

Keras_Cifar10_PT

May 5, 2022

1 Hyperparameter tuning for Keras Model with both Dense and Conv layer

1.0.1 Load library

```
[ ]: !pip install scikit-optimize
#imports we know we'll need
import skopt
from skopt import gbrt_minimize, gp_minimize
from skopt.utils import use_named_args
from skopt.space import Real, Categorical, Integer
from tensorflow.python.keras import backend as K
from tensorflow.python.framework import ops
from tensorflow.keras.datasets import cifar10
from keras.utils import np_utils
import tensorflow as tf
import tensorflow.keras
from tensorflow.keras import Input
from tensorflow.keras.optimizers import Adam, SGD
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Flatten, Conv2D, MaxPooling2D

import pandas as pd
import random
import numpy as np
```

Collecting scikit-optimize

Downloading scikit_optimize-0.9.0-py2.py3-none-any.whl (100 kB)

| 100 kB 8.0 MB/s

Collecting pyaml>=16.9

Downloading pyaml-21.10.1-py2.py3-none-any.whl (24 kB)

Requirement already satisfied: joblib>=0.11 in /usr/local/lib/python3.7/dist-packages (from scikit-optimize) (1.1.0)

Requirement already satisfied: scipy>=0.19.1 in /usr/local/lib/python3.7/dist-packages (from scikit-optimize) (1.4.1)

Requirement already satisfied: scikit-learn>=0.20.0 in

/usr/local/lib/python3.7/dist-packages (from scikit-optimize) (1.0.2)

Requirement already satisfied: numpy>=1.13.3 in /usr/local/lib/python3.7/dist-

```

packages (from scikit-optimize) (1.21.6)
Requirement already satisfied: PyYAML in /usr/local/lib/python3.7/dist-packages
(from pyaml>=16.9->scikit-optimize) (3.13)
Requirement already satisfied: threadpoolctl>=2.0.0 in
/usr/local/lib/python3.7/dist-packages (from scikit-learn>=0.20.0->scikit-
optimize) (3.1.0)
Installing collected packages: pyaml, scikit-optimize
Successfully installed pyaml-21.10.1 scikit-optimize-0.9.0

```

1.0.2 Load data

```
[ ]: (X_train, y_train), (X_test, y_test) = cifar10.load_data()
```

```

Downloading data from https://www.cs.toronto.edu/~kriz/cifar-10-python.tar.gz
170500096/170498071 [=====] - 6s 0us/step
170508288/170498071 [=====] - 6s 0us/step

```

Scale the data to between 0 & 1

```
[ ]: X_train = X_train/ 255
X_test = X_test/ 255
print(X_train.min(),X_train.max())
```

```
0.0 1.0
```

Convert the y's to used with softmax function

```
[ ]: y_train.shape
```

```
[ ]: (50000, 1)
```

```
[ ]: input_shape= X_train[0].shape
print(input_shape)
```

```
(32, 32, 3)
```

```
[ ]: y_train = np_utils.to_categorical(y_train, 10)
y_test = np_utils.to_categorical(y_test, 10)
```

1.1 Checking result against a baseline

```
[ ]: model =Sequential()
model.add(Conv2D(32, (3, 3), activation='relu',
↳kernel_initializer='he_uniform', padding='same', input_shape=(32, 32, 3)))
model.add(Conv2D(32, (3, 3), activation='relu',
↳kernel_initializer='he_uniform', padding='same'))
model.add(MaxPooling2D((2, 2)))
model.add(Flatten())
model.add(Dense(16, activation='relu',name = 'input_layer'))
```

```

model.add(Dense(16, activation='relu', name="hidden_layer"))

model.add(Dense(10, activation='softmax', name="output_layer"))
model.compile(optimizer = SGD(learning_rate = 0.001),
↳loss='categorical_crossentropy', metrics=["accuracy"])
model.summary()

```

Model: "sequential"

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 32, 32, 32)	896
conv2d_1 (Conv2D)	(None, 32, 32, 32)	9248
max_pooling2d (MaxPooling2D)	(None, 16, 16, 32)	0
flatten (Flatten)	(None, 8192)	0
input_layer (Dense)	(None, 16)	131088
hidden_layer (Dense)	(None, 16)	272
output_layer (Dense)	(None, 10)	170
Total params: 141,674		
Trainable params: 141,674		
Non-trainable params: 0		

```

[ ]: early_S = tf.keras.callbacks.EarlyStopping(monitor='loss', patience=10)
blackbox = model.fit(X_train, y_train, batch_size=128, epochs = 30,
↳validation_split=.15, callbacks = [early_S])

```

Epoch 1/30

333/333 [=====] - 15s 9ms/step - loss: 2.2473 - accuracy: 0.1476 - val_loss: 2.2160 - val_accuracy: 0.1620

Epoch 2/30

333/333 [=====] - 2s 7ms/step - loss: 2.1813 - accuracy: 0.1753 - val_loss: 2.2665 - val_accuracy: 0.1420

Epoch 3/30

333/333 [=====] - 3s 8ms/step - loss: 2.1319 - accuracy: 0.1967 - val_loss: 2.1591 - val_accuracy: 0.1864

Epoch 4/30

333/333 [=====] - 2s 7ms/step - loss: 2.0918 -

accuracy: 0.2112 - val_loss: 2.0947 - val_accuracy: 0.2168
 Epoch 5/30
 333/333 [=====] - 2s 7ms/step - loss: 2.0544 -
 accuracy: 0.2296 - val_loss: 2.0716 - val_accuracy: 0.2463
 Epoch 6/30
 333/333 [=====] - 3s 8ms/step - loss: 2.0174 -
 accuracy: 0.2541 - val_loss: 2.0971 - val_accuracy: 0.2272
 Epoch 7/30
 333/333 [=====] - 3s 8ms/step - loss: 1.9827 -
 accuracy: 0.2806 - val_loss: 1.9839 - val_accuracy: 0.2848
 Epoch 8/30
 333/333 [=====] - 3s 8ms/step - loss: 1.9532 -
 accuracy: 0.2961 - val_loss: 1.9661 - val_accuracy: 0.2843
 Epoch 9/30
 333/333 [=====] - 3s 8ms/step - loss: 1.9278 -
 accuracy: 0.3082 - val_loss: 2.0494 - val_accuracy: 0.2504
 Epoch 10/30
 333/333 [=====] - 3s 8ms/step - loss: 1.9052 -
 accuracy: 0.3161 - val_loss: 2.0570 - val_accuracy: 0.2692
 Epoch 11/30
 333/333 [=====] - 3s 8ms/step - loss: 1.8850 -
 accuracy: 0.3256 - val_loss: 1.9943 - val_accuracy: 0.2827
 Epoch 12/30
 333/333 [=====] - 3s 8ms/step - loss: 1.8647 -
 accuracy: 0.3346 - val_loss: 2.0650 - val_accuracy: 0.2363
 Epoch 13/30
 333/333 [=====] - 3s 8ms/step - loss: 1.8463 -
 accuracy: 0.3443 - val_loss: 2.2353 - val_accuracy: 0.1873
 Epoch 14/30
 333/333 [=====] - 3s 8ms/step - loss: 1.8261 -
 accuracy: 0.3512 - val_loss: 2.2737 - val_accuracy: 0.1887
 Epoch 15/30
 333/333 [=====] - 3s 8ms/step - loss: 1.8068 -
 accuracy: 0.3584 - val_loss: 1.9012 - val_accuracy: 0.3043
 Epoch 16/30
 333/333 [=====] - 3s 8ms/step - loss: 1.7839 -
 accuracy: 0.3666 - val_loss: 2.1885 - val_accuracy: 0.2411
 Epoch 17/30
 333/333 [=====] - 3s 8ms/step - loss: 1.7642 -
 accuracy: 0.3765 - val_loss: 2.0242 - val_accuracy: 0.2500
 Epoch 18/30
 333/333 [=====] - 3s 8ms/step - loss: 1.7437 -
 accuracy: 0.3831 - val_loss: 1.8908 - val_accuracy: 0.3209
 Epoch 19/30
 333/333 [=====] - 2s 7ms/step - loss: 1.7223 -
 accuracy: 0.3922 - val_loss: 2.2224 - val_accuracy: 0.2331
 Epoch 20/30
 333/333 [=====] - 2s 7ms/step - loss: 1.7016 -

```

accuracy: 0.3976 - val_loss: 1.7550 - val_accuracy: 0.3743
Epoch 21/30
333/333 [=====] - 3s 8ms/step - loss: 1.6801 -
accuracy: 0.4038 - val_loss: 1.9734 - val_accuracy: 0.3023
Epoch 22/30
333/333 [=====] - 3s 8ms/step - loss: 1.6609 -
accuracy: 0.4103 - val_loss: 3.2200 - val_accuracy: 0.2009
Epoch 23/30
333/333 [=====] - 3s 8ms/step - loss: 1.6497 -
accuracy: 0.4162 - val_loss: 1.7762 - val_accuracy: 0.3633
Epoch 24/30
333/333 [=====] - 3s 8ms/step - loss: 1.6273 -
accuracy: 0.4214 - val_loss: 2.5049 - val_accuracy: 0.2321
Epoch 25/30
333/333 [=====] - 3s 8ms/step - loss: 1.6132 -
accuracy: 0.4270 - val_loss: 2.8547 - val_accuracy: 0.1963
Epoch 26/30
333/333 [=====] - 3s 8ms/step - loss: 1.6014 -
accuracy: 0.4292 - val_loss: 2.1567 - val_accuracy: 0.2607
Epoch 27/30
333/333 [=====] - 3s 8ms/step - loss: 1.5850 -
accuracy: 0.4349 - val_loss: 1.6647 - val_accuracy: 0.3917
Epoch 28/30
333/333 [=====] - 3s 8ms/step - loss: 1.5723 -
accuracy: 0.4366 - val_loss: 2.7354 - val_accuracy: 0.1839
Epoch 29/30
333/333 [=====] - 3s 8ms/step - loss: 1.5613 -
accuracy: 0.4437 - val_loss: 1.6691 - val_accuracy: 0.3823
Epoch 30/30
333/333 [=====] - 3s 8ms/step - loss: 1.5496 -
accuracy: 0.4456 - val_loss: 1.8042 - val_accuracy: 0.3565

```

```
[ ]: accuracy = model.evaluate(X_test,y_test)[1]
      print(accuracy)
```

```

313/313 [=====] - 1s 3ms/step - loss: 1.8045 -
accuracy: 0.3565
0.3564999997615814

```

1.1.1 Hyperparameter space

```
[ ]: dim_learning_rate = Real(low=1e-4, high=1e-1, prior='log-uniform',
                             name='learning_rate')
dim_num_conv_layers = Integer(low=1, high=3, name='num_conv_layers')
dim_num_dense_layers = Integer(low=1, high=5, name='num_dense_layers')
dim_num_dense_nodes = Integer(low=1, high=28, name='num_dense_nodes')
dim_activation = Categorical(categories=['relu', 'sigmoid'],
                              name='activation')
```

```

dim_batch_size = Integer(low=1, high=128, name='batch_size')

dimensions = [dim_learning_rate,
              dim_num_conv_layers,
              dim_num_dense_layers,
              dim_num_dense_nodes,
              dim_activation,
              dim_batch_size
              ]
default_parameters = [1e-3,1, 1, 13, 'relu',64]

```

1.1.2 Create Model

```

[ ]: def create_model(learning_rate, num_conv_layers, num_dense_layers,
                    num_dense_nodes, activation):
    #start the model making process and create our first layer
    model = Sequential()
    model.add(Input(shape=(32,32,3)))
    #create a loop making a new dense layer for the amount passed to this model.
    #naming the layers helps avoid tensorflow error deep in the stack trace.

    for i in range(num_conv_layers):
        name = 'layer_conv_1_{0}'.format(i+1)
        if i == 0: node = 32
        elif i == 1: node = 64
        else: node = 128
        model.add(Conv2D(node, (3, 3), activation='relu',
                        kernel_initializer='he_uniform', padding='same',
                        name=name))
        name = 'layer_conv_2_{0}'.format(i+1)
        model.add(Conv2D(node, (3, 3), activation='relu',
                        kernel_initializer='he_uniform', padding='same',
                        name=name))
        model.add(MaxPooling2D((2, 2)))

    model.add(Flatten())

    for i in range(num_dense_layers):
        name = 'layer_dense_{0}'.format(i+1)
        model.add(Dense(num_dense_nodes,
                        activation=activation,
                        name=name
                        ))
    #add our classification layer.
    model.add(Dense(10,activation='softmax'))

    #setup our optimizer and compile

```

```
sgd = SGD(learning_rate=learning_rate)
model.compile(optimizer=sgd, loss='categorical_crossentropy',
              metrics=['accuracy'])
return model
```

1.1.3 Objective function

```
[ ]: @use_named_args(dimensions=dimensions)
def fitness(learning_rate, num_conv_layers, num_dense_layers,
            num_dense_nodes, activation, batch_size):

    model = create_model(learning_rate=learning_rate,
                          num_conv_layers = num_conv_layers,
                          num_dense_layers=num_dense_layers,
                          num_dense_nodes=num_dense_nodes,
                          activation=activation
                        )

    early_S = tf.keras.callbacks.EarlyStopping(monitor='loss', patience=10)
    #named blackbox becuae it represents the structure
    blackbox = model.fit(x=X_train,
                        y=y_train,
                        epochs=25,
                        batch_size=batch_size,
                        validation_split=0.15,
                        callbacks = [early_S]
                      )

    #return the validation accuracy for the last epoch.
    accuracy = blackbox.history['val_accuracy'][-1]

    # Print the classification accuracy.
    print()
    print("Accuracy: {0:.2%}".format(accuracy))
    print()

    # Delete the Keras model with these hyper-parameters from memory.
    del model

    # Clear the Keras session, otherwise it will keep adding new
# models to the same TensorFlow graph each time we create
# a model with a different set of hyper-parameters.
    K.clear_session()
    ops.reset_default_graph()

    return -accuracy
```

1.1.4 Run the optimizer

```
[ ]: gp_result = gp_minimize(func=fitness,
                             dimensions=dimensions,
                             n_calls=50,
                             noise= 0.01,
                             n_jobs=-1,
                             verbose=True,
                             kappa = 5,
                             x0=default_parameters)
```

Iteration No: 1 started. Evaluating function at provided point.

Epoch 1/25

665/665 [=====] - 4s 6ms/step - loss: 2.2175 -
accuracy: 0.1679 - val_loss: 2.1806 - val_accuracy: 0.1976

Epoch 2/25

665/665 [=====] - 3s 5ms/step - loss: 2.1135 -
accuracy: 0.2275 - val_loss: 2.0751 - val_accuracy: 0.2365

Epoch 3/25

665/665 [=====] - 3s 5ms/step - loss: 2.0105 -
accuracy: 0.2828 - val_loss: 2.0312 - val_accuracy: 0.2729

Epoch 4/25

665/665 [=====] - 3s 5ms/step - loss: 1.9014 -
accuracy: 0.3293 - val_loss: 1.9398 - val_accuracy: 0.2904

Epoch 5/25

665/665 [=====] - 3s 5ms/step - loss: 1.8278 -
accuracy: 0.3553 - val_loss: 2.0583 - val_accuracy: 0.2635

Epoch 6/25

665/665 [=====] - 3s 5ms/step - loss: 1.7774 -
accuracy: 0.3740 - val_loss: 1.7776 - val_accuracy: 0.3708

Epoch 7/25

665/665 [=====] - 3s 5ms/step - loss: 1.7357 -
accuracy: 0.3918 - val_loss: 1.8607 - val_accuracy: 0.3348

Epoch 8/25

665/665 [=====] - 3s 5ms/step - loss: 1.6987 -
accuracy: 0.4016 - val_loss: 1.8819 - val_accuracy: 0.3372

Epoch 9/25

665/665 [=====] - 3s 5ms/step - loss: 1.6643 -
accuracy: 0.4126 - val_loss: 1.7517 - val_accuracy: 0.3541

Epoch 10/25

665/665 [=====] - 3s 5ms/step - loss: 1.6319 -
accuracy: 0.4250 - val_loss: 1.7058 - val_accuracy: 0.3819

Epoch 11/25

665/665 [=====] - 3s 5ms/step - loss: 1.6021 -
accuracy: 0.4333 - val_loss: 2.3807 - val_accuracy: 0.2232

Epoch 12/25

665/665 [=====] - 3s 5ms/step - loss: 1.5737 -
accuracy: 0.4414 - val_loss: 1.6982 - val_accuracy: 0.3789

