss: 0.1149 - accuracy: 0.9637 - val_loss: 0.1848 - val_accuracy: 0.9635
Epoch 698/800
168/168 [=====] - 1s 4ms/step - loss: 0.1184 - accuracy: 0.9621 - val_loss: 0.1923 - val_accuracy: 0.9583
Epoch 699/800
168/168 [=====] - 1s 5ms/step - loss: 0.1073 - accuracy: 0.9641 - val_loss: 0.1958 - val_accuracy: 0.9576
Epoch 700/800
168/168 [=====] - 1s 5ms/step - loss: 0.1184 - accuracy: 0.9632 - val_loss: 0.1831 - val_accuracy: 0.9628
Epoch 701/800
168/168 [=====] - 1s 4ms/step - loss: 0.1091 - accuracy: 0.9676 - val_loss: 0.2046 - val_accuracy: 0.9591
Epoch 702/800
168/168 [=====] - 1s 5ms/step - loss: 0.1142 - accuracy: 0.9658 - val_loss: 0.1894 - val_accuracy: 0.9591
Epoch 703/800
168/168 [=====] - 1s 5ms/step - loss: 0.0988 - accuracy: 0.9678 - val_loss: 0.2064 - val_accuracy: 0.9621

Epoch 704/800
168/168 [=====] - 1s 4ms/step - loss: 0.1102 - accuracy: 0.9645 - val_loss: 0.1992 - val_accuracy: 0.9621
Epoch 705/800
168/168 [=====] - 1s 5ms/step - loss: 0.1171 - accuracy: 0.9626 - val_loss: 0.1980 - val_accuracy: 0.9598
Epoch 706/800
168/168 [=====] - 1s 5ms/step - loss: 0.1244 - accuracy: 0.9604 - val_loss: 0.1924 - val_accuracy: 0.9606
Epoch 707/800
168/168 [=====] - 1s 5ms/step - loss: 0.1187 - accuracy: 0.9628 - val_loss: 0.1765 - val_accuracy: 0.9621
Epoch 708/800
168/168 [=====] - 1s 5ms/step - loss: 0.1190 - accuracy: 0.9604 - val_loss: 0.1833 - val_accuracy: 0.9635
Epoch 709/800
168/168 [=====] - 1s 5ms/step - loss: 0.0959 - accuracy: 0.9693 - val_loss: 0.1811 - val_accuracy: 0.9658
Epoch 710/800
168/168 [=====] - 1s 5ms/step - loss: 0.1039 - accuracy: 0.9676 - val_loss: 0.1830 - val_accuracy: 0.9635
Epoch 711/800
168/168 [=====] - 1s 4ms/step - loss: 0.1050 - accuracy: 0.9658 - val_loss: 0.2197 - val_accuracy: 0.9509
Epoch 712/800
168/168 [=====] - 1s 5ms/step - loss: 0.1174 - accuracy: 0.9632 - val_loss: 0.1947 - val_accuracy: 0.9546
Epoch 713/800
168/168 [=====] - 1s 5ms/step - loss: 0.1067 - accuracy: 0.9697 - val_loss: 0.1945 - val_accuracy: 0.9621
Epoch 714/800
168/168 [=====] - 1s 5ms/step - loss: 0.1241 - accuracy: 0.9641 - val_loss: 0.2040 - val_accuracy: 0.9598
Epoch 715/800
168/168 [=====] - 1s 7ms/step - loss: 0.1262 - accuracy: 0.9632 - val_loss: 0.2005 - val_accuracy: 0.9568
Epoch 716/800
168/168 [=====] - 2s 9ms/step - loss: 0.1103 - accuracy: 0.9635 - val_loss: 0.1982 - val_accuracy: 0.9583
Epoch 717/800
168/168 [=====] - 1s 4ms/step - loss: 0.1009 - accuracy: 0.9674 - val_loss: 0.2042 - val_accuracy: 0.9613
Epoch 718/800
168/168 [=====] - 1s 5ms/step - loss: 0.1034 - accuracy: 0.9684 - val_loss: 0.1949 - val_accuracy: 0.9576
Epoch 719/800
168/168 [=====] - 1s 4ms/step - loss: 0.1164 - accuracy: 0.9647 - val_loss: 0.1999 - val_accuracy: 0.9598
Epoch 720/800
168/168 [=====] - 1s 5ms/step - loss: 0.1048 - accuracy: 0.9656 - val_loss: 0.1942 - val_accuracy: 0.9658
Epoch 721/800
168/168 [=====] - 1s 5ms/step - loss: 0.1149 - accuracy: 0.9641 - val_loss: 0.1964 - val_accuracy: 0.9591
Epoch 722/800
168/168 [=====] - 1s 5ms/step - loss: 0.1066 - accuracy: 0.9671 - val_loss: 0.2015 - val_accuracy: 0.9554
Epoch 723/800
168/168 [=====] - 1s 4ms/step - loss: 0.1245 - accuracy: 0.9656 - val_loss: 0.1879 - val_accuracy: 0.9621
Epoch 724/800
168/168 [=====] - 1s 5ms/step - loss: 0.1155 - accuracy: 0.9682 - val_loss: 0.1876 - val_accuracy: 0.9591
Epoch 725/800
168/168 [=====] - 1s 4ms/step - loss: 0.1085 - accuracy: 0.9663 - val_loss: 0.1704 - val_accuracy: 0.9635
Epoch 726/800
168/168 [=====] - 1s 5ms/step - loss: 0.1029 - accuracy: 0.9719 - val_loss: 0.1831 - val_accuracy: 0.9606
Epoch 727/800
168/168 [=====] - 1s 5ms/step - loss: 0.1131 - accuracy: 0.9663 - val_loss: 0.1778 - val_accuracy: 0.9628
Epoch 728/800
168/168 [=====] - 1s 5ms/step - loss: 0.1028 - accuracy: 0.9678 - val_loss: 0.1807 - val_accuracy: 0.9606
Epoch 729/800
168/168 [=====] - 1s 5ms/step - loss: 0.0999 - accuracy: 0.9697 - val_loss: 0.1997 - val_accuracy: 0.9583
Epoch 730/800
168/168 [=====] - 1s 5ms/step - loss: 0.1145 - accuracy: 0.9643 - val_loss: 0.1961 - val_accuracy: 0.9606
Epoch 731/800
168/168 [=====] - 1s 5ms/step - loss: 0.1132 - accuracy: 0.9648 - val_loss: 0.1812 - val_accuracy: 0.9643
Epoch 732/800
168/168 [=====] - 1s 4ms/step - loss: 0.1221 - accuracy: 0.9617 - val_loss: 0.1787 - val_accuracy: 0.9583
Epoch 733/800
168/168 [=====] - 1s 5ms/step - loss: 0.0928 - accuracy: 0.9699 - val_loss: 0.1730 - val_accuracy: 0.9650
Epoch 734/800
168/168 [=====] - 1s 5ms/step - loss: 0.1311 - accuracy: 0.9608 - val_loss: 0.1646 - val_accuracy: 0.9621
Epoch 735/800
168/168 [=====] - 1s 5ms/step - loss: 0.1177 - accuracy: 0.9645 - val_loss: 0.2049 - val_accuracy:

y: 0.9568
Epoch 736/800
168/168 [=====] - 1s 4ms/step - loss: 0.1236 - accuracy: 0.9643 - val_loss: 0.2033 - val_accuracy: 0.9568
y: 0.9568
Epoch 737/800
168/168 [=====] - 1s 5ms/step - loss: 0.1249 - accuracy: 0.9617 - val_loss: 0.1741 - val_accuracy: 0.9621
y: 0.9621
Epoch 738/800
168/168 [=====] - 1s 5ms/step - loss: 0.1220 - accuracy: 0.9587 - val_loss: 0.1600 - val_accuracy: 0.9680
y: 0.9680
Epoch 739/800
168/168 [=====] - 1s 5ms/step - loss: 0.1199 - accuracy: 0.9652 - val_loss: 0.1839 - val_accuracy: 0.9606
y: 0.9606
Epoch 740/800
168/168 [=====] - 1s 5ms/step - loss: 0.1074 - accuracy: 0.9656 - val_loss: 0.1776 - val_accuracy: 0.9583
y: 0.9583
Epoch 741/800
168/168 [=====] - 1s 4ms/step - loss: 0.1099 - accuracy: 0.9667 - val_loss: 0.1719 - val_accuracy: 0.9658
y: 0.9658
Epoch 742/800
168/168 [=====] - 1s 5ms/step - loss: 0.1129 - accuracy: 0.9630 - val_loss: 0.1990 - val_accuracy: 0.9591
y: 0.9591
Epoch 743/800
168/168 [=====] - 1s 5ms/step - loss: 0.1141 - accuracy: 0.9619 - val_loss: 0.1714 - val_accuracy: 0.9650
y: 0.9650
Epoch 744/800
168/168 [=====] - 1s 4ms/step - loss: 0.1115 - accuracy: 0.9632 - val_loss: 0.1672 - val_accuracy: 0.9650
y: 0.9650
Epoch 745/800
168/168 [=====] - 1s 5ms/step - loss: 0.1037 - accuracy: 0.9708 - val_loss: 0.1957 - val_accuracy: 0.9613
y: 0.9613
Epoch 746/800
168/168 [=====] - 1s 5ms/step - loss: 0.1216 - accuracy: 0.9632 - val_loss: 0.1642 - val_accuracy: 0.9717
y: 0.9717
Epoch 747/800
168/168 [=====] - 1s 4ms/step - loss: 0.1145 - accuracy: 0.9637 - val_loss: 0.1797 - val_accuracy: 0.9635
y: 0.9635
Epoch 748/800
168/168 [=====] - 1s 4ms/step - loss: 0.1119 - accuracy: 0.9626 - val_loss: 0.1813 - val_accuracy: 0.9606
y: 0.9606
Epoch 749/800
168/168 [=====] - 1s 5ms/step - loss: 0.1162 - accuracy: 0.9628 - val_loss: 0.1847 - val_accuracy: 0.9628
y: 0.9628
Epoch 750/800
168/168 [=====] - 2s 11ms/step - loss: 0.1015 - accuracy: 0.9691 - val_loss: 0.1769 - val_accuracy: 0.9598
y: 0.9598
Epoch 751/800