Epoch 13/25
665/665 [=====] - 3s 5ms/step - loss: 1.5459 -
accuracy: 0.4502 - val_loss: 1.6361 - val_accuracy: 0.3983
Epoch 14/25
665/665 [=====] - 3s 5ms/step - loss: 1.5204 -
accuracy: 0.4593 - val_loss: 1.6256 - val_accuracy: 0.3991
Epoch 15/25
665/665 [=====] - 3s 5ms/step - loss: 1.4946 -
accuracy: 0.4664 - val_loss: 1.6735 - val_accuracy: 0.3891
Epoch 16/25
665/665 [=====] - 3s 5ms/step - loss: 1.4728 -
accuracy: 0.4750 - val_loss: 1.6854 - val_accuracy: 0.3949
Epoch 17/25
665/665 [=====] - 3s 5ms/step - loss: 1.4512 -
accuracy: 0.4819 - val_loss: 1.6634 - val_accuracy: 0.4033
Epoch 18/25
665/665 [=====] - 3s 5ms/step - loss: 1.4329 -
accuracy: 0.4901 - val_loss: 1.5266 - val_accuracy: 0.4432
Epoch 19/25
665/665 [=====] - 3s 5ms/step - loss: 1.4143 -
accuracy: 0.4953 - val_loss: 1.4621 - val_accuracy: 0.4739
Epoch 20/25
665/665 [=====] - 3s 5ms/step - loss: 1.3972 -
accuracy: 0.5012 - val_loss: 1.5173 - val_accuracy: 0.4477
Epoch 21/25
665/665 [=====] - 3s 5ms/step - loss: 1.3826 -
accuracy: 0.5072 - val_loss: 1.8681 - val_accuracy: 0.3388
Epoch 22/25
665/665 [=====] - 3s 5ms/step - loss: 1.3676 -
accuracy: 0.5105 - val_loss: 1.6712 - val_accuracy: 0.4065
Epoch 23/25
665/665 [=====] - 3s 5ms/step - loss: 1.3538 -
accuracy: 0.5185 - val_loss: 1.5963 - val_accuracy: 0.4356
Epoch 24/25
665/665 [=====] - 3s 5ms/step - loss: 1.3413 -
accuracy: 0.5215 - val_loss: 1.4116 - val_accuracy: 0.4980
Epoch 25/25
665/665 [=====] - 3s 5ms/step - loss: 1.3288 -
accuracy: 0.5272 - val_loss: 1.3867 - val_accuracy: 0.5028

Accuracy: 50.28%

Iteration No: 1 ended. Evaluation done at provided point.
Time taken: 85.3309
Function value obtained: -0.5028
Current minimum: -0.5028
Iteration No: 2 started. Evaluating function at random point.
Epoch 1/25

1037/1037 [=====] - 7s 6ms/step - loss: 2.1924 - accuracy: 0.1899 - val_loss: 2.0728 - val_accuracy: 0.2337
Epoch 2/25
1037/1037 [=====] - 6s 5ms/step - loss: 1.8880 - accuracy: 0.3208 - val_loss: 1.7842 - val_accuracy: 0.3507
Epoch 3/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.6686 - accuracy: 0.3985 - val_loss: 1.6658 - val_accuracy: 0.3969
Epoch 4/25
1037/1037 [=====] - 6s 5ms/step - loss: 1.5313 - accuracy: 0.4433 - val_loss: 1.6300 - val_accuracy: 0.4051
Epoch 5/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.4422 - accuracy: 0.4720 - val_loss: 1.4613 - val_accuracy: 0.4731
Epoch 6/25
1037/1037 [=====] - 6s 5ms/step - loss: 1.3740 - accuracy: 0.4987 - val_loss: 1.4774 - val_accuracy: 0.4771
Epoch 7/25
1037/1037 [=====] - 6s 5ms/step - loss: 1.3156 - accuracy: 0.5195 - val_loss: 1.3527 - val_accuracy: 0.5097
Epoch 8/25
1037/1037 [=====] - 6s 5ms/step - loss: 1.2667 - accuracy: 0.5369 - val_loss: 1.3212 - val_accuracy: 0.5249
Epoch 9/25
1037/1037 [=====] - 6s 5ms/step - loss: 1.2205 - accuracy: 0.5558 - val_loss: 1.2793 - val_accuracy: 0.5387
Epoch 10/25
1037/1037 [=====] - 6s 5ms/step - loss: 1.1765 - accuracy: 0.5748 - val_loss: 1.2348 - val_accuracy: 0.5579
Epoch 11/25
1037/1037 [=====] - 6s 5ms/step - loss: 1.1380 - accuracy: 0.5889 - val_loss: 1.1884 - val_accuracy: 0.5769
Epoch 12/25
1037/1037 [=====] - 6s 5ms/step - loss: 1.1011 - accuracy: 0.6033 - val_loss: 1.2959 - val_accuracy: 0.5313
Epoch 13/25
1037/1037 [=====] - 6s 5ms/step - loss: 1.0660 - accuracy: 0.6162 - val_loss: 1.1449 - val_accuracy: 0.5999
Epoch 14/25
1037/1037 [=====] - 6s 5ms/step - loss: 1.0360 - accuracy: 0.6318 - val_loss: 1.1530 - val_accuracy: 0.5943
Epoch 15/25
1037/1037 [=====] - 6s 5ms/step - loss: 1.0064 - accuracy: 0.6407 - val_loss: 1.0931 - val_accuracy: 0.6149
Epoch 16/25
1037/1037 [=====] - 6s 5ms/step - loss: 0.9775 - accuracy: 0.6512 - val_loss: 1.0821 - val_accuracy: 0.6216
Epoch 17/25

1037/1037 [=====] - 6s 5ms/step - loss: 0.9489 -
accuracy: 0.6644 - val_loss: 1.0734 - val_accuracy: 0.6240
Epoch 18/25
1037/1037 [=====] - 6s 5ms/step - loss: 0.9227 -
accuracy: 0.6735 - val_loss: 1.0593 - val_accuracy: 0.6333
Epoch 19/25
1037/1037 [=====] - 6s 5ms/step - loss: 0.9020 -
accuracy: 0.6796 - val_loss: 1.0209 - val_accuracy: 0.6419
Epoch 20/25
1037/1037 [=====] - 6s 5ms/step - loss: 0.8780 -
accuracy: 0.6900 - val_loss: 1.0392 - val_accuracy: 0.6405
Epoch 21/25
1037/1037 [=====] - 6s 5ms/step - loss: 0.8564 -
accuracy: 0.6962 - val_loss: 1.0045 - val_accuracy: 0.6515
Epoch 22/25
1037/1037 [=====] - 6s 5ms/step - loss: 0.8352 -
accuracy: 0.7052 - val_loss: 1.0071 - val_accuracy: 0.6537
Epoch 23/25
1037/1037 [=====] - 6s 5ms/step - loss: 0.8146 -
accuracy: 0.7124 - val_loss: 1.0669 - val_accuracy: 0.6336
Epoch 24/25
1037/1037 [=====] - 6s 5ms/step - loss: 0.7959 -
accuracy: 0.7169 - val_loss: 1.0124 - val_accuracy: 0.6577
Epoch 25/25
1037/1037 [=====] - 6s 5ms/step - loss: 0.7773 -
accuracy: 0.7246 - val_loss: 0.9926 - val_accuracy: 0.6519

Accuracy: 65.19%

Iteration No: 2 ended. Evaluation done at random point.

Time taken: 143.9982

Function value obtained: -0.6519

Current minimum: -0.6519

Iteration No: 3 started. Evaluating function at random point.

Epoch 1/25

686/686 [=====] - 7s 8ms/step - loss: 2.2797 -
accuracy: 0.1195 - val_loss: 2.2148 - val_accuracy: 0.1463

Epoch 2/25

686/686 [=====] - 5s 8ms/step - loss: 2.1329 -
accuracy: 0.1800 - val_loss: 2.0356 - val_accuracy: 0.1979

Epoch 3/25

686/686 [=====] - 5s 8ms/step - loss: 2.0050 -
accuracy: 0.1998 - val_loss: 1.9829 - val_accuracy: 0.2017

Epoch 4/25

686/686 [=====] - 5s 8ms/step - loss: 1.9330 -
accuracy: 0.2030 - val_loss: 1.9269 - val_accuracy: 0.2021

Epoch 5/25

686/686 [=====] - 5s 7ms/step - loss: 1.8918 -

accuracy: 0.2072 - val_loss: 2.0790 - val_accuracy: 0.1696
 Epoch 6/25
 686/686 [=====] - 5s 8ms/step - loss: 1.8642 -
 accuracy: 0.2105 - val_loss: 1.8526 - val_accuracy: 0.2135
 Epoch 7/25
 686/686 [=====] - 5s 7ms/step - loss: 1.8379 -
 accuracy: 0.2116 - val_loss: 1.8510 - val_accuracy: 0.2091
 Epoch 8/25
 686/686 [=====] - 5s 8ms/step - loss: 1.8181 -
 accuracy: 0.2158 - val_loss: 1.8410 - val_accuracy: 0.2227
 Epoch 9/25
 686/686 [=====] - 5s 8ms/step - loss: 1.8021 -
 accuracy: 0.2205 - val_loss: 1.8728 - val_accuracy: 0.2167
 Epoch 10/25
 686/686 [=====] - 5s 7ms/step - loss: 1.7835 -
 accuracy: 0.2224 - val_loss: 1.8052 - val_accuracy: 0.2128
 Epoch 11/25
 686/686 [=====] - 5s 8ms/step - loss: 1.7664 -
 accuracy: 0.2288 - val_loss: 1.8266 - val_accuracy: 0.2125
 Epoch 12/25
 686/686 [=====] - 5s 8ms/step - loss: 1.7475 -
 accuracy: 0.2408 - val_loss: 1.8105 - val_accuracy: 0.2436
 Epoch 13/25
 686/686 [=====] - 5s 8ms/step - loss: 1.7310 -
 accuracy: 0.2453 - val_loss: 1.8010 - val_accuracy: 0.2307
 Epoch 14/25
 686/686 [=====] - 5s 8ms/step - loss: 1.7102 -
 accuracy: 0.2592 - val_loss: 1.8177 - val_accuracy: 0.2449
 Epoch 15/25
 686/686 [=====] - 5s 7ms/step - loss: 1.6928 -
 accuracy: 0.2648 - val_loss: 1.8323 - val_accuracy: 0.2452
 Epoch 16/25
 686/686 [=====] - 5s 7ms/step - loss: 1.6732 -
 accuracy: 0.2755 - val_loss: 1.7826 - val_accuracy: 0.2603
 Epoch 17/25
 686/686 [=====] - 5s 7ms/step - loss: 1.6638 -
 accuracy: 0.2795 - val_loss: 1.7665 - val_accuracy: 0.2576
 Epoch 18/25
 686/686 [=====] - 5s 7ms/step - loss: 1.6356 -
 accuracy: 0.2910 - val_loss: 1.7773 - val_accuracy: 0.2693
 Epoch 19/25
 686/686 [=====] - 5s 8ms/step - loss: 1.6162 -
 accuracy: 0.3030 - val_loss: 1.8011 - val_accuracy: 0.2456
 Epoch 20/25
 686/686 [=====] - 5s 8ms/step - loss: 1.6026 -
 accuracy: 0.3032 - val_loss: 1.7573 - val_accuracy: 0.2771
 Epoch 21/25
 686/686 [=====] - 5s 8ms/step - loss: 1.5808 -

accuracy: 0.3136 - val_loss: 1.7588 - val_accuracy: 0.2800
Epoch 22/25
686/686 [=====] - 5s 8ms/step - loss: 1.5619 -
accuracy: 0.3292 - val_loss: 1.7995 - val_accuracy: 0.2932
Epoch 23/25
686/686 [=====] - 5s 8ms/step - loss: 1.5411 -
accuracy: 0.3499 - val_loss: 1.8687 - val_accuracy: 0.2989
Epoch 24/25
686/686 [=====] - 5s 8ms/step - loss: 1.5291 -
accuracy: 0.3664 - val_loss: 1.8089 - val_accuracy: 0.2916
Epoch 25/25
686/686 [=====] - 5s 8ms/step - loss: 1.5196 -
accuracy: 0.3752 - val_loss: 1.8493 - val_accuracy: 0.3265

Accuracy: 32.65%

Iteration No: 3 ended. Evaluation done at random point.

Time taken: 131.5137

Function value obtained: -0.3265

Current minimum: -0.6519

Iteration No: 4 started. Evaluating function at random point.

Epoch 1/25
802/802 [=====] - 5s 5ms/step - loss: 2.2962 -
accuracy: 0.1062 - val_loss: 2.2547 - val_accuracy: 0.1339
Epoch 2/25
802/802 [=====] - 4s 5ms/step - loss: 1.9956 -
accuracy: 0.2675 - val_loss: 1.7450 - val_accuracy: 0.3393
Epoch 3/25
802/802 [=====] - 4s 5ms/step - loss: 1.6607 -
accuracy: 0.3634 - val_loss: 1.5178 - val_accuracy: 0.4375
Epoch 4/25
802/802 [=====] - 4s 5ms/step - loss: 1.4066 -
accuracy: 0.4781 - val_loss: 1.3812 - val_accuracy: 0.5043
Epoch 5/25
802/802 [=====] - 4s 5ms/step - loss: 1.2228 -
accuracy: 0.5533 - val_loss: 1.1960 - val_accuracy: 0.5788
Epoch 6/25
802/802 [=====] - 4s 5ms/step - loss: 1.1060 -
accuracy: 0.6000 - val_loss: 1.1439 - val_accuracy: 0.5887
Epoch 7/25
802/802 [=====] - 4s 5ms/step - loss: 1.0184 -
accuracy: 0.6337 - val_loss: 1.0450 - val_accuracy: 0.6320
Epoch 8/25
802/802 [=====] - 4s 5ms/step - loss: 0.9489 -
accuracy: 0.6572 - val_loss: 1.1048 - val_accuracy: 0.6159
Epoch 9/25
802/802 [=====] - 4s 5ms/step - loss: 0.8881 -
accuracy: 0.6819 - val_loss: 1.0955 - val_accuracy: 0.6248

Epoch 10/25
802/802 [=====] - 4s 5ms/step - loss: 0.8367 -
accuracy: 0.7007 - val_loss: 1.0817 - val_accuracy: 0.6317
Epoch 11/25
802/802 [=====] - 4s 5ms/step - loss: 0.7900 -
accuracy: 0.7179 - val_loss: 1.3264 - val_accuracy: 0.5716
Epoch 12/25
802/802 [=====] - 4s 5ms/step - loss: 0.7443 -
accuracy: 0.7350 - val_loss: 1.1277 - val_accuracy: 0.6281
Epoch 13/25
802/802 [=====] - 4s 5ms/step - loss: 0.7058 -
accuracy: 0.7472 - val_loss: 1.2128 - val_accuracy: 0.6104
Epoch 14/25
802/802 [=====] - 4s 5ms/step - loss: 0.6626 -
accuracy: 0.7629 - val_loss: 1.1715 - val_accuracy: 0.6257
Epoch 15/25
802/802 [=====] - 4s 5ms/step - loss: 0.6302 -
accuracy: 0.7761 - val_loss: 1.2455 - val_accuracy: 0.6241
Epoch 16/25
802/802 [=====] - 4s 5ms/step - loss: 0.5961 -
accuracy: 0.7852 - val_loss: 1.2960 - val_accuracy: 0.6228
Epoch 17/25
802/802 [=====] - 4s 5ms/step - loss: 0.5676 -
accuracy: 0.7965 - val_loss: 1.3209 - val_accuracy: 0.6172
Epoch 18/25
802/802 [=====] - 4s 5ms/step - loss: 0.5447 -
accuracy: 0.8057 - val_loss: 1.3404 - val_accuracy: 0.6131
Epoch 19/25
802/802 [=====] - 4s 5ms/step - loss: 0.5192 -
accuracy: 0.8129 - val_loss: 1.3479 - val_accuracy: 0.6152
Epoch 20/25
802/802 [=====] - 4s 5ms/step - loss: 0.4979 -
accuracy: 0.8218 - val_loss: 1.3965 - val_accuracy: 0.6053
Epoch 21/25
802/802 [=====] - 4s 5ms/step - loss: 0.4707 -
accuracy: 0.8325 - val_loss: 1.5038 - val_accuracy: 0.6039
Epoch 22/25
802/802 [=====] - 4s 5ms/step - loss: 0.4534 -
accuracy: 0.8386 - val_loss: 1.4461 - val_accuracy: 0.6268
Epoch 23/25
802/802 [=====] - 4s 5ms/step - loss: 0.4387 -
accuracy: 0.8435 - val_loss: 1.5373 - val_accuracy: 0.6049
Epoch 24/25
802/802 [=====] - 4s 5ms/step - loss: 0.4186 -
accuracy: 0.8507 - val_loss: 1.6632 - val_accuracy: 0.6097
Epoch 25/25
802/802 [=====] - 4s 5ms/step - loss: 0.3904 -
accuracy: 0.8590 - val_loss: 1.7652 - val_accuracy: 0.6080

Accuracy: 60.80%

Iteration No: 4 ended. Evaluation done at random point.

Time taken: 95.0946

Function value obtained: -0.6080

Current minimum: -0.6519

Iteration No: 5 started. Evaluating function at random point.