168/168 [=====] - 1s 5ms/step - loss: 0.1078 - accuracy: 0.9658 - val_loss: 0.1775 - val_accuracy: 0.9606
y: 0.9606
Epoch 752/800
168/168 [=====] - 1s 5ms/step - loss: 0.0996 - accuracy: 0.9686 - val_loss: 0.1903 - val_accuracy: 0.9606
y: 0.9606
Epoch 753/800
168/168 [=====] - 1s 4ms/step - loss: 0.1070 - accuracy: 0.9647 - val_loss: 0.1845 - val_accuracy: 0.9613
y: 0.9613
Epoch 754/800
168/168 [=====] - 1s 5ms/step - loss: 0.1082 - accuracy: 0.9667 - val_loss: 0.2023 - val_accuracy: 0.9554
y: 0.9554
Epoch 755/800
168/168 [=====] - 1s 5ms/step - loss: 0.1285 - accuracy: 0.9602 - val_loss: 0.2007 - val_accuracy: 0.9591
y: 0.9591
Epoch 756/800
168/168 [=====] - 1s 5ms/step - loss: 0.1184 - accuracy: 0.9639 - val_loss: 0.1842 - val_accuracy: 0.9628
y: 0.9628
Epoch 757/800
168/168 [=====] - 1s 4ms/step - loss: 0.1174 - accuracy: 0.9652 - val_loss: 0.1937 - val_accuracy: 0.9613
y: 0.9613
Epoch 758/800
168/168 [=====] - 1s 5ms/step - loss: 0.0981 - accuracy: 0.9699 - val_loss: 0.1672 - val_accuracy: 0.9665
y: 0.9665
Epoch 759/800
168/168 [=====] - 1s 4ms/step - loss: 0.0919 - accuracy: 0.9701 - val_loss: 0.1839 - val_accuracy: 0.9688
y: 0.9688
Epoch 760/800
168/168 [=====] - 1s 4ms/step - loss: 0.0911 - accuracy: 0.9725 - val_loss: 0.1850 - val_accuracy: 0.9665
y: 0.9665
Epoch 761/800
168/168 [=====] - 1s 4ms/step - loss: 0.1127 - accuracy: 0.9645 - val_loss: 0.1840 - val_accuracy: 0.9583
y: 0.9583
Epoch 762/800
168/168 [=====] - 1s 5ms/step - loss: 0.1140 - accuracy: 0.9671 - val_loss: 0.1894 - val_accuracy: 0.9591
y: 0.9591
Epoch 763/800
168/168 [=====] - 1s 5ms/step - loss: 0.1173 - accuracy: 0.9643 - val_loss: 0.1713 - val_accuracy: 0.9680
y: 0.9680
Epoch 764/800
168/168 [=====] - 1s 5ms/step - loss: 0.1101 - accuracy: 0.9647 - val_loss: 0.1814 - val_accuracy: 0.9621
y: 0.9621
Epoch 765/800
168/168 [=====] - 1s 4ms/step - loss: 0.1099 - accuracy: 0.9669 - val_loss: 0.1781 - val_accuracy: 0.9643
y: 0.9643
Epoch 766/800
168/168 [=====] - 1s 5ms/step - loss: 0.0930 - accuracy: 0.9715 - val_loss: 0.1735 - val_accuracy: 0.9628
y: 0.9628
Epoch 767/800

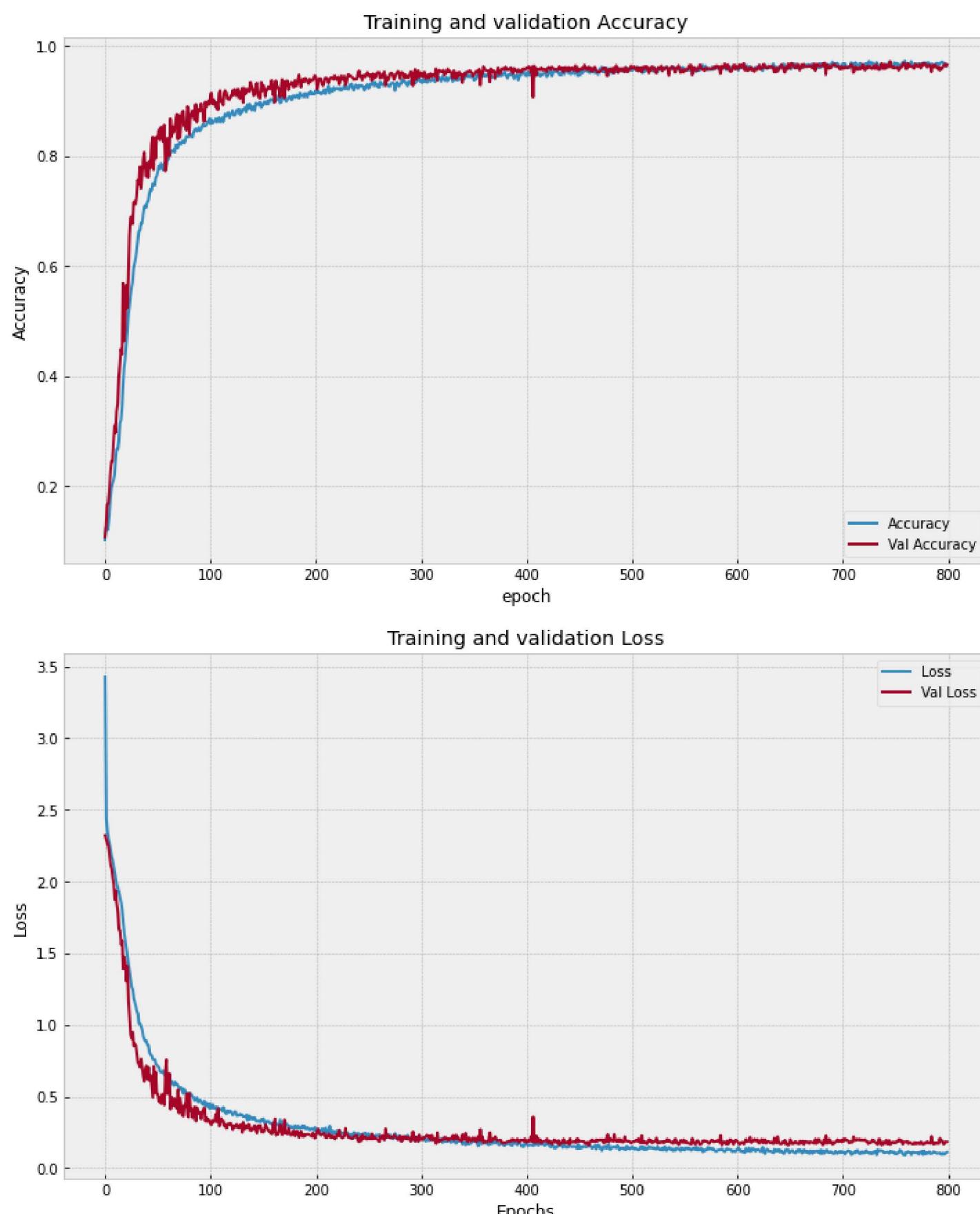
168/168 [=====] - 1s 5ms/step - loss: 0.1128 - accuracy: 0.9652 - val_loss: 0.1678 - val_accuracy: 0.9628
Epoch 768/800
168/168 [=====] - 1s 4ms/step - loss: 0.1131 - accuracy: 0.9660 - val_loss: 0.1695 - val_accuracy: 0.9606
Epoch 769/800
168/168 [=====] - 1s 5ms/step - loss: 0.1081 - accuracy: 0.9669 - val_loss: 0.1804 - val_accuracy: 0.9591
Epoch 770/800
168/168 [=====] - 1s 5ms/step - loss: 0.1099 - accuracy: 0.9661 - val_loss: 0.1694 - val_accuracy: 0.9673
Epoch 771/800
168/168 [=====] - 1s 5ms/step - loss: 0.1069 - accuracy: 0.9650 - val_loss: 0.1771 - val_accuracy: 0.9643
Epoch 772/800
168/168 [=====] - 1s 5ms/step - loss: 0.1106 - accuracy: 0.9641 - val_loss: 0.1729 - val_accuracy: 0.9628
Epoch 773/800
168/168 [=====] - 1s 5ms/step - loss: 0.0979 - accuracy: 0.9680 - val_loss: 0.1780 - val_accuracy: 0.9621
Epoch 774/800
168/168 [=====] - 1s 4ms/step - loss: 0.1145 - accuracy: 0.9645 - val_loss: 0.1693 - val_accuracy: 0.9665
Epoch 775/800
168/168 [=====] - 1s 4ms/step - loss: 0.1068 - accuracy: 0.9665 - val_loss: 0.1857 - val_accuracy: 0.9598
Epoch 776/800
168/168 [=====] - 1s 4ms/step - loss: 0.1205 - accuracy: 0.9643 - val_loss: 0.1787 - val_accuracy: 0.9621
Epoch 777/800
168/168 [=====] - 1s 5ms/step - loss: 0.0953 - accuracy: 0.9691 - val_loss: 0.1652 - val_accuracy: 0.9680
Epoch 778/800
168/168 [=====] - 1s 5ms/step - loss: 0.1229 - accuracy: 0.9652 - val_loss: 0.1703 - val_accuracy: 0.9665
Epoch 779/800
168/168 [=====] - 1s 5ms/step - loss: 0.0991 - accuracy: 0.9695 - val_loss: 0.1778 - val_accuracy: 0.9680
Epoch 780/800
168/168 [=====] - 1s 5ms/step - loss: 0.1097 - accuracy: 0.9684 - val_loss: 0.1746 - val_accuracy: 0.9650
Epoch 781/800
168/168 [=====] - 1s 4ms/step - loss: 0.1034 - accuracy: 0.9673 - val_loss: 0.1868 - val_accuracy: 0.9613
Epoch 782/800
168/168 [=====] - 1s 5ms/step - loss: 0.1080 - accuracy: 0.9699 - val_loss: 0.1757 - val_accuracy: 0.9643
Epoch 783/800
168/168 [=====] - 1s 5ms/step - loss: 0.1167 - accuracy: 0.9656 - val_loss: 0.1784 - val_accuracy: 0.9650