Epoch 1/25

421/421 [=====] - 5s 10ms/step - loss: 2.3097 -
accuracy: 0.0936 - val_loss: 2.3028 - val_accuracy: 0.0996

Epoch 2/25

421/421 [=====] - 4s 9ms/step - loss: 2.3008 -
accuracy: 0.0994 - val_loss: 2.3000 - val_accuracy: 0.1025

Epoch 3/25

421/421 [=====] - 4s 9ms/step - loss: 2.2981 -
accuracy: 0.1097 - val_loss: 2.2962 - val_accuracy: 0.1300

Epoch 4/25

421/421 [=====] - 4s 9ms/step - loss: 2.2929 -
accuracy: 0.1399 - val_loss: 2.2904 - val_accuracy: 0.1436

Epoch 5/25

421/421 [=====] - 4s 9ms/step - loss: 2.2887 -
accuracy: 0.1448 - val_loss: 2.2857 - val_accuracy: 0.1464

Epoch 6/25

421/421 [=====] - 4s 9ms/step - loss: 2.2838 -
accuracy: 0.1486 - val_loss: 2.2801 - val_accuracy: 0.1517

Epoch 7/25

421/421 [=====] - 4s 9ms/step - loss: 2.2781 -
accuracy: 0.1549 - val_loss: 2.2737 - val_accuracy: 0.1555

Epoch 8/25

421/421 [=====] - 4s 9ms/step - loss: 2.2711 -
accuracy: 0.1589 - val_loss: 2.2663 - val_accuracy: 0.1571

Epoch 9/25

421/421 [=====] - 4s 9ms/step - loss: 2.2625 -
accuracy: 0.1619 - val_loss: 2.2570 - val_accuracy: 0.1641

Epoch 10/25

421/421 [=====] - 4s 9ms/step - loss: 2.2520 -
accuracy: 0.1664 - val_loss: 2.2457 - val_accuracy: 0.1659

Epoch 11/25

421/421 [=====] - 4s 9ms/step - loss: 2.2410 -
accuracy: 0.1702 - val_loss: 2.2349 - val_accuracy: 0.1696

Epoch 12/25

421/421 [=====] - 4s 9ms/step - loss: 2.2303 -
accuracy: 0.1738 - val_loss: 2.2241 - val_accuracy: 0.1733

Epoch 13/25

421/421 [=====] - 4s 9ms/step - loss: 2.2200 -
accuracy: 0.1770 - val_loss: 2.2136 - val_accuracy: 0.1816

Epoch 14/25

421/421 [=====] - 4s 9ms/step - loss: 2.2100 -
accuracy: 0.1801 - val_loss: 2.2035 - val_accuracy: 0.1809
Epoch 15/25
421/421 [=====] - 4s 9ms/step - loss: 2.2002 -
accuracy: 0.1836 - val_loss: 2.1933 - val_accuracy: 0.1911
Epoch 16/25
421/421 [=====] - 4s 9ms/step - loss: 2.1903 -
accuracy: 0.1887 - val_loss: 2.1832 - val_accuracy: 0.1945
Epoch 17/25
421/421 [=====] - 4s 9ms/step - loss: 2.1805 -
accuracy: 0.1944 - val_loss: 2.1735 - val_accuracy: 0.1987
Epoch 18/25
421/421 [=====] - 4s 9ms/step - loss: 2.1705 -
accuracy: 0.2006 - val_loss: 2.1632 - val_accuracy: 0.2061
Epoch 19/25
421/421 [=====] - 4s 9ms/step - loss: 2.1605 -
accuracy: 0.2060 - val_loss: 2.1529 - val_accuracy: 0.2124
Epoch 20/25
421/421 [=====] - 4s 9ms/step - loss: 2.1502 -
accuracy: 0.2130 - val_loss: 2.1424 - val_accuracy: 0.2185
Epoch 21/25
421/421 [=====] - 4s 9ms/step - loss: 2.1398 -
accuracy: 0.2187 - val_loss: 2.1319 - val_accuracy: 0.2259
Epoch 22/25
421/421 [=====] - 4s 9ms/step - loss: 2.1292 -
accuracy: 0.2256 - val_loss: 2.1209 - val_accuracy: 0.2311
Epoch 23/25
421/421 [=====] - 4s 9ms/step - loss: 2.1185 -
accuracy: 0.2300 - val_loss: 2.1100 - val_accuracy: 0.2347
Epoch 24/25
421/421 [=====] - 4s 9ms/step - loss: 2.1073 -
accuracy: 0.2364 - val_loss: 2.0990 - val_accuracy: 0.2367
Epoch 25/25
421/421 [=====] - 4s 9ms/step - loss: 2.0958 -
accuracy: 0.2411 - val_loss: 2.0875 - val_accuracy: 0.2427

Accuracy: 24.27%

Iteration No: 5 ended. Evaluation done at random point.

Time taken: 98.3325

Function value obtained: -0.2427

Current minimum: -0.6519

Iteration No: 6 started. Evaluating function at random point.

Epoch 1/25

575/575 [=====] - 6s 9ms/step - loss: 2.1062 -
accuracy: 0.2070 - val_loss: 1.8862 - val_accuracy: 0.3113

Epoch 2/25

575/575 [=====] - 5s 8ms/step - loss: 1.7741 -

accuracy: 0.3371 - val_loss: 1.7546 - val_accuracy: 0.3479
Epoch 3/25
575/575 [=====] - 5s 8ms/step - loss: 1.5683 -
accuracy: 0.4196 - val_loss: 1.5649 - val_accuracy: 0.4080
Epoch 4/25
575/575 [=====] - 5s 9ms/step - loss: 1.3949 -
accuracy: 0.4884 - val_loss: 1.3490 - val_accuracy: 0.5104
Epoch 5/25
575/575 [=====] - 5s 8ms/step - loss: 1.2724 -
accuracy: 0.5325 - val_loss: 1.2427 - val_accuracy: 0.5409
Epoch 6/25
575/575 [=====] - 5s 8ms/step - loss: 1.1615 -
accuracy: 0.5769 - val_loss: 1.2119 - val_accuracy: 0.5571
Epoch 7/25
575/575 [=====] - 5s 9ms/step - loss: 1.0789 -
accuracy: 0.6134 - val_loss: 1.1131 - val_accuracy: 0.5999
Epoch 8/25
575/575 [=====] - 5s 8ms/step - loss: 0.9954 -
accuracy: 0.6452 - val_loss: 1.2002 - val_accuracy: 0.5816
Epoch 9/25
575/575 [=====] - 5s 8ms/step - loss: 0.9154 -
accuracy: 0.6735 - val_loss: 1.1280 - val_accuracy: 0.6173
Epoch 10/25
575/575 [=====] - 5s 8ms/step - loss: 0.8505 -
accuracy: 0.6987 - val_loss: 1.0307 - val_accuracy: 0.6420
Epoch 11/25
575/575 [=====] - 5s 8ms/step - loss: 0.7855 -
accuracy: 0.7200 - val_loss: 1.1441 - val_accuracy: 0.6056
Epoch 12/25
575/575 [=====] - 5s 8ms/step - loss: 0.7238 -
accuracy: 0.7417 - val_loss: 1.6915 - val_accuracy: 0.5152
Epoch 13/25
575/575 [=====] - 5s 8ms/step - loss: 0.6706 -
accuracy: 0.7617 - val_loss: 1.0403 - val_accuracy: 0.6569
Epoch 14/25
575/575 [=====] - 5s 8ms/step - loss: 0.6191 -
accuracy: 0.7817 - val_loss: 0.9631 - val_accuracy: 0.6772
Epoch 15/25
575/575 [=====] - 5s 8ms/step - loss: 0.5729 -
accuracy: 0.7943 - val_loss: 1.1907 - val_accuracy: 0.6349
Epoch 16/25
575/575 [=====] - 5s 8ms/step - loss: 0.5208 -
accuracy: 0.8141 - val_loss: 0.9226 - val_accuracy: 0.7024
Epoch 17/25
575/575 [=====] - 5s 9ms/step - loss: 0.4727 -
accuracy: 0.8303 - val_loss: 1.0187 - val_accuracy: 0.6859
Epoch 18/25
575/575 [=====] - 5s 9ms/step - loss: 0.4357 -

accuracy: 0.8434 - val_loss: 0.9713 - val_accuracy: 0.7085
Epoch 19/25
575/575 [=====] - 5s 9ms/step - loss: 0.3956 -
accuracy: 0.8591 - val_loss: 1.1614 - val_accuracy: 0.6725
Epoch 20/25
575/575 [=====] - 5s 9ms/step - loss: 0.3559 -
accuracy: 0.8723 - val_loss: 1.0804 - val_accuracy: 0.6893
Epoch 21/25
575/575 [=====] - 5s 8ms/step - loss: 0.3271 -
accuracy: 0.8823 - val_loss: 1.2006 - val_accuracy: 0.6843
Epoch 22/25
575/575 [=====] - 5s 8ms/step - loss: 0.2836 -
accuracy: 0.8966 - val_loss: 1.5629 - val_accuracy: 0.6291
Epoch 23/25
575/575 [=====] - 5s 8ms/step - loss: 0.2719 -
accuracy: 0.9029 - val_loss: 1.8829 - val_accuracy: 0.6071
Epoch 24/25
575/575 [=====] - 5s 8ms/step - loss: 0.2487 -
accuracy: 0.9101 - val_loss: 1.2646 - val_accuracy: 0.6965
Epoch 25/25
575/575 [=====] - 5s 8ms/step - loss: 0.2117 -
accuracy: 0.9250 - val_loss: 1.4666 - val_accuracy: 0.6751

Accuracy: 67.51%

Iteration No: 6 ended. Evaluation done at random point.

Time taken: 124.5499

Function value obtained: -0.6751

Current minimum: -0.6751

Iteration No: 7 started. Evaluating function at random point.

Epoch 1/25

733/733 [=====] - 6s 7ms/step - loss: 2.2493 -
accuracy: 0.1631 - val_loss: 2.1948 - val_accuracy: 0.1892

Epoch 2/25

733/733 [=====] - 5s 6ms/step - loss: 2.1472 -
accuracy: 0.1883 - val_loss: 2.0849 - val_accuracy: 0.2044

Epoch 3/25

733/733 [=====] - 5s 6ms/step - loss: 2.0349 -
accuracy: 0.2401 - val_loss: 1.9891 - val_accuracy: 0.2768

Epoch 4/25

733/733 [=====] - 5s 6ms/step - loss: 1.9463 -
accuracy: 0.2935 - val_loss: 1.9058 - val_accuracy: 0.3119

Epoch 5/25

733/733 [=====] - 5s 6ms/step - loss: 1.8714 -
accuracy: 0.3272 - val_loss: 1.8489 - val_accuracy: 0.3416

Epoch 6/25

733/733 [=====] - 5s 6ms/step - loss: 1.8024 -
accuracy: 0.3549 - val_loss: 1.9753 - val_accuracy: 0.3128

Epoch 7/25
733/733 [=====] - 5s 6ms/step - loss: 1.7323 - accuracy: 0.3757 - val_loss: 1.6959 - val_accuracy: 0.3924

Epoch 8/25
733/733 [=====] - 5s 6ms/step - loss: 1.6745 - accuracy: 0.3959 - val_loss: 1.8216 - val_accuracy: 0.3607

Epoch 9/25
733/733 [=====] - 5s 6ms/step - loss: 1.6189 - accuracy: 0.4128 - val_loss: 1.6801 - val_accuracy: 0.3849

Epoch 10/25
733/733 [=====] - 5s 6ms/step - loss: 1.5791 - accuracy: 0.4308 - val_loss: 1.5520 - val_accuracy: 0.4428

Epoch 11/25
733/733 [=====] - 5s 6ms/step - loss: 1.5381 - accuracy: 0.4439 - val_loss: 1.5100 - val_accuracy: 0.4516

Epoch 12/25
733/733 [=====] - 5s 6ms/step - loss: 1.5020 - accuracy: 0.4571 - val_loss: 1.5051 - val_accuracy: 0.4561

Epoch 13/25
733/733 [=====] - 5s 6ms/step - loss: 1.4749 - accuracy: 0.4651 - val_loss: 1.5238 - val_accuracy: 0.4544

Epoch 14/25
733/733 [=====] - 5s 6ms/step - loss: 1.4509 - accuracy: 0.4770 - val_loss: 1.4634 - val_accuracy: 0.4720

Epoch 15/25
733/733 [=====] - 5s 6ms/step - loss: 1.4285 - accuracy: 0.4825 - val_loss: 1.5472 - val_accuracy: 0.4257

Epoch 16/25
733/733 [=====] - 5s 6ms/step - loss: 1.4082 - accuracy: 0.4897 - val_loss: 1.4603 - val_accuracy: 0.4716

Epoch 17/25
733/733 [=====] - 5s 6ms/step - loss: 1.3879 - accuracy: 0.4984 - val_loss: 1.5169 - val_accuracy: 0.4555

Epoch 18/25
733/733 [=====] - 5s 6ms/step - loss: 1.3684 - accuracy: 0.5047 - val_loss: 1.4276 - val_accuracy: 0.4856

Epoch 19/25
733/733 [=====] - 5s 6ms/step - loss: 1.3524 - accuracy: 0.5102 - val_loss: 1.3971 - val_accuracy: 0.4933

Epoch 20/25
733/733 [=====] - 5s 6ms/step - loss: 1.3345 - accuracy: 0.5173 - val_loss: 1.3594 - val_accuracy: 0.5152

Epoch 21/25
733/733 [=====] - 5s 6ms/step - loss: 1.3230 - accuracy: 0.5235 - val_loss: 1.3251 - val_accuracy: 0.5271

Epoch 22/25
733/733 [=====] - 5s 6ms/step - loss: 1.3044 - accuracy: 0.5298 - val_loss: 1.3564 - val_accuracy: 0.5111

Epoch 23/25
733/733 [=====] - 5s 6ms/step - loss: 1.2906 -
accuracy: 0.5356 - val_loss: 1.3206 - val_accuracy: 0.5304
Epoch 24/25
733/733 [=====] - 5s 6ms/step - loss: 1.2767 -
accuracy: 0.5378 - val_loss: 1.3005 - val_accuracy: 0.5339
Epoch 25/25
733/733 [=====] - 5s 6ms/step - loss: 1.2636 -
accuracy: 0.5426 - val_loss: 1.3389 - val_accuracy: 0.5259

Accuracy: 52.59%

Iteration No: 7 ended. Evaluation done at random point.

Time taken: 115.6841

Function value obtained: -0.5259

Current minimum: -0.6751

Iteration No: 8 started. Evaluating function at random point.

Epoch 1/25
3864/3864 [=====] - 20s 5ms/step - loss: 2.3070 -
accuracy: 0.1006 - val_loss: 2.3036 - val_accuracy: 0.0999
Epoch 2/25
3864/3864 [=====] - 18s 5ms/step - loss: 2.3033 -
accuracy: 0.0988 - val_loss: 2.3031 - val_accuracy: 0.1389
Epoch 3/25
3864/3864 [=====] - 18s 5ms/step - loss: 2.3025 -
accuracy: 0.1030 - val_loss: 2.3009 - val_accuracy: 0.1160
Epoch 4/25
3864/3864 [=====] - 18s 5ms/step - loss: 2.3007 -
accuracy: 0.1071 - val_loss: 2.2987 - val_accuracy: 0.1015
Epoch 5/25
3864/3864 [=====] - 18s 5ms/step - loss: 2.2964 -
accuracy: 0.1216 - val_loss: 2.2920 - val_accuracy: 0.1159
Epoch 6/25
3864/3864 [=====] - 18s 5ms/step - loss: 2.2787 -
accuracy: 0.1589 - val_loss: 2.2466 - val_accuracy: 0.1967
Epoch 7/25
3864/3864 [=====] - 18s 5ms/step - loss: 2.1422 -
accuracy: 0.1911 - val_loss: 1.9787 - val_accuracy: 0.2012
Epoch 8/25
3864/3864 [=====] - 18s 5ms/step - loss: 1.9067 -
accuracy: 0.2393 - val_loss: 1.8466 - val_accuracy: 0.2680
Epoch 9/25
3864/3864 [=====] - 19s 5ms/step - loss: 1.8039 -
accuracy: 0.2810 - val_loss: 1.7883 - val_accuracy: 0.2823
Epoch 10/25
3864/3864 [=====] - 18s 5ms/step - loss: 1.7021 -
accuracy: 0.3188 - val_loss: 1.9632 - val_accuracy: 0.2881
Epoch 11/25

```

3864/3864 [=====] - 18s 5ms/step - loss: 1.5819 -
accuracy: 0.3554 - val_loss: 1.5538 - val_accuracy: 0.3583
Epoch 12/25
3864/3864 [=====] - 18s 5ms/step - loss: 1.4877 -
accuracy: 0.4001 - val_loss: 1.4834 - val_accuracy: 0.4145
Epoch 13/25
3864/3864 [=====] - 18s 5ms/step - loss: 1.4155 -
accuracy: 0.4439 - val_loss: 1.4032 - val_accuracy: 0.4548
Epoch 14/25
3864/3864 [=====] - 18s 5ms/step - loss: 1.3462 -
accuracy: 0.4848 - val_loss: 1.3868 - val_accuracy: 0.4703
Epoch 15/25
3864/3864 [=====] - 18s 5ms/step - loss: 1.2777 -
accuracy: 0.5261 - val_loss: 1.3449 - val_accuracy: 0.5168
Epoch 16/25
3864/3864 [=====] - 18s 5ms/step - loss: 1.2118 -
accuracy: 0.5590 - val_loss: 1.3260 - val_accuracy: 0.5299
Epoch 17/25
3864/3864 [=====] - 18s 5ms/step - loss: 1.1459 -
accuracy: 0.5892 - val_loss: 1.3009 - val_accuracy: 0.5485
Epoch 18/25
3864/3864 [=====] - 18s 5ms/step - loss: 1.0908 -
accuracy: 0.6125 - val_loss: 1.2364 - val_accuracy: 0.5867
Epoch 19/25
3864/3864 [=====] - 19s 5ms/step - loss: 1.0402 -
accuracy: 0.6355 - val_loss: 1.1738 - val_accuracy: 0.5952
Epoch 20/25
3864/3864 [=====] - 19s 5ms/step - loss: 1.0061 -
accuracy: 0.6516 - val_loss: 1.2201 - val_accuracy: 0.6007
Epoch 21/25
3864/3864 [=====] - 19s 5ms/step - loss: 0.9659 -
accuracy: 0.6648 - val_loss: 1.1463 - val_accuracy: 0.6243
Epoch 22/25
3864/3864 [=====] - 19s 5ms/step - loss: 0.9339 -
accuracy: 0.6761 - val_loss: 1.1817 - val_accuracy: 0.6072
Epoch 23/25
3864/3864 [=====] - 19s 5ms/step - loss: 0.9129 -
accuracy: 0.6867 - val_loss: 1.2105 - val_accuracy: 0.6127
Epoch 24/25
3864/3864 [=====] - 19s 5ms/step - loss: 0.9073 -
accuracy: 0.6856 - val_loss: 1.1429 - val_accuracy: 0.6241
Epoch 25/25
3864/3864 [=====] - 18s 5ms/step - loss: 0.8917 -
accuracy: 0.6948 - val_loss: 1.2091 - val_accuracy: 0.6167

```

Accuracy: 61.67%

Iteration No: 8 ended. Evaluation done at random point.