Epoch 784/800
168/168 [=====] - 1s 4ms/step - loss: 0.1016 - accuracy: 0.9663 - val_loss: 0.1741 - val_accuracy: 0.9643
Epoch 785/800
168/168 [=====] - 1s 5ms/step - loss: 0.1031 - accuracy: 0.9669 - val_loss: 0.2221 - val_accuracy: 0.9524
Epoch 786/800
168/168 [=====] - 1s 5ms/step - loss: 0.1051 - accuracy: 0.9665 - val_loss: 0.1816 - val_accuracy: 0.9635
Epoch 787/800
168/168 [=====] - 1s 4ms/step - loss: 0.1177 - accuracy: 0.9656 - val_loss: 0.1666 - val_accuracy: 0.9650
Epoch 788/800
168/168 [=====] - 1s 5ms/step - loss: 0.1124 - accuracy: 0.9654 - val_loss: 0.1779 - val_accuracy: 0.9613
Epoch 789/800
168/168 [=====] - 2s 11ms/step - loss: 0.1123 - accuracy: 0.9650 - val_loss: 0.1721 - val_accuracy: 0.9650
Epoch 790/800
168/168 [=====] - 1s 5ms/step - loss: 0.1036 - accuracy: 0.9684 - val_loss: 0.1779 - val_accuracy: 0.9613
Epoch 791/800
168/168 [=====] - 1s 5ms/step - loss: 0.1049 - accuracy: 0.9680 - val_loss: 0.1733 - val_accuracy: 0.9591
Epoch 792/800
168/168 [=====] - 1s 5ms/step - loss: 0.1062 - accuracy: 0.9656 - val_loss: 0.1732 - val_accuracy: 0.9621
Epoch 793/800
168/168 [=====] - 1s 4ms/step - loss: 0.1087 - accuracy: 0.9682 - val_loss: 0.2100 - val_accuracy: 0.9554
Epoch 794/800
168/168 [=====] - 1s 5ms/step - loss: 0.0984 - accuracy: 0.9693 - val_loss: 0.1946 - val_accuracy: 0.9591
Epoch 795/800
168/168 [=====] - 1s 4ms/step - loss: 0.0962 - accuracy: 0.9708 - val_loss: 0.1935 - val_accuracy: 0.9583
Epoch 796/800
168/168 [=====] - 1s 5ms/step - loss: 0.1076 - accuracy: 0.9680 - val_loss: 0.1726 - val_accuracy: 0.9621
Epoch 797/800
168/168 [=====] - 1s 4ms/step - loss: 0.0982 - accuracy: 0.9688 - val_loss: 0.1669 - val_accuracy: 0.9643
Epoch 798/800
168/168 [=====] - 1s 4ms/step - loss: 0.1003 - accuracy: 0.9680 - val_loss: 0.1867 - val_accuracy: 0.9665

```

Epoch 799/800
168/168 [=====] - 1s 4ms/step - loss: 0.1096 - accuracy: 0.9637 - val_loss: 0.1824 - val_accuracy: 0.9628
Epoch 800/800
168/168 [=====] - 1s 5ms/step - loss: 0.1129 - accuracy: 0.9639 - val_loss: 0.1847 - val_accuracy: 0.9658
Model Fitted