Time taken: 461.2637
Function value obtained: -0.6167
Current minimum: -0.6751
Iteration No: 9 started. Evaluating function at random point.

Epoch 1/25
850/850 [=====] - 5s 6ms/step - loss: 2.3408 -
accuracy: 0.1005 - val_loss: 2.3377 - val_accuracy: 0.0972

Epoch 2/25
850/850 [=====] - 4s 5ms/step - loss: 2.3332 -
accuracy: 0.1005 - val_loss: 2.3311 - val_accuracy: 0.0972

Epoch 3/25
850/850 [=====] - 4s 5ms/step - loss: 2.3275 -
accuracy: 0.1005 - val_loss: 2.3259 - val_accuracy: 0.0972

Epoch 4/25
850/850 [=====] - 4s 5ms/step - loss: 2.3228 -
accuracy: 0.1005 - val_loss: 2.3217 - val_accuracy: 0.0972

Epoch 5/25
850/850 [=====] - 4s 5ms/step - loss: 2.3191 -
accuracy: 0.1005 - val_loss: 2.3183 - val_accuracy: 0.0972

Epoch 6/25
850/850 [=====] - 4s 5ms/step - loss: 2.3161 -
accuracy: 0.1005 - val_loss: 2.3155 - val_accuracy: 0.0972

Epoch 7/25
850/850 [=====] - 4s 5ms/step - loss: 2.3136 -
accuracy: 0.1005 - val_loss: 2.3133 - val_accuracy: 0.0972

Epoch 8/25
850/850 [=====] - 4s 5ms/step - loss: 2.3116 -
accuracy: 0.1005 - val_loss: 2.3114 - val_accuracy: 0.0972

Epoch 9/25
850/850 [=====] - 4s 5ms/step - loss: 2.3099 -
accuracy: 0.1005 - val_loss: 2.3097 - val_accuracy: 0.0972

Epoch 10/25
850/850 [=====] - 4s 5ms/step - loss: 2.3084 -
accuracy: 0.1005 - val_loss: 2.3083 - val_accuracy: 0.0972

Epoch 11/25
850/850 [=====] - 4s 5ms/step - loss: 2.3071 -
accuracy: 0.1005 - val_loss: 2.3070 - val_accuracy: 0.0972

Epoch 12/25
850/850 [=====] - 4s 5ms/step - loss: 2.3060 -
accuracy: 0.1005 - val_loss: 2.3060 - val_accuracy: 0.0972

Epoch 13/25
850/850 [=====] - 4s 5ms/step - loss: 2.3051 -
accuracy: 0.1005 - val_loss: 2.3051 - val_accuracy: 0.0972

Epoch 14/25
850/850 [=====] - 4s 5ms/step - loss: 2.3042 -
accuracy: 0.1005 - val_loss: 2.3043 - val_accuracy: 0.0972

Epoch 15/25
850/850 [=====] - 4s 5ms/step - loss: 2.3036 -

```

accuracy: 0.1006 - val_loss: 2.3036 - val_accuracy: 0.0972
Epoch 16/25
850/850 [=====] - 4s 5ms/step - loss: 2.3030 -
accuracy: 0.1007 - val_loss: 2.3030 - val_accuracy: 0.0971
Epoch 17/25
850/850 [=====] - 4s 5ms/step - loss: 2.3024 -
accuracy: 0.1008 - val_loss: 2.3025 - val_accuracy: 0.0971
Epoch 18/25
850/850 [=====] - 4s 5ms/step - loss: 2.3020 -
accuracy: 0.1015 - val_loss: 2.3021 - val_accuracy: 0.0979
Epoch 19/25
850/850 [=====] - 4s 5ms/step - loss: 2.3016 -
accuracy: 0.1025 - val_loss: 2.3017 - val_accuracy: 0.0985
Epoch 20/25
850/850 [=====] - 4s 5ms/step - loss: 2.3013 -
accuracy: 0.1038 - val_loss: 2.3014 - val_accuracy: 0.1007
Epoch 21/25
850/850 [=====] - 4s 5ms/step - loss: 2.3010 -
accuracy: 0.1044 - val_loss: 2.3011 - val_accuracy: 0.1031
Epoch 22/25
850/850 [=====] - 4s 5ms/step - loss: 2.3007 -
accuracy: 0.1063 - val_loss: 2.3009 - val_accuracy: 0.1052
Epoch 23/25
850/850 [=====] - 4s 5ms/step - loss: 2.3005 -
accuracy: 0.1086 - val_loss: 2.3007 - val_accuracy: 0.1069
Epoch 24/25
850/850 [=====] - 4s 5ms/step - loss: 2.3003 -
accuracy: 0.1103 - val_loss: 2.3004 - val_accuracy: 0.1105
Epoch 25/25
850/850 [=====] - 4s 5ms/step - loss: 2.3001 -
accuracy: 0.1125 - val_loss: 2.3003 - val_accuracy: 0.1131

```

Accuracy: 11.31%

Iteration No: 9 ended. Evaluation done at random point.

Time taken: 112.2725

Function value obtained: -0.1131

Current minimum: -0.6751

Iteration No: 10 started. Evaluating function at random point.

Epoch 1/25

```

1518/1518 [=====] - 8s 5ms/step - loss: 1.9458 -
accuracy: 0.2676 - val_loss: 1.5424 - val_accuracy: 0.4253

```

Epoch 2/25

```

1518/1518 [=====] - 8s 5ms/step - loss: 1.3822 -
accuracy: 0.4959 - val_loss: 1.3206 - val_accuracy: 0.5171

```

Epoch 3/25

```

1518/1518 [=====] - 8s 5ms/step - loss: 1.0899 -
accuracy: 0.6117 - val_loss: 1.2355 - val_accuracy: 0.5771

```

Epoch 4/25
1518/1518 [=====] - 8s 5ms/step - loss: 0.9162 - accuracy: 0.6785 - val_loss: 0.9572 - val_accuracy: 0.6733

Epoch 5/25
1518/1518 [=====] - 8s 5ms/step - loss: 0.7946 - accuracy: 0.7230 - val_loss: 0.8813 - val_accuracy: 0.6967

Epoch 6/25
1518/1518 [=====] - 8s 5ms/step - loss: 0.7002 - accuracy: 0.7568 - val_loss: 0.9015 - val_accuracy: 0.7053

Epoch 7/25
1518/1518 [=====] - 8s 5ms/step - loss: 0.6303 - accuracy: 0.7832 - val_loss: 0.8146 - val_accuracy: 0.7245

Epoch 8/25
1518/1518 [=====] - 8s 5ms/step - loss: 0.5670 - accuracy: 0.8047 - val_loss: 0.8424 - val_accuracy: 0.7275

Epoch 9/25
1518/1518 [=====] - 7s 5ms/step - loss: 0.5166 - accuracy: 0.8229 - val_loss: 0.8752 - val_accuracy: 0.7148

Epoch 10/25
1518/1518 [=====] - 7s 5ms/step - loss: 0.4771 - accuracy: 0.8370 - val_loss: 0.8633 - val_accuracy: 0.7445

Epoch 11/25
1518/1518 [=====] - 7s 5ms/step - loss: 0.4409 - accuracy: 0.8516 - val_loss: 1.0477 - val_accuracy: 0.6976

Epoch 12/25
1518/1518 [=====] - 7s 5ms/step - loss: 0.4058 - accuracy: 0.8612 - val_loss: 0.8561 - val_accuracy: 0.7532

Epoch 13/25
1518/1518 [=====] - 7s 5ms/step - loss: 0.3839 - accuracy: 0.8684 - val_loss: 0.9076 - val_accuracy: 0.7331

Epoch 14/25
1518/1518 [=====] - 7s 5ms/step - loss: 0.3662 - accuracy: 0.8755 - val_loss: 0.9669 - val_accuracy: 0.7399

Epoch 15/25
1518/1518 [=====] - 7s 5ms/step - loss: 0.3502 - accuracy: 0.8821 - val_loss: 0.9345 - val_accuracy: 0.7459

Epoch 16/25
1518/1518 [=====] - 8s 5ms/step - loss: 0.3451 - accuracy: 0.8858 - val_loss: 0.9462 - val_accuracy: 0.7408

Epoch 17/25
1518/1518 [=====] - 7s 5ms/step - loss: 0.3318 - accuracy: 0.8899 - val_loss: 0.9691 - val_accuracy: 0.7431

Epoch 18/25
1518/1518 [=====] - 7s 5ms/step - loss: 0.3234 - accuracy: 0.8940 - val_loss: 0.9585 - val_accuracy: 0.7324

Epoch 19/25
1518/1518 [=====] - 7s 5ms/step - loss: 0.3114 - accuracy: 0.8989 - val_loss: 0.9977 - val_accuracy: 0.7491

Epoch 20/25
1518/1518 [=====] - 7s 5ms/step - loss: 0.3097 -
accuracy: 0.8995 - val_loss: 1.3529 - val_accuracy: 0.6801
Epoch 21/25
1518/1518 [=====] - 7s 5ms/step - loss: 0.2970 -
accuracy: 0.9060 - val_loss: 1.0209 - val_accuracy: 0.7419
Epoch 22/25
1518/1518 [=====] - 7s 5ms/step - loss: 0.2889 -
accuracy: 0.9073 - val_loss: 1.0652 - val_accuracy: 0.7424
Epoch 23/25
1518/1518 [=====] - 7s 5ms/step - loss: 0.3045 -
accuracy: 0.9025 - val_loss: 1.0653 - val_accuracy: 0.7276
Epoch 24/25
1518/1518 [=====] - 7s 5ms/step - loss: 0.3102 -
accuracy: 0.9034 - val_loss: 0.9975 - val_accuracy: 0.7440
Epoch 25/25
1518/1518 [=====] - 7s 5ms/step - loss: 0.2986 -
accuracy: 0.9073 - val_loss: 1.0316 - val_accuracy: 0.7380

Accuracy: 73.80%

Iteration No: 10 ended. Evaluation done at random point.
Time taken: 188.5775
Function value obtained: -0.7380
Current minimum: -0.7380
Iteration No: 11 started. Evaluating function at random point.

Epoch 1/25
7084/7084 [=====] - 25s 3ms/step - loss: 1.7594 -
accuracy: 0.3650 - val_loss: 1.4505 - val_accuracy: 0.4767
Epoch 2/25
7084/7084 [=====] - 24s 3ms/step - loss: 1.3171 -
accuracy: 0.5304 - val_loss: 1.2463 - val_accuracy: 0.5611
Epoch 3/25
7084/7084 [=====] - 23s 3ms/step - loss: 1.1599 -
accuracy: 0.5911 - val_loss: 1.2225 - val_accuracy: 0.5667
Epoch 4/25
7084/7084 [=====] - 23s 3ms/step - loss: 1.0624 -
accuracy: 0.6269 - val_loss: 1.1477 - val_accuracy: 0.5948
Epoch 5/25
7084/7084 [=====] - 23s 3ms/step - loss: 0.9924 -
accuracy: 0.6552 - val_loss: 1.2300 - val_accuracy: 0.5749
Epoch 6/25
7084/7084 [=====] - 23s 3ms/step - loss: 0.9349 -
accuracy: 0.6752 - val_loss: 1.1702 - val_accuracy: 0.5991
Epoch 7/25
7084/7084 [=====] - 23s 3ms/step - loss: 0.8832 -
accuracy: 0.6913 - val_loss: 1.2413 - val_accuracy: 0.5771
Epoch 8/25

7084/7084 [=====] - 23s 3ms/step - loss: 0.8399 - accuracy: 0.7054 - val_loss: 1.1261 - val_accuracy: 0.6184
Epoch 9/25
7084/7084 [=====] - 23s 3ms/step - loss: 0.7993 - accuracy: 0.7233 - val_loss: 1.2340 - val_accuracy: 0.5853
Epoch 10/25
7084/7084 [=====] - 24s 3ms/step - loss: 0.7709 - accuracy: 0.7325 - val_loss: 1.3025 - val_accuracy: 0.5808
Epoch 11/25
7084/7084 [=====] - 23s 3ms/step - loss: 0.7431 - accuracy: 0.7396 - val_loss: 1.2922 - val_accuracy: 0.5875
Epoch 12/25
7084/7084 [=====] - 24s 3ms/step - loss: 0.7347 - accuracy: 0.7435 - val_loss: 1.3374 - val_accuracy: 0.5776
Epoch 13/25
7084/7084 [=====] - 23s 3ms/step - loss: 0.7133 - accuracy: 0.7528 - val_loss: 1.3443 - val_accuracy: 0.5819
Epoch 14/25
7084/7084 [=====] - 24s 3ms/step - loss: 0.6916 - accuracy: 0.7600 - val_loss: 1.3364 - val_accuracy: 0.5852
Epoch 15/25
7084/7084 [=====] - 23s 3ms/step - loss: 0.6855 - accuracy: 0.7621 - val_loss: 1.3678 - val_accuracy: 0.5841
Epoch 16/25
7084/7084 [=====] - 23s 3ms/step - loss: 0.6915 - accuracy: 0.7623 - val_loss: 1.3801 - val_accuracy: 0.5793
Epoch 17/25
7084/7084 [=====] - 23s 3ms/step - loss: 0.6870 - accuracy: 0.7627 - val_loss: 1.4358 - val_accuracy: 0.5613
Epoch 18/25
7084/7084 [=====] - 23s 3ms/step - loss: 0.6752 - accuracy: 0.7684 - val_loss: 1.4723 - val_accuracy: 0.5576
Epoch 19/25
7084/7084 [=====] - 23s 3ms/step - loss: 0.6758 - accuracy: 0.7655 - val_loss: 1.4394 - val_accuracy: 0.5735
Epoch 20/25
7084/7084 [=====] - 23s 3ms/step - loss: 0.6891 - accuracy: 0.7629 - val_loss: 1.4897 - val_accuracy: 0.5537
Epoch 21/25
7084/7084 [=====] - 23s 3ms/step - loss: 0.6964 - accuracy: 0.7603 - val_loss: 1.4346 - val_accuracy: 0.5643
Epoch 22/25
7084/7084 [=====] - 23s 3ms/step - loss: 0.6978 - accuracy: 0.7612 - val_loss: 1.4384 - val_accuracy: 0.5745
Epoch 23/25
7084/7084 [=====] - 23s 3ms/step - loss: 0.7148 - accuracy: 0.7554 - val_loss: 1.4515 - val_accuracy: 0.5699
Epoch 24/25

7084/7084 [=====] - 23s 3ms/step - loss: 0.7200 -
accuracy: 0.7543 - val_loss: 1.4500 - val_accuracy: 0.5628

Epoch 25/25

7084/7084 [=====] - 23s 3ms/step - loss: 0.7238 -
accuracy: 0.7545 - val_loss: 1.4708 - val_accuracy: 0.5671

Accuracy: 56.71%

Iteration No: 11 ended. Evaluation done at random point.

Time taken: 584.9922

Function value obtained: -0.5671

Current minimum: -0.7380

Iteration No: 12 started. Evaluating function at random point.

Epoch 1/25

335/335 [=====] - 3s 9ms/step - loss: 2.3021 -
accuracy: 0.0951 - val_loss: 2.3020 - val_accuracy: 0.1112

Epoch 2/25

335/335 [=====] - 2s 7ms/step - loss: 2.3018 -
accuracy: 0.1116 - val_loss: 2.3016 - val_accuracy: 0.1183

Epoch 3/25

335/335 [=====] - 2s 7ms/step - loss: 2.3014 -
accuracy: 0.1189 - val_loss: 2.3011 - val_accuracy: 0.1155

Epoch 4/25

335/335 [=====] - 2s 7ms/step - loss: 2.3009 -
accuracy: 0.1215 - val_loss: 2.3006 - val_accuracy: 0.1187

Epoch 5/25

335/335 [=====] - 3s 7ms/step - loss: 2.3003 -
accuracy: 0.1234 - val_loss: 2.3001 - val_accuracy: 0.1216

Epoch 6/25

335/335 [=====] - 2s 7ms/step - loss: 2.2998 -
accuracy: 0.1242 - val_loss: 2.2996 - val_accuracy: 0.1243

Epoch 7/25

335/335 [=====] - 2s 7ms/step - loss: 2.2992 -
accuracy: 0.1260 - val_loss: 2.2991 - val_accuracy: 0.1239

Epoch 8/25

335/335 [=====] - 2s 7ms/step - loss: 2.2987 -
accuracy: 0.1273 - val_loss: 2.2986 - val_accuracy: 0.1273

Epoch 9/25

335/335 [=====] - 2s 7ms/step - loss: 2.2982 -
accuracy: 0.1291 - val_loss: 2.2981 - val_accuracy: 0.1269

Epoch 10/25

335/335 [=====] - 2s 7ms/step - loss: 2.2976 -
accuracy: 0.1304 - val_loss: 2.2976 - val_accuracy: 0.1301

Epoch 11/25

335/335 [=====] - 2s 7ms/step - loss: 2.2971 -
accuracy: 0.1326 - val_loss: 2.2971 - val_accuracy: 0.1281

Epoch 12/25

335/335 [=====] - 3s 7ms/step - loss: 2.2966 -

accuracy: 0.1333 - val_loss: 2.2966 - val_accuracy: 0.1299
Epoch 13/25
335/335 [=====] - 3s 7ms/step - loss: 2.2961 -
accuracy: 0.1343 - val_loss: 2.2961 - val_accuracy: 0.1341
Epoch 14/25
335/335 [=====] - 3s 7ms/step - loss: 2.2955 -
accuracy: 0.1368 - val_loss: 2.2956 - val_accuracy: 0.1301
Epoch 15/25
335/335 [=====] - 2s 7ms/step - loss: 2.2950 -
accuracy: 0.1369 - val_loss: 2.2951 - val_accuracy: 0.1327
Epoch 16/25
335/335 [=====] - 3s 7ms/step - loss: 2.2945 -
accuracy: 0.1386 - val_loss: 2.2946 - val_accuracy: 0.1343
Epoch 17/25
335/335 [=====] - 3s 8ms/step - loss: 2.2939 -
accuracy: 0.1395 - val_loss: 2.2940 - val_accuracy: 0.1349
Epoch 18/25
335/335 [=====] - 3s 8ms/step - loss: 2.2933 -
accuracy: 0.1400 - val_loss: 2.2935 - val_accuracy: 0.1392
Epoch 19/25
335/335 [=====] - 2s 7ms/step - loss: 2.2927 -
accuracy: 0.1420 - val_loss: 2.2929 - val_accuracy: 0.1387
Epoch 20/25
335/335 [=====] - 3s 7ms/step - loss: 2.2921 -
accuracy: 0.1428 - val_loss: 2.2923 - val_accuracy: 0.1392
Epoch 21/25
335/335 [=====] - 3s 8ms/step - loss: 2.2915 -
accuracy: 0.1433 - val_loss: 2.2917 - val_accuracy: 0.1408
Epoch 22/25
335/335 [=====] - 3s 8ms/step - loss: 2.2909 -
accuracy: 0.1443 - val_loss: 2.2911 - val_accuracy: 0.1399
Epoch 23/25
335/335 [=====] - 3s 8ms/step - loss: 2.2902 -
accuracy: 0.1445 - val_loss: 2.2904 - val_accuracy: 0.1413
Epoch 24/25
335/335 [=====] - 3s 7ms/step - loss: 2.2895 -
accuracy: 0.1454 - val_loss: 2.2897 - val_accuracy: 0.1424
Epoch 25/25
335/335 [=====] - 2s 7ms/step - loss: 2.2888 -
accuracy: 0.1458 - val_loss: 2.2890 - val_accuracy: 0.1455

Accuracy: 14.55%

Iteration No: 12 ended. Evaluation done at random point.

Time taken: 65.0431

Function value obtained: -0.1455

Current minimum: -0.7380

Iteration No: 13 started. Searching for the next optimal point.

Epoch 1/25
3270/3270 [=====] - 17s 5ms/step - loss: 2.3066 - accuracy: 0.1006 - val_loss: 2.3053 - val_accuracy: 0.1015

Epoch 2/25
3270/3270 [=====] - 16s 5ms/step - loss: 2.3048 - accuracy: 0.0950 - val_loss: 2.3041 - val_accuracy: 0.0975

Epoch 3/25
3270/3270 [=====] - 16s 5ms/step - loss: 2.3041 - accuracy: 0.1012 - val_loss: 2.3042 - val_accuracy: 0.1015

Epoch 4/25
3270/3270 [=====] - 16s 5ms/step - loss: 2.3042 - accuracy: 0.1026 - val_loss: 2.3049 - val_accuracy: 0.0972

Epoch 5/25
3270/3270 [=====] - 16s 5ms/step - loss: 2.3041 - accuracy: 0.0995 - val_loss: 2.3053 - val_accuracy: 0.0972

Epoch 6/25
3270/3270 [=====] - 16s 5ms/step - loss: 2.3038 - accuracy: 0.1016 - val_loss: 2.3031 - val_accuracy: 0.1015

Epoch 7/25
3270/3270 [=====] - 16s 5ms/step - loss: 2.3036 - accuracy: 0.1031 - val_loss: 2.3035 - val_accuracy: 0.0975

Epoch 8/25
3270/3270 [=====] - 16s 5ms/step - loss: 2.3025 - accuracy: 0.1035 - val_loss: 2.3011 - val_accuracy: 0.1000

Epoch 9/25
3270/3270 [=====] - 16s 5ms/step - loss: 2.3002 - accuracy: 0.1110 - val_loss: 2.2974 - val_accuracy: 0.0999

Epoch 10/25
3270/3270 [=====] - 16s 5ms/step - loss: 2.2872 - accuracy: 0.1367 - val_loss: 2.2925 - val_accuracy: 0.1231

Epoch 11/25
3270/3270 [=====] - 16s 5ms/step - loss: 2.1476 - accuracy: 0.1634 - val_loss: 2.0172 - val_accuracy: 0.1708

Epoch 12/25
3270/3270 [=====] - 16s 5ms/step - loss: 1.9165 - accuracy: 0.1919 - val_loss: 1.8537 - val_accuracy: 0.2228

Epoch 13/25
3270/3270 [=====] - 16s 5ms/step - loss: 1.8471 - accuracy: 0.2168 - val_loss: 1.8450 - val_accuracy: 0.2181

Epoch 14/25
3270/3270 [=====] - 16s 5ms/step - loss: 1.8045 - accuracy: 0.2436 - val_loss: 1.9584 - val_accuracy: 0.2097

Epoch 15/25
3270/3270 [=====] - 16s 5ms/step - loss: 1.7557 - accuracy: 0.2809 - val_loss: 1.7324 - val_accuracy: 0.2831

Epoch 16/25
3270/3270 [=====] - 16s 5ms/step - loss: 1.7029 - accuracy: 0.3097 - val_loss: 1.6809 - val_accuracy: 0.3231

Epoch 17/25
 3270/3270 [=====] - 16s 5ms/step - loss: 1.6436 - accuracy: 0.3404 - val_loss: 1.6231 - val_accuracy: 0.3353
 Epoch 18/25
 3270/3270 [=====] - 16s 5ms/step - loss: 1.5901 - accuracy: 0.3609 - val_loss: 1.6108 - val_accuracy: 0.3732
 Epoch 19/25
 3270/3270 [=====] - 16s 5ms/step - loss: 1.5280 - accuracy: 0.3829 - val_loss: 1.6260 - val_accuracy: 0.3733
 Epoch 20/25
 3270/3270 [=====] - 16s 5ms/step - loss: 1.4763 - accuracy: 0.4040 - val_loss: 1.5508 - val_accuracy: 0.3979
 Epoch 21/25
 3270/3270 [=====] - 16s 5ms/step - loss: 1.4240 - accuracy: 0.4246 - val_loss: 1.5119 - val_accuracy: 0.4155
 Epoch 22/25
 3270/3270 [=====] - 16s 5ms/step - loss: 1.3805 - accuracy: 0.4455 - val_loss: 1.4495 - val_accuracy: 0.4465
 Epoch 23/25
 3270/3270 [=====] - 16s 5ms/step - loss: 1.3274 - accuracy: 0.4707 - val_loss: 1.4723 - val_accuracy: 0.4677
 Epoch 24/25
 3270/3270 [=====] - 16s 5ms/step - loss: 1.3015 - accuracy: 0.4875 - val_loss: 1.5900 - val_accuracy: 0.4151
 Epoch 25/25
 3270/3270 [=====] - 16s 5ms/step - loss: 1.2643 - accuracy: 0.5042 - val_loss: 1.4606 - val_accuracy: 0.4773

Accuracy: 47.73%

Iteration No: 13 ended. Search finished for the next optimal point.

Time taken: 401.3364

Function value obtained: -0.4773

Current minimum: -0.7380

Iteration No: 14 started. Searching for the next optimal point.

Epoch 1/25

733/733 [=====] - 6s 8ms/step - loss: 2.1002 - accuracy: 0.2110 - val_loss: 2.1031 - val_accuracy: 0.2249

Epoch 2/25

733/733 [=====] - 5s 7ms/step - loss: 1.6587 - accuracy: 0.3883 - val_loss: 1.5643 - val_accuracy: 0.4116

Epoch 3/25

733/733 [=====] - 5s 7ms/step - loss: 1.4426 - accuracy: 0.4674 - val_loss: 1.4272 - val_accuracy: 0.4895

Epoch 4/25

733/733 [=====] - 5s 7ms/step - loss: 1.3101 - accuracy: 0.5231 - val_loss: 1.2859 - val_accuracy: 0.5424

Epoch 5/25

733/733 [=====] - 5s 7ms/step - loss: 1.1928 -
accuracy: 0.5681 - val_loss: 1.2190 - val_accuracy: 0.5675
Epoch 6/25
733/733 [=====] - 5s 7ms/step - loss: 1.0956 -
accuracy: 0.6047 - val_loss: 1.1014 - val_accuracy: 0.6064
Epoch 7/25
733/733 [=====] - 5s 7ms/step - loss: 1.0022 -
accuracy: 0.6410 - val_loss: 1.1263 - val_accuracy: 0.6096
Epoch 8/25
733/733 [=====] - 5s 7ms/step - loss: 0.9208 -
accuracy: 0.6712 - val_loss: 1.0980 - val_accuracy: 0.6004
Epoch 9/25
733/733 [=====] - 5s 7ms/step - loss: 0.8370 -
accuracy: 0.7024 - val_loss: 0.9529 - val_accuracy: 0.6656
Epoch 10/25
733/733 [=====] - 5s 7ms/step - loss: 0.7713 -
accuracy: 0.7248 - val_loss: 0.9796 - val_accuracy: 0.6600
Epoch 11/25
733/733 [=====] - 5s 7ms/step - loss: 0.7092 -
accuracy: 0.7472 - val_loss: 1.1184 - val_accuracy: 0.6337
Epoch 12/25
733/733 [=====] - 5s 7ms/step - loss: 0.6473 -
accuracy: 0.7692 - val_loss: 0.9857 - val_accuracy: 0.6815
Epoch 13/25
733/733 [=====] - 5s 7ms/step - loss: 0.5885 -
accuracy: 0.7892 - val_loss: 0.9541 - val_accuracy: 0.6903
Epoch 14/25
733/733 [=====] - 5s 7ms/step - loss: 0.5325 -
accuracy: 0.8122 - val_loss: 0.9777 - val_accuracy: 0.6888
Epoch 15/25
733/733 [=====] - 5s 7ms/step - loss: 0.4750 -
accuracy: 0.8290 - val_loss: 1.0561 - val_accuracy: 0.6739
Epoch 16/25
733/733 [=====] - 5s 7ms/step - loss: 0.4266 -
accuracy: 0.8478 - val_loss: 1.3374 - val_accuracy: 0.6168
Epoch 17/25
733/733 [=====] - 5s 7ms/step - loss: 0.3848 -
accuracy: 0.8607 - val_loss: 1.1002 - val_accuracy: 0.6956
Epoch 18/25
733/733 [=====] - 5s 7ms/step - loss: 0.3552 -
accuracy: 0.8704 - val_loss: 1.1437 - val_accuracy: 0.6812
Epoch 19/25
733/733 [=====] - 5s 7ms/step - loss: 0.3109 -
accuracy: 0.8886 - val_loss: 1.1566 - val_accuracy: 0.6888
Epoch 20/25
733/733 [=====] - 5s 7ms/step - loss: 0.2849 -
accuracy: 0.8972 - val_loss: 1.1187 - val_accuracy: 0.6968
Epoch 21/25

733/733 [=====] - 5s 7ms/step - loss: 0.2470 -
accuracy: 0.9105 - val_loss: 1.3174 - val_accuracy: 0.6857
Epoch 22/25
733/733 [=====] - 5s 7ms/step - loss: 0.2170 -
accuracy: 0.9210 - val_loss: 1.3193 - val_accuracy: 0.6965
Epoch 23/25
733/733 [=====] - 5s 7ms/step - loss: 0.2017 -
accuracy: 0.9280 - val_loss: 1.3063 - val_accuracy: 0.6939
Epoch 24/25
733/733 [=====] - 5s 7ms/step - loss: 0.1830 -
accuracy: 0.9351 - val_loss: 1.5733 - val_accuracy: 0.6693
Epoch 25/25
733/733 [=====] - 5s 7ms/step - loss: 0.1701 -
accuracy: 0.9395 - val_loss: 1.7942 - val_accuracy: 0.6507

Accuracy: 65.07%

Iteration No: 14 ended. Search finished for the next optimal point.

Time taken: 143.7922

Function value obtained: -0.6507

Current minimum: -0.7380

Iteration No: 15 started. Searching for the next optimal point.

Epoch 1/25

2834/2834 [=====] - 14s 5ms/step - loss: 1.8691 -
accuracy: 0.3032 - val_loss: 1.7779 - val_accuracy: 0.3349

Epoch 2/25

2834/2834 [=====] - 13s 5ms/step - loss: 1.4386 -
accuracy: 0.4825 - val_loss: 1.4943 - val_accuracy: 0.4749

Epoch 3/25

2834/2834 [=====] - 13s 5ms/step - loss: 1.2719 -
accuracy: 0.5494 - val_loss: 1.2220 - val_accuracy: 0.5591

Epoch 4/25

2834/2834 [=====] - 13s 5ms/step - loss: 1.1770 -
accuracy: 0.5924 - val_loss: 1.2760 - val_accuracy: 0.5629

Epoch 5/25

2834/2834 [=====] - 13s 5ms/step - loss: 1.1425 -
accuracy: 0.6075 - val_loss: 1.3069 - val_accuracy: 0.5357

Epoch 6/25

2834/2834 [=====] - 13s 5ms/step - loss: 1.1250 -
accuracy: 0.6175 - val_loss: 1.4727 - val_accuracy: 0.5060

Epoch 7/25

2834/2834 [=====] - 13s 5ms/step - loss: 1.1385 -
accuracy: 0.6162 - val_loss: 1.1950 - val_accuracy: 0.6016

Epoch 8/25

2834/2834 [=====] - 13s 5ms/step - loss: 1.1513 -
accuracy: 0.6134 - val_loss: 1.2788 - val_accuracy: 0.5631

Epoch 9/25

2834/2834 [=====] - 13s 5ms/step - loss: 1.1701 -

accuracy: 0.6104 - val_loss: 1.3317 - val_accuracy: 0.5421
Epoch 10/25
2834/2834 [=====] - 13s 5ms/step - loss: 1.2415 -
accuracy: 0.5871 - val_loss: 1.2787 - val_accuracy: 0.5696
Epoch 11/25
2834/2834 [=====] - 13s 5ms/step - loss: 1.3011 -
accuracy: 0.5722 - val_loss: 1.5406 - val_accuracy: 0.5109
Epoch 12/25
2834/2834 [=====] - 13s 5ms/step - loss: 1.3755 -
accuracy: 0.5516 - val_loss: 1.5253 - val_accuracy: 0.4751
Epoch 13/25
2834/2834 [=====] - 13s 5ms/step - loss: 1.4436 -
accuracy: 0.5258 - val_loss: 1.8227 - val_accuracy: 0.4261
Epoch 14/25
2834/2834 [=====] - 13s 5ms/step - loss: 1.5670 -
accuracy: 0.4836 - val_loss: 1.7718 - val_accuracy: 0.4440
Epoch 15/25
2834/2834 [=====] - 13s 5ms/step - loss: 1.7874 -
accuracy: 0.3938 - val_loss: 2.3035 - val_accuracy: 0.0989
Epoch 16/25
2834/2834 [=====] - 13s 5ms/step - loss: 2.2112 -
accuracy: 0.1617 - val_loss: 1.8743 - val_accuracy: 0.3471

Accuracy: 34.71%

Iteration No: 15 ended. Search finished for the next optimal point.

Time taken: 214.3838

Function value obtained: -0.3471

Current minimum: -0.7380

Iteration No: 16 started. Searching for the next optimal point.

Epoch 1/25

552/552 [=====] - 5s 9ms/step - loss: 2.3696 -
accuracy: 0.1075 - val_loss: 2.3349 - val_accuracy: 0.1149

Epoch 2/25

552/552 [=====] - 4s 8ms/step - loss: 2.3207 -
accuracy: 0.1191 - val_loss: 2.3102 - val_accuracy: 0.1217

Epoch 3/25

552/552 [=====] - 4s 8ms/step - loss: 2.3041 -
accuracy: 0.1244 - val_loss: 2.2988 - val_accuracy: 0.1300

Epoch 4/25

552/552 [=====] - 4s 8ms/step - loss: 2.2949 -
accuracy: 0.1348 - val_loss: 2.2914 - val_accuracy: 0.1417

Epoch 5/25

552/552 [=====] - 4s 8ms/step - loss: 2.2882 -
accuracy: 0.1425 - val_loss: 2.2856 - val_accuracy: 0.1489

Epoch 6/25

552/552 [=====] - 4s 8ms/step - loss: 2.2826 -
accuracy: 0.1481 - val_loss: 2.2802 - val_accuracy: 0.1548

Epoch 7/25
552/552 [=====] - 4s 8ms/step - loss: 2.2772 - accuracy: 0.1532 - val_loss: 2.2750 - val_accuracy: 0.1575
Epoch 8/25
552/552 [=====] - 4s 8ms/step - loss: 2.2720 - accuracy: 0.1592 - val_loss: 2.2697 - val_accuracy: 0.1652
Epoch 9/25
552/552 [=====] - 4s 8ms/step - loss: 2.2666 - accuracy: 0.1661 - val_loss: 2.2642 - val_accuracy: 0.1723
Epoch 10/25
552/552 [=====] - 4s 8ms/step - loss: 2.2612 - accuracy: 0.1730 - val_loss: 2.2588 - val_accuracy: 0.1753
Epoch 11/25
552/552 [=====] - 4s 8ms/step - loss: 2.2556 - accuracy: 0.1790 - val_loss: 2.2530 - val_accuracy: 0.1832
Epoch 12/25
552/552 [=====] - 4s 8ms/step - loss: 2.2498 - accuracy: 0.1855 - val_loss: 2.2470 - val_accuracy: 0.1896
Epoch 13/25
552/552 [=====] - 4s 8ms/step - loss: 2.2438 - accuracy: 0.1911 - val_loss: 2.2410 - val_accuracy: 0.1941
Epoch 14/25
552/552 [=====] - 4s 8ms/step - loss: 2.2376 - accuracy: 0.1966 - val_loss: 2.2346 - val_accuracy: 0.2008
Epoch 15/25
552/552 [=====] - 4s 8ms/step - loss: 2.2313 - accuracy: 0.2034 - val_loss: 2.2282 - val_accuracy: 0.2065
Epoch 16/25
552/552 [=====] - 4s 8ms/step - loss: 2.2247 - accuracy: 0.2081 - val_loss: 2.2215 - val_accuracy: 0.2129
Epoch 17/25
552/552 [=====] - 4s 8ms/step - loss: 2.2180 - accuracy: 0.2133 - val_loss: 2.2148 - val_accuracy: 0.2168
Epoch 18/25
552/552 [=====] - 4s 8ms/step - loss: 2.2111 - accuracy: 0.2169 - val_loss: 2.2077 - val_accuracy: 0.2224
Epoch 19/25
552/552 [=====] - 4s 8ms/step - loss: 2.2041 - accuracy: 0.2217 - val_loss: 2.2006 - val_accuracy: 0.2245
Epoch 20/25
552/552 [=====] - 4s 8ms/step - loss: 2.1970 - accuracy: 0.2252 - val_loss: 2.1936 - val_accuracy: 0.2253
Epoch 21/25
552/552 [=====] - 4s 8ms/step - loss: 2.1900 - accuracy: 0.2284 - val_loss: 2.1864 - val_accuracy: 0.2308
Epoch 22/25
552/552 [=====] - 4s 8ms/step - loss: 2.1829 - accuracy: 0.2313 - val_loss: 2.1792 - val_accuracy: 0.2337

Epoch 23/25
552/552 [=====] - 4s 8ms/step - loss: 2.1758 -
accuracy: 0.2348 - val_loss: 2.1722 - val_accuracy: 0.2365
Epoch 24/25
552/552 [=====] - 4s 8ms/step - loss: 2.1687 -
accuracy: 0.2381 - val_loss: 2.1655 - val_accuracy: 0.2427
Epoch 25/25
552/552 [=====] - 4s 8ms/step - loss: 2.1616 -
accuracy: 0.2414 - val_loss: 2.1583 - val_accuracy: 0.2425

Accuracy: 24.25%

Iteration No: 16 ended. Search finished for the next optimal point.

Time taken: 108.5190

Function value obtained: -0.2425

Current minimum: -0.7380

Iteration No: 17 started. Searching for the next optimal point.

Epoch 1/25
868/868 [=====] - 7s 7ms/step - loss: 2.3059 -
accuracy: 0.0983 - val_loss: 2.3032 - val_accuracy: 0.0975
Epoch 2/25
868/868 [=====] - 6s 6ms/step - loss: 2.3029 -
accuracy: 0.1005 - val_loss: 2.3034 - val_accuracy: 0.0984
Epoch 3/25
868/868 [=====] - 6s 7ms/step - loss: 2.1237 -
accuracy: 0.1639 - val_loss: 2.0163 - val_accuracy: 0.1805
Epoch 4/25
868/868 [=====] - 6s 7ms/step - loss: 1.8332 -
accuracy: 0.2600 - val_loss: 1.7808 - val_accuracy: 0.3467
Epoch 5/25
868/868 [=====] - 6s 7ms/step - loss: 1.4280 -
accuracy: 0.4724 - val_loss: 1.4280 - val_accuracy: 0.4788
Epoch 6/25
868/868 [=====] - 6s 7ms/step - loss: 1.1435 -
accuracy: 0.5873 - val_loss: 1.3597 - val_accuracy: 0.5023
Epoch 7/25
868/868 [=====] - 6s 6ms/step - loss: 0.9637 -
accuracy: 0.6549 - val_loss: 1.2114 - val_accuracy: 0.5663
Epoch 8/25
868/868 [=====] - 6s 6ms/step - loss: 0.8331 -
accuracy: 0.7031 - val_loss: 1.4600 - val_accuracy: 0.5405
Epoch 9/25
868/868 [=====] - 6s 7ms/step - loss: 0.7373 -
accuracy: 0.7402 - val_loss: 1.1176 - val_accuracy: 0.6380
Epoch 10/25
868/868 [=====] - 6s 7ms/step - loss: 0.6421 -
accuracy: 0.7722 - val_loss: 0.9570 - val_accuracy: 0.6752
Epoch 11/25

868/868 [=====] - 6s 7ms/step - loss: 0.5719 -
accuracy: 0.7976 - val_loss: 0.9878 - val_accuracy: 0.6777
Epoch 12/25
868/868 [=====] - 6s 6ms/step - loss: 0.5020 -
accuracy: 0.8213 - val_loss: 1.1487 - val_accuracy: 0.6568
Epoch 13/25
868/868 [=====] - 6s 6ms/step - loss: 0.4576 -
accuracy: 0.8378 - val_loss: 1.0198 - val_accuracy: 0.7041
Epoch 14/25
868/868 [=====] - 6s 7ms/step - loss: 0.4023 -
accuracy: 0.8579 - val_loss: 1.1990 - val_accuracy: 0.6635
Epoch 15/25
868/868 [=====] - 6s 6ms/step - loss: 0.3649 -
accuracy: 0.8712 - val_loss: 0.9376 - val_accuracy: 0.7297
Epoch 16/25
868/868 [=====] - 6s 7ms/step - loss: 0.3351 -
accuracy: 0.8827 - val_loss: 1.3443 - val_accuracy: 0.6803
Epoch 17/25
868/868 [=====] - 6s 6ms/step - loss: 0.3054 -
accuracy: 0.8921 - val_loss: 1.7045 - val_accuracy: 0.6153
Epoch 18/25
868/868 [=====] - 6s 6ms/step - loss: 0.2858 -
accuracy: 0.8998 - val_loss: 1.2187 - val_accuracy: 0.7012
Epoch 19/25
868/868 [=====] - 6s 6ms/step - loss: 0.2645 -
accuracy: 0.9065 - val_loss: 1.0331 - val_accuracy: 0.7323
Epoch 20/25
868/868 [=====] - 6s 7ms/step - loss: 0.2422 -
accuracy: 0.9159 - val_loss: 1.3216 - val_accuracy: 0.6981
Epoch 21/25
868/868 [=====] - 6s 6ms/step - loss: 0.2449 -
accuracy: 0.9130 - val_loss: 1.2557 - val_accuracy: 0.7197
Epoch 22/25
868/868 [=====] - 6s 6ms/step - loss: 0.2185 -
accuracy: 0.9240 - val_loss: 1.4305 - val_accuracy: 0.6940
Epoch 23/25
868/868 [=====] - 6s 6ms/step - loss: 0.2174 -
accuracy: 0.9255 - val_loss: 1.6925 - val_accuracy: 0.6597
Epoch 24/25
868/868 [=====] - 6s 6ms/step - loss: 0.1912 -
accuracy: 0.9339 - val_loss: 1.4179 - val_accuracy: 0.7065
Epoch 25/25
868/868 [=====] - 6s 6ms/step - loss: 0.1900 -
accuracy: 0.9350 - val_loss: 1.4477 - val_accuracy: 0.7112

Accuracy: 71.12%

Iteration No: 17 ended. Search finished for the next optimal point.

Time taken: 144.0074
Function value obtained: -0.7112
Current minimum: -0.7380
Iteration No: 18 started. Searching for the next optimal point.

Epoch 1/25
635/635 [=====] - 4s 6ms/step - loss: 2.3079 -
accuracy: 0.1506 - val_loss: 2.2727 - val_accuracy: 0.1912

Epoch 2/25
635/635 [=====] - 3s 5ms/step - loss: 2.2549 -
accuracy: 0.2199 - val_loss: 2.2393 - val_accuracy: 0.2200

Epoch 3/25
635/635 [=====] - 3s 5ms/step - loss: 2.2196 -
accuracy: 0.2437 - val_loss: 2.2023 - val_accuracy: 0.2405

Epoch 4/25
635/635 [=====] - 3s 5ms/step - loss: 2.1797 -
accuracy: 0.2573 - val_loss: 2.1631 - val_accuracy: 0.2447

Epoch 5/25
635/635 [=====] - 3s 5ms/step - loss: 2.1393 -
accuracy: 0.2698 - val_loss: 2.1239 - val_accuracy: 0.2729

Epoch 6/25
635/635 [=====] - 3s 5ms/step - loss: 2.1020 -
accuracy: 0.2817 - val_loss: 2.0905 - val_accuracy: 0.2777

Epoch 7/25
635/635 [=====] - 3s 5ms/step - loss: 2.0693 -
accuracy: 0.2896 - val_loss: 2.0639 - val_accuracy: 0.2788

Epoch 8/25
635/635 [=====] - 3s 5ms/step - loss: 2.0404 -
accuracy: 0.3003 - val_loss: 2.0418 - val_accuracy: 0.2991

Epoch 9/25
635/635 [=====] - 3s 5ms/step - loss: 2.0138 -
accuracy: 0.3075 - val_loss: 2.0196 - val_accuracy: 0.3031

Epoch 10/25
635/635 [=====] - 3s 5ms/step - loss: 1.9870 -
accuracy: 0.3180 - val_loss: 1.9825 - val_accuracy: 0.3105

Epoch 11/25
635/635 [=====] - 3s 5ms/step - loss: 1.9590 -
accuracy: 0.3247 - val_loss: 1.9505 - val_accuracy: 0.3188

Epoch 12/25
635/635 [=====] - 3s 5ms/step - loss: 1.9286 -
accuracy: 0.3342 - val_loss: 1.9696 - val_accuracy: 0.2992

Epoch 13/25
635/635 [=====] - 3s 5ms/step - loss: 1.8974 -
accuracy: 0.3457 - val_loss: 1.9065 - val_accuracy: 0.3267

Epoch 14/25
635/635 [=====] - 3s 5ms/step - loss: 1.8666 -
accuracy: 0.3527 - val_loss: 1.8572 - val_accuracy: 0.3460

Epoch 15/25
635/635 [=====] - 3s 5ms/step - loss: 1.8366 -

accuracy: 0.3620 - val_loss: 1.8357 - val_accuracy: 0.3592
Epoch 16/25
635/635 [=====] - 3s 5ms/step - loss: 1.8088 -
accuracy: 0.3694 - val_loss: 1.8437 - val_accuracy: 0.3359
Epoch 17/25
635/635 [=====] - 3s 5ms/step - loss: 1.7812 -
accuracy: 0.3759 - val_loss: 1.7798 - val_accuracy: 0.3660
Epoch 18/25
635/635 [=====] - 3s 5ms/step - loss: 1.7562 -
accuracy: 0.3810 - val_loss: 1.7530 - val_accuracy: 0.3728
Epoch 19/25
635/635 [=====] - 3s 5ms/step - loss: 1.7329 -
accuracy: 0.3855 - val_loss: 1.7346 - val_accuracy: 0.3768
Epoch 20/25
635/635 [=====] - 3s 5ms/step - loss: 1.7104 -
accuracy: 0.3914 - val_loss: 1.7523 - val_accuracy: 0.3685
Epoch 21/25
635/635 [=====] - 3s 5ms/step - loss: 1.6886 -
accuracy: 0.3991 - val_loss: 1.7128 - val_accuracy: 0.3847
Epoch 22/25
635/635 [=====] - 3s 5ms/step - loss: 1.6703 -
accuracy: 0.4037 - val_loss: 1.6644 - val_accuracy: 0.4037
Epoch 23/25
635/635 [=====] - 3s 5ms/step - loss: 1.6507 -
accuracy: 0.4101 - val_loss: 1.6476 - val_accuracy: 0.4205
Epoch 24/25
635/635 [=====] - 3s 5ms/step - loss: 1.6305 -
accuracy: 0.4174 - val_loss: 1.6335 - val_accuracy: 0.4172
Epoch 25/25
635/635 [=====] - 3s 5ms/step - loss: 1.6140 -
accuracy: 0.4236 - val_loss: 1.6808 - val_accuracy: 0.4063

Accuracy: 40.63%

Iteration No: 18 ended. Search finished for the next optimal point.

Time taken: 143.7304

Function value obtained: -0.4063

Current minimum: -0.7380

Iteration No: 19 started. Searching for the next optimal point.

Epoch 1/25

788/788 [=====] - 7s 8ms/step - loss: 2.0079 -
accuracy: 0.2606 - val_loss: 3.8026 - val_accuracy: 0.1097

Epoch 2/25

788/788 [=====] - 6s 7ms/step - loss: 1.5072 -
accuracy: 0.4535 - val_loss: 3.8636 - val_accuracy: 0.2416

Epoch 3/25

788/788 [=====] - 6s 7ms/step - loss: 1.2562 -
accuracy: 0.5484 - val_loss: 2.3272 - val_accuracy: 0.2997

Epoch 4/25
788/788 [=====] - 6s 7ms/step - loss: 1.0771 - accuracy: 0.6159 - val_loss: 1.8809 - val_accuracy: 0.4340

Epoch 5/25
788/788 [=====] - 6s 7ms/step - loss: 0.9293 - accuracy: 0.6686 - val_loss: 2.5396 - val_accuracy: 0.3988

Epoch 6/25
788/788 [=====] - 6s 7ms/step - loss: 0.8382 - accuracy: 0.7050 - val_loss: 0.8975 - val_accuracy: 0.6987

Epoch 7/25
788/788 [=====] - 6s 7ms/step - loss: 0.7216 - accuracy: 0.7481 - val_loss: 1.6856 - val_accuracy: 0.5173

Epoch 8/25
788/788 [=====] - 6s 7ms/step - loss: 0.6418 - accuracy: 0.7750 - val_loss: 0.9142 - val_accuracy: 0.6981

Epoch 9/25
788/788 [=====] - 6s 7ms/step - loss: 0.5663 - accuracy: 0.8014 - val_loss: 5.0280 - val_accuracy: 0.3337

Epoch 10/25
788/788 [=====] - 6s 7ms/step - loss: 0.5313 - accuracy: 0.8137 - val_loss: 0.9814 - val_accuracy: 0.6925

Epoch 11/25
788/788 [=====] - 6s 7ms/step - loss: 0.4528 - accuracy: 0.8386 - val_loss: 1.6455 - val_accuracy: 0.5909

Epoch 12/25
788/788 [=====] - 6s 7ms/step - loss: 0.3984 - accuracy: 0.8580 - val_loss: 1.2281 - val_accuracy: 0.6756

Epoch 13/25
788/788 [=====] - 6s 7ms/step - loss: 0.3583 - accuracy: 0.8749 - val_loss: 3.8737 - val_accuracy: 0.3711

Epoch 14/25
788/788 [=====] - 6s 7ms/step - loss: 0.3840 - accuracy: 0.8671 - val_loss: 1.0015 - val_accuracy: 0.7167

Epoch 15/25
788/788 [=====] - 6s 7ms/step - loss: 0.2947 - accuracy: 0.8965 - val_loss: 1.1488 - val_accuracy: 0.7013

Epoch 16/25
788/788 [=====] - 6s 7ms/step - loss: 0.2568 - accuracy: 0.9111 - val_loss: 1.2719 - val_accuracy: 0.6983

Epoch 17/25
788/788 [=====] - 6s 7ms/step - loss: 0.2452 - accuracy: 0.9143 - val_loss: 1.1400 - val_accuracy: 0.7196

Epoch 18/25
788/788 [=====] - 6s 7ms/step - loss: 0.2248 - accuracy: 0.9230 - val_loss: 1.1855 - val_accuracy: 0.7131

Epoch 19/25
788/788 [=====] - 6s 7ms/step - loss: 0.2147 - accuracy: 0.9264 - val_loss: 1.7319 - val_accuracy: 0.6661

Epoch 20/25
788/788 [=====] - 6s 7ms/step - loss: 0.1914 -
accuracy: 0.9355 - val_loss: 1.2771 - val_accuracy: 0.7211
Epoch 21/25
788/788 [=====] - 6s 7ms/step - loss: 0.1801 -
accuracy: 0.9381 - val_loss: 1.2433 - val_accuracy: 0.7161
Epoch 22/25
788/788 [=====] - 6s 7ms/step - loss: 0.1731 -
accuracy: 0.9409 - val_loss: 1.2293 - val_accuracy: 0.7097
Epoch 23/25
788/788 [=====] - 6s 7ms/step - loss: 0.1556 -
accuracy: 0.9471 - val_loss: 111.3614 - val_accuracy: 0.1003
Epoch 24/25
788/788 [=====] - 5s 7ms/step - loss: nan - accuracy:
0.0997 - val_loss: nan - val_accuracy: 0.1015
Epoch 25/25
788/788 [=====] - 6s 7ms/step - loss: nan - accuracy:
0.0997 - val_loss: nan - val_accuracy: 0.1015

Accuracy: 10.15%

Iteration No: 19 ended. Search finished for the next optimal point.

Time taken: 143.5796

Function value obtained: -0.1015

Current minimum: -0.7380

Iteration No: 20 started. Searching for the next optimal point.

Epoch 1/25
1771/1771 [=====] - 10s 5ms/step - loss: 1.7797 -
accuracy: 0.3404 - val_loss: 1.4888 - val_accuracy: 0.4464
Epoch 2/25
1771/1771 [=====] - 9s 5ms/step - loss: 1.3205 -
accuracy: 0.5157 - val_loss: 1.1247 - val_accuracy: 0.5903
Epoch 3/25
1771/1771 [=====] - 9s 5ms/step - loss: 1.0757 -
accuracy: 0.6175 - val_loss: 0.9781 - val_accuracy: 0.6604
Epoch 4/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.9014 -
accuracy: 0.6809 - val_loss: 1.0007 - val_accuracy: 0.6595
Epoch 5/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.7834 -
accuracy: 0.7234 - val_loss: 0.9506 - val_accuracy: 0.6785
Epoch 6/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.6864 -
accuracy: 0.7583 - val_loss: 0.8231 - val_accuracy: 0.7241
Epoch 7/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.6008 -
accuracy: 0.7890 - val_loss: 0.8907 - val_accuracy: 0.7208
Epoch 8/25

1771/1771 [=====] - 9s 5ms/step - loss: 0.5232 - accuracy: 0.8168 - val_loss: 0.8744 - val_accuracy: 0.7145
Epoch 9/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.4643 - accuracy: 0.8362 - val_loss: 0.8253 - val_accuracy: 0.7339
Epoch 10/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.4114 - accuracy: 0.8538 - val_loss: 0.8132 - val_accuracy: 0.7501
Epoch 11/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.3596 - accuracy: 0.8744 - val_loss: 0.9265 - val_accuracy: 0.7333
Epoch 12/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.3210 - accuracy: 0.8860 - val_loss: 0.9527 - val_accuracy: 0.7335
Epoch 13/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.2882 - accuracy: 0.8996 - val_loss: 0.9319 - val_accuracy: 0.7403
Epoch 14/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.2658 - accuracy: 0.9052 - val_loss: 1.0240 - val_accuracy: 0.7375
Epoch 15/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.2418 - accuracy: 0.9147 - val_loss: 0.9684 - val_accuracy: 0.7504
Epoch 16/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.2263 - accuracy: 0.9199 - val_loss: 1.1946 - val_accuracy: 0.7028
Epoch 17/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1961 - accuracy: 0.9307 - val_loss: 1.1317 - val_accuracy: 0.7353
Epoch 18/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1878 - accuracy: 0.9347 - val_loss: 1.1605 - val_accuracy: 0.7357
Epoch 19/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1721 - accuracy: 0.9396 - val_loss: 1.1462 - val_accuracy: 0.7323
Epoch 20/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1510 - accuracy: 0.9470 - val_loss: 1.1640 - val_accuracy: 0.7517
Epoch 21/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1456 - accuracy: 0.9494 - val_loss: 1.2843 - val_accuracy: 0.7395
Epoch 22/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1258 - accuracy: 0.9572 - val_loss: 1.2821 - val_accuracy: 0.7420
Epoch 23/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1273 - accuracy: 0.9564 - val_loss: 1.3369 - val_accuracy: 0.7383
Epoch 24/25

1771/1771 [=====] - 9s 5ms/step - loss: 0.1199 -
accuracy: 0.9587 - val_loss: 1.2146 - val_accuracy: 0.7461

Epoch 25/25

1771/1771 [=====] - 9s 5ms/step - loss: 0.1056 -
accuracy: 0.9633 - val_loss: 1.3762 - val_accuracy: 0.7476

Accuracy: 74.76%

Iteration No: 20 ended. Search finished for the next optimal point.

Time taken: 218.5125

Function value obtained: -0.7476

Current minimum: -0.7476

Iteration No: 21 started. Searching for the next optimal point.

Epoch 1/25

3270/3270 [=====] - 16s 5ms/step - loss: 2.2459 -
accuracy: 0.1683 - val_loss: 2.1731 - val_accuracy: 0.2247

Epoch 2/25

3270/3270 [=====] - 16s 5ms/step - loss: 2.0652 -
accuracy: 0.2627 - val_loss: 1.9814 - val_accuracy: 0.2748

Epoch 3/25

3270/3270 [=====] - 15s 5ms/step - loss: 1.8586 -
accuracy: 0.3263 - val_loss: 1.7734 - val_accuracy: 0.3637

Epoch 4/25

3270/3270 [=====] - 15s 5ms/step - loss: 1.7279 -
accuracy: 0.3747 - val_loss: 1.6845 - val_accuracy: 0.3908

Epoch 5/25

3270/3270 [=====] - 15s 5ms/step - loss: 1.6355 -
accuracy: 0.4107 - val_loss: 1.7248 - val_accuracy: 0.3724

Epoch 6/25

3270/3270 [=====] - 16s 5ms/step - loss: 1.5654 -
accuracy: 0.4341 - val_loss: 1.5366 - val_accuracy: 0.4397

Epoch 7/25

3270/3270 [=====] - 16s 5ms/step - loss: 1.5129 -
accuracy: 0.4571 - val_loss: 1.5493 - val_accuracy: 0.4464

Epoch 8/25

3270/3270 [=====] - 16s 5ms/step - loss: 1.4713 -
accuracy: 0.4723 - val_loss: 1.4624 - val_accuracy: 0.4744

Epoch 9/25

3270/3270 [=====] - 15s 5ms/step - loss: 1.4330 -
accuracy: 0.4845 - val_loss: 1.4546 - val_accuracy: 0.4717

Epoch 10/25

3270/3270 [=====] - 16s 5ms/step - loss: 1.3974 -
accuracy: 0.4994 - val_loss: 1.4697 - val_accuracy: 0.4772

Epoch 11/25

3270/3270 [=====] - 16s 5ms/step - loss: 1.3653 -
accuracy: 0.5107 - val_loss: 1.5905 - val_accuracy: 0.4472

Epoch 12/25

3270/3270 [=====] - 15s 5ms/step - loss: 1.3341 -

accuracy: 0.5219 - val_loss: 1.3348 - val_accuracy: 0.5161
Epoch 13/25
3270/3270 [=====] - 15s 5ms/step - loss: 1.3062 -
accuracy: 0.5304 - val_loss: 1.3737 - val_accuracy: 0.5100
Epoch 14/25
3270/3270 [=====] - 15s 5ms/step - loss: 1.2789 -
accuracy: 0.5417 - val_loss: 1.4042 - val_accuracy: 0.5084
Epoch 15/25
3270/3270 [=====] - 15s 5ms/step - loss: 1.2531 -
accuracy: 0.5519 - val_loss: 1.2776 - val_accuracy: 0.5392
Epoch 16/25
3270/3270 [=====] - 15s 5ms/step - loss: 1.2300 -
accuracy: 0.5593 - val_loss: 1.2652 - val_accuracy: 0.5483
Epoch 17/25
3270/3270 [=====] - 15s 5ms/step - loss: 1.2048 -
accuracy: 0.5700 - val_loss: 1.3397 - val_accuracy: 0.5347
Epoch 18/25
3270/3270 [=====] - 15s 5ms/step - loss: 1.1834 -
accuracy: 0.5780 - val_loss: 1.3079 - val_accuracy: 0.5368
Epoch 19/25
3270/3270 [=====] - 15s 5ms/step - loss: 1.1614 -
accuracy: 0.5840 - val_loss: 1.2515 - val_accuracy: 0.5631
Epoch 20/25
3270/3270 [=====] - 15s 5ms/step - loss: 1.1427 -
accuracy: 0.5925 - val_loss: 1.3060 - val_accuracy: 0.5369
Epoch 21/25
3270/3270 [=====] - 15s 5ms/step - loss: 1.1217 -
accuracy: 0.6004 - val_loss: 1.1927 - val_accuracy: 0.5785
Epoch 22/25
3270/3270 [=====] - 16s 5ms/step - loss: 1.1022 -
accuracy: 0.6095 - val_loss: 1.3100 - val_accuracy: 0.5463
Epoch 23/25
3270/3270 [=====] - 15s 5ms/step - loss: 1.0825 -
accuracy: 0.6135 - val_loss: 1.2083 - val_accuracy: 0.5792
Epoch 24/25
3270/3270 [=====] - 15s 5ms/step - loss: 1.0652 -
accuracy: 0.6212 - val_loss: 1.3239 - val_accuracy: 0.5428
Epoch 25/25
3270/3270 [=====] - 15s 5ms/step - loss: 1.0473 -
accuracy: 0.6294 - val_loss: 1.2370 - val_accuracy: 0.5649

Accuracy: 56.49%

Iteration No: 21 ended. Search finished for the next optimal point.

Time taken: 388.8966

Function value obtained: -0.5649

Current minimum: -0.7476

Iteration No: 22 started. Searching for the next optimal point.

Epoch 1/25
532/532 [=====] - 6s 10ms/step - loss: 2.2299 - accuracy: 0.1714 - val_loss: 2.1733 - val_accuracy: 0.2007
Epoch 2/25
532/532 [=====] - 5s 9ms/step - loss: 1.7119 - accuracy: 0.3790 - val_loss: 1.5574 - val_accuracy: 0.4357
Epoch 3/25
532/532 [=====] - 5s 9ms/step - loss: 1.4031 - accuracy: 0.4891 - val_loss: 1.5593 - val_accuracy: 0.4281
Epoch 4/25
532/532 [=====] - 5s 9ms/step - loss: 1.2207 - accuracy: 0.5575 - val_loss: 1.3093 - val_accuracy: 0.5539
Epoch 5/25
532/532 [=====] - 5s 9ms/step - loss: 1.0789 - accuracy: 0.6151 - val_loss: 1.1755 - val_accuracy: 0.5633
Epoch 6/25
532/532 [=====] - 5s 9ms/step - loss: 0.9526 - accuracy: 0.6607 - val_loss: 1.1674 - val_accuracy: 0.5879
Epoch 7/25
532/532 [=====] - 5s 9ms/step - loss: 0.8514 - accuracy: 0.6993 - val_loss: 1.0288 - val_accuracy: 0.6376
Epoch 8/25
532/532 [=====] - 5s 9ms/step - loss: 0.7586 - accuracy: 0.7328 - val_loss: 1.0028 - val_accuracy: 0.6653
Epoch 9/25
532/532 [=====] - 5s 9ms/step - loss: 0.6823 - accuracy: 0.7602 - val_loss: 1.1240 - val_accuracy: 0.6291
Epoch 10/25
532/532 [=====] - 5s 9ms/step - loss: 0.6132 - accuracy: 0.7830 - val_loss: 1.2406 - val_accuracy: 0.6255
Epoch 11/25
532/532 [=====] - 5s 9ms/step - loss: 0.5479 - accuracy: 0.8063 - val_loss: 1.1991 - val_accuracy: 0.6435
Epoch 12/25
532/532 [=====] - 5s 9ms/step - loss: 0.4846 - accuracy: 0.8292 - val_loss: 1.3423 - val_accuracy: 0.6111
Epoch 13/25
532/532 [=====] - 5s 9ms/step - loss: 0.4391 - accuracy: 0.8448 - val_loss: 1.1299 - val_accuracy: 0.6849
Epoch 14/25
532/532 [=====] - 5s 9ms/step - loss: 0.3823 - accuracy: 0.8640 - val_loss: 2.0372 - val_accuracy: 0.5209
Epoch 15/25
532/532 [=====] - 5s 9ms/step - loss: 0.3486 - accuracy: 0.8771 - val_loss: 1.0707 - val_accuracy: 0.7019
Epoch 16/25
532/532 [=====] - 5s 9ms/step - loss: 0.3064 - accuracy: 0.8924 - val_loss: 1.1342 - val_accuracy: 0.7035

Epoch 17/25
532/532 [=====] - 5s 9ms/step - loss: 0.2860 -
accuracy: 0.8983 - val_loss: 1.2772 - val_accuracy: 0.6817
Epoch 18/25
532/532 [=====] - 5s 9ms/step - loss: 0.2502 -
accuracy: 0.9098 - val_loss: 1.7356 - val_accuracy: 0.6175
Epoch 19/25
532/532 [=====] - 5s 9ms/step - loss: 0.2483 -
accuracy: 0.9129 - val_loss: 1.5773 - val_accuracy: 0.6569
Epoch 20/25
532/532 [=====] - 5s 9ms/step - loss: 0.2061 -
accuracy: 0.9271 - val_loss: 1.3456 - val_accuracy: 0.6863
Epoch 21/25
532/532 [=====] - 5s 9ms/step - loss: 0.1881 -
accuracy: 0.9341 - val_loss: 1.6583 - val_accuracy: 0.6453
Epoch 22/25
532/532 [=====] - 5s 9ms/step - loss: 0.1802 -
accuracy: 0.9373 - val_loss: 1.5650 - val_accuracy: 0.6817
Epoch 23/25
532/532 [=====] - 5s 9ms/step - loss: 0.1653 -
accuracy: 0.9416 - val_loss: 1.5761 - val_accuracy: 0.6803
Epoch 24/25
532/532 [=====] - 5s 9ms/step - loss: 0.1452 -
accuracy: 0.9490 - val_loss: 1.4224 - val_accuracy: 0.7057
Epoch 25/25
532/532 [=====] - 5s 9ms/step - loss: 0.1444 -
accuracy: 0.9514 - val_loss: 2.2152 - val_accuracy: 0.6356

Accuracy: 63.56%

Iteration No: 22 ended. Search finished for the next optimal point.

Time taken: 124.2332

Function value obtained: -0.6356

Current minimum: -0.7476

Iteration No: 23 started. Searching for the next optimal point.

Epoch 1/25

42500/42500 [=====] - 157s 4ms/step - loss: nan -
accuracy: 0.0997 - val_loss: nan - val_accuracy: 0.1015

Epoch 2/25

42500/42500 [=====] - 155s 4ms/step - loss: nan -
accuracy: 0.0997 - val_loss: nan - val_accuracy: 0.1015

Epoch 3/25

42500/42500 [=====] - 148s 3ms/step - loss: nan -
accuracy: 0.0997 - val_loss: nan - val_accuracy: 0.1015

Epoch 4/25

42500/42500 [=====] - 148s 3ms/step - loss: nan -
accuracy: 0.0997 - val_loss: nan - val_accuracy: 0.1015

Epoch 5/25

42500/42500 [=====] - 148s 3ms/step - loss: nan -
accuracy: 0.0997 - val_loss: nan - val_accuracy: 0.1015
Epoch 6/25
42500/42500 [=====] - 147s 3ms/step - loss: nan -
accuracy: 0.0997 - val_loss: nan - val_accuracy: 0.1015
Epoch 7/25
42500/42500 [=====] - 146s 3ms/step - loss: nan -
accuracy: 0.0997 - val_loss: nan - val_accuracy: 0.1015
Epoch 8/25
42500/42500 [=====] - 146s 3ms/step - loss: nan -
accuracy: 0.0997 - val_loss: nan - val_accuracy: 0.1015
Epoch 9/25
42500/42500 [=====] - 147s 3ms/step - loss: nan -
accuracy: 0.0997 - val_loss: nan - val_accuracy: 0.1015
Epoch 10/25
42500/42500 [=====] - 147s 3ms/step - loss: nan -
accuracy: 0.0997 - val_loss: nan - val_accuracy: 0.1015

Accuracy: 10.15%

Iteration No: 23 ended. Search finished for the next optimal point.

Time taken: 1490.5837

Function value obtained: -0.1015

Current minimum: -0.7476

Iteration No: 24 started. Searching for the next optimal point.

Epoch 1/25
1932/1932 [=====] - 11s 5ms/step - loss: 1.8945 -
accuracy: 0.2862 - val_loss: 1.5259 - val_accuracy: 0.4369
Epoch 2/25
1932/1932 [=====] - 9s 5ms/step - loss: 1.3881 -
accuracy: 0.4976 - val_loss: 1.2633 - val_accuracy: 0.5463
Epoch 3/25
1932/1932 [=====] - 9s 5ms/step - loss: 1.1652 -
accuracy: 0.5859 - val_loss: 1.1845 - val_accuracy: 0.5999
Epoch 4/25
1932/1932 [=====] - 9s 5ms/step - loss: 1.0242 -
accuracy: 0.6430 - val_loss: 0.9631 - val_accuracy: 0.6736
Epoch 5/25
1932/1932 [=====] - 9s 5ms/step - loss: 0.9235 -
accuracy: 0.6819 - val_loss: 0.9216 - val_accuracy: 0.6763
Epoch 6/25
1932/1932 [=====] - 9s 5ms/step - loss: 0.8659 -
accuracy: 0.7036 - val_loss: 1.0761 - val_accuracy: 0.6548
Epoch 7/25
1932/1932 [=====] - 9s 5ms/step - loss: 0.8169 -
accuracy: 0.7224 - val_loss: 0.9123 - val_accuracy: 0.7012
Epoch 8/25
1932/1932 [=====] - 9s 5ms/step - loss: 0.7930 -

```

accuracy: 0.7328 - val_loss: 1.0429 - val_accuracy: 0.6547
Epoch 9/25
1932/1932 [=====] - 9s 5ms/step - loss: 0.7788 -
accuracy: 0.7358 - val_loss: 0.9518 - val_accuracy: 0.6957
Epoch 10/25
1932/1932 [=====] - 9s 5ms/step - loss: 0.7660 -
accuracy: 0.7458 - val_loss: 0.9014 - val_accuracy: 0.7105
Epoch 11/25
1932/1932 [=====] - 9s 5ms/step - loss: 0.7636 -
accuracy: 0.7472 - val_loss: 0.9495 - val_accuracy: 0.7009
Epoch 12/25
1932/1932 [=====] - 9s 5ms/step - loss: 0.7623 -
accuracy: 0.7526 - val_loss: 1.0592 - val_accuracy: 0.6451
Epoch 13/25
1932/1932 [=====] - 9s 5ms/step - loss: 0.7834 -
accuracy: 0.7492 - val_loss: 0.9702 - val_accuracy: 0.7040
Epoch 14/25
1932/1932 [=====] - 9s 5ms/step - loss: 0.8002 -
accuracy: 0.7447 - val_loss: 0.9891 - val_accuracy: 0.6933
Epoch 15/25
1932/1932 [=====] - 9s 5ms/step - loss: 0.8462 -
accuracy: 0.7318 - val_loss: 1.1827 - val_accuracy: 0.6595
Epoch 16/25
1932/1932 [=====] - 9s 5ms/step - loss: 0.9047 -
accuracy: 0.7134 - val_loss: 1.2502 - val_accuracy: 0.6385
Epoch 17/25
1932/1932 [=====] - 9s 5ms/step - loss: 0.9459 -
accuracy: 0.7046 - val_loss: 1.1026 - val_accuracy: 0.6600
Epoch 18/25
1932/1932 [=====] - 9s 5ms/step - loss: 0.9850 -
accuracy: 0.6955 - val_loss: 1.1480 - val_accuracy: 0.6635
Epoch 19/25
1932/1932 [=====] - 9s 5ms/step - loss: 1.0411 -
accuracy: 0.6756 - val_loss: 1.2761 - val_accuracy: 0.5964
Epoch 20/25
1932/1932 [=====] - 9s 5ms/step - loss: 1.0572 -
accuracy: 0.6722 - val_loss: 1.6136 - val_accuracy: 0.5669
Epoch 21/25
1932/1932 [=====] - 10s 5ms/step - loss: 1.2330 -
accuracy: 0.6235 - val_loss: 1.3810 - val_accuracy: 0.5379
Epoch 22/25
1932/1932 [=====] - 9s 5ms/step - loss: 1.7976 -
accuracy: 0.4381 - val_loss: 2.3037 - val_accuracy: 0.1015

```

Accuracy: 10.15%

Iteration No: 24 ended. Search finished for the next optimal point.
Time taken: 208.3791

Function value obtained: -0.1015
Current minimum: -0.7476
Iteration No: 25 started. Searching for the next optimal point.

Epoch 1/25
1700/1700 [=====] - 9s 5ms/step - loss: 2.3028 -
accuracy: 0.1012 - val_loss: 2.3032 - val_accuracy: 0.0952

Epoch 2/25
1700/1700 [=====] - 8s 5ms/step - loss: 2.3029 -
accuracy: 0.0968 - val_loss: 2.3029 - val_accuracy: 0.0972

Epoch 3/25
1700/1700 [=====] - 8s 4ms/step - loss: 2.3028 -
accuracy: 0.1000 - val_loss: 2.3027 - val_accuracy: 0.0972

Epoch 4/25
1700/1700 [=====] - 8s 5ms/step - loss: 2.3029 -
accuracy: 0.0971 - val_loss: 2.3029 - val_accuracy: 0.0972

Epoch 5/25
1700/1700 [=====] - 8s 5ms/step - loss: 2.3028 -
accuracy: 0.0995 - val_loss: 2.3027 - val_accuracy: 0.1015

Epoch 6/25
1700/1700 [=====] - 8s 5ms/step - loss: 2.3028 -
accuracy: 0.1006 - val_loss: 2.3031 - val_accuracy: 0.0999

Epoch 7/25
1700/1700 [=====] - 8s 5ms/step - loss: 2.3028 -
accuracy: 0.0984 - val_loss: 2.3035 - val_accuracy: 0.0972

Epoch 8/25
1700/1700 [=====] - 8s 5ms/step - loss: 2.3029 -
accuracy: 0.0971 - val_loss: 2.3028 - val_accuracy: 0.0999

Epoch 9/25
1700/1700 [=====] - 8s 5ms/step - loss: 2.3028 -
accuracy: 0.0989 - val_loss: 2.3026 - val_accuracy: 0.0975

Epoch 10/25
1700/1700 [=====] - 8s 4ms/step - loss: 2.3029 -
accuracy: 0.0973 - val_loss: 2.3027 - val_accuracy: 0.1029

Epoch 11/25
1700/1700 [=====] - 8s 4ms/step - loss: 2.3029 -
accuracy: 0.0971 - val_loss: 2.3027 - val_accuracy: 0.0972

Epoch 12/25
1700/1700 [=====] - 8s 5ms/step - loss: 2.3028 -
accuracy: 0.0987 - val_loss: 2.3030 - val_accuracy: 0.0975

Epoch 13/25
1700/1700 [=====] - 8s 5ms/step - loss: 2.3029 -
accuracy: 0.0978 - val_loss: 2.3025 - val_accuracy: 0.1029

Epoch 14/25
1700/1700 [=====] - 8s 5ms/step - loss: 2.3029 -
accuracy: 0.0980 - val_loss: 2.3028 - val_accuracy: 0.0975

Epoch 15/25
1700/1700 [=====] - 8s 5ms/step - loss: 2.3029 -
accuracy: 0.0967 - val_loss: 2.3029 - val_accuracy: 0.1008

Epoch 16/25
1700/1700 [=====] - 8s 5ms/step - loss: 2.3029 - accuracy: 0.0961 - val_loss: 2.3030 - val_accuracy: 0.0972
Epoch 17/25
1700/1700 [=====] - 8s 5ms/step - loss: 2.3029 - accuracy: 0.0968 - val_loss: 2.3029 - val_accuracy: 0.1015

Accuracy: 10.15%

Iteration No: 25 ended. Search finished for the next optimal point.
Time taken: 134.8285
Function value obtained: -0.1015
Current minimum: -0.7476
Iteration No: 26 started. Searching for the next optimal point.

Epoch 1/25
1037/1037 [=====] - 7s 6ms/step - loss: 2.2358 - accuracy: 0.1784 - val_loss: 2.1706 - val_accuracy: 0.2072
Epoch 2/25
1037/1037 [=====] - 6s 6ms/step - loss: 2.0884 - accuracy: 0.2550 - val_loss: 2.0400 - val_accuracy: 0.2459
Epoch 3/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.9206 - accuracy: 0.3028 - val_loss: 1.8624 - val_accuracy: 0.2973
Epoch 4/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.7704 - accuracy: 0.3407 - val_loss: 1.9688 - val_accuracy: 0.2557
Epoch 5/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.6738 - accuracy: 0.3809 - val_loss: 1.6139 - val_accuracy: 0.4049
Epoch 6/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.5934 - accuracy: 0.4072 - val_loss: 1.5606 - val_accuracy: 0.4256
Epoch 7/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.5242 - accuracy: 0.4392 - val_loss: 1.5308 - val_accuracy: 0.4361
Epoch 8/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.4586 - accuracy: 0.4659 - val_loss: 1.4356 - val_accuracy: 0.4732
Epoch 9/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.4011 - accuracy: 0.4911 - val_loss: 1.3771 - val_accuracy: 0.5043
Epoch 10/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.3458 - accuracy: 0.5140 - val_loss: 1.3946 - val_accuracy: 0.4881
Epoch 11/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.2969 - accuracy: 0.5310 - val_loss: 1.3347 - val_accuracy: 0.5092
Epoch 12/25

1037/1037 [=====] - 6s 6ms/step - loss: 1.2510 -
accuracy: 0.5477 - val_loss: 1.3452 - val_accuracy: 0.5020
Epoch 13/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.2058 -
accuracy: 0.5675 - val_loss: 1.2757 - val_accuracy: 0.5435
Epoch 14/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.1690 -
accuracy: 0.5796 - val_loss: 1.1847 - val_accuracy: 0.5808
Epoch 15/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.1368 -
accuracy: 0.5915 - val_loss: 1.1904 - val_accuracy: 0.5657
Epoch 16/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.1032 -
accuracy: 0.6051 - val_loss: 1.1556 - val_accuracy: 0.5893
Epoch 17/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.0741 -
accuracy: 0.6176 - val_loss: 1.1867 - val_accuracy: 0.5775
Epoch 18/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.0480 -
accuracy: 0.6241 - val_loss: 1.0978 - val_accuracy: 0.6111
Epoch 19/25
1037/1037 [=====] - 6s 6ms/step - loss: 1.0196 -
accuracy: 0.6365 - val_loss: 1.1123 - val_accuracy: 0.6048
Epoch 20/25
1037/1037 [=====] - 6s 6ms/step - loss: 0.9963 -
accuracy: 0.6455 - val_loss: 1.0800 - val_accuracy: 0.6144
Epoch 21/25
1037/1037 [=====] - 6s 6ms/step - loss: 0.9689 -
accuracy: 0.6555 - val_loss: 1.1366 - val_accuracy: 0.5991
Epoch 22/25
1037/1037 [=====] - 6s 5ms/step - loss: 0.9458 -
accuracy: 0.6644 - val_loss: 1.0610 - val_accuracy: 0.6261
Epoch 23/25
1037/1037 [=====] - 6s 6ms/step - loss: 0.9223 -
accuracy: 0.6740 - val_loss: 1.0312 - val_accuracy: 0.6397
Epoch 24/25
1037/1037 [=====] - 6s 6ms/step - loss: 0.9038 -
accuracy: 0.6776 - val_loss: 1.0504 - val_accuracy: 0.6376
Epoch 25/25
1037/1037 [=====] - 6s 6ms/step - loss: 0.8799 -
accuracy: 0.6875 - val_loss: 1.0147 - val_accuracy: 0.6464

Accuracy: 64.64%

Iteration No: 26 ended. Search finished for the next optimal point.

Time taken: 149.7637

Function value obtained: -0.6464

Current minimum: -0.7476

Iteration No: 27 started. Searching for the next optimal point.

Epoch 1/25
1771/1771 [=====] - 10s 5ms/step - loss: 1.8304 -
accuracy: 0.3210 - val_loss: 1.4359 - val_accuracy: 0.4721

Epoch 2/25
1771/1771 [=====] - 9s 5ms/step - loss: 1.3393 -
accuracy: 0.5112 - val_loss: 1.2995 - val_accuracy: 0.5323

Epoch 3/25
1771/1771 [=====] - 9s 5ms/step - loss: 1.0810 -
accuracy: 0.6154 - val_loss: 0.9772 - val_accuracy: 0.6539

Epoch 4/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.9095 -
accuracy: 0.6818 - val_loss: 0.9204 - val_accuracy: 0.6785

Epoch 5/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.7804 -
accuracy: 0.7288 - val_loss: 0.9073 - val_accuracy: 0.6841

Epoch 6/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.6772 -
accuracy: 0.7651 - val_loss: 0.8176 - val_accuracy: 0.7200

Epoch 7/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.5942 -
accuracy: 0.7931 - val_loss: 0.8225 - val_accuracy: 0.7284

Epoch 8/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.5185 -
accuracy: 0.8189 - val_loss: 0.9127 - val_accuracy: 0.6996

Epoch 9/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.4546 -
accuracy: 0.8410 - val_loss: 0.8630 - val_accuracy: 0.7299

Epoch 10/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.3993 -
accuracy: 0.8597 - val_loss: 0.9403 - val_accuracy: 0.7121

Epoch 11/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.3562 -
accuracy: 0.8745 - val_loss: 0.8620 - val_accuracy: 0.7377

Epoch 12/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.3090 -
accuracy: 0.8920 - val_loss: 1.0365 - val_accuracy: 0.7167

Epoch 13/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.2779 -
accuracy: 0.9023 - val_loss: 0.9813 - val_accuracy: 0.7313

Epoch 14/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.2437 -
accuracy: 0.9154 - val_loss: 1.0732 - val_accuracy: 0.7179

Epoch 15/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.2281 -
accuracy: 0.9198 - val_loss: 1.1856 - val_accuracy: 0.7172

Epoch 16/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.2135 -

accuracy: 0.9248 - val_loss: 1.1098 - val_accuracy: 0.7243
Epoch 17/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1835 -
accuracy: 0.9370 - val_loss: 1.1739 - val_accuracy: 0.7305
Epoch 18/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1757 -
accuracy: 0.9396 - val_loss: 1.1515 - val_accuracy: 0.7429
Epoch 19/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1588 -
accuracy: 0.9449 - val_loss: 1.2439 - val_accuracy: 0.7313
Epoch 20/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1445 -
accuracy: 0.9509 - val_loss: 1.1544 - val_accuracy: 0.7467
Epoch 21/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1462 -
accuracy: 0.9490 - val_loss