```

In [10]: `summarize_diagnostics(history)`



We can see that we are getting a flat line around 600-800 epochs with accuracy greater than 95%, and both Validation and Training accuracy and loss are close, so there is no underfitting and overfitting, but val_loss is increasing after some 700 epochs, so we should use epochs between 600 and 700. So, this model is good, so we can train our model with these parameters on complete data_train set.

Below are the final functions used to Load, Preprocess amd Train our full data.

In [12]:

```

def final_training_complete(dataX, dataY):
    model = define_model(learn_rate = 0.0007)
    trainX, trainY = dataX, dataY

    # fit model
    history = model.fit(trainX, trainY, epochs = 650, batch_size = 32, verbose=0)
    print("Model Fitted")
    return model, history

```

In [13]:

```

def load_full_dataset():
    # Load dataset
    data_rgb = []
    kernel = np.ones((4,4),np.uint8)
    for i in range(train_data_length):
        data_rgb.append(data_train[:,i].reshape(300,300))
        data_rgb[i] = cv2.medianBlur(data_rgb[i], 3)
        data_rgb[i] = cv2.morphologyEx(data_rgb[i], cv2.MORPH_OPEN, kernel)
        data_rgb[i] = cv2.resize(data_rgb[i], (50,50), interpolation=cv2.INTER_AREA)
    data_rgb = np.array(data_rgb)
    print(data_rgb.shape)

```

```
# reshape dataset to have a single channel
data_rgb = data_rgb.reshape((data_rgb.shape[0], 50,50, 1))

# one hot encode target values
labels = to_categorical(labels_train)
print(data_rgb.shape, labels.shape)
return data_rgb, labels
```

```
In [14]: def prep_final_pixels(data):
    # convert from integers to floats
    data_norm = data.astype('float32')

    # he_uniformize to range 0-1
    data_norm = (data_norm) / 255.0

    # return he_uniformized images
    return data_norm
```

In this cell all final functions are called to train our dataset on all images.

```
In [15]: data, target = load_full_dataset()

# prepare pixel data
data = prep_final_pixels(data)

# training the model
model, history = final_training_complete(data, target)
```

```
(6720, 50, 50)
(6720, 50, 50, 1) (6720, 10)
Model Fitted
```

```
In [16]: plt.figure(figsize=(12,7))
plt.plot(history.history['accuracy'])
plt.plot(history.history['loss'])
plt.title('Training accuracy and Loss')
plt.ylabel('Accuracy and Loss')
plt.xlabel('epoch')
plt.legend(['Accuracy', 'Loss'], loc='center right')
plt.show()
```



```
In [17]: # model.save("Final_CNN")
```

```
2022-04-20 14:16:39.478446: W tensorflow/python/util/util.cc:348] Sets are not currently considered sequences, but this may change in the future, so consider avoiding using them.
INFO:tensorflow:Assets written to: Final_CNN/assets
```

Finally, we saved our model as "Final_CNN" and will use this trained model in our Easy_Test and Hard_Test files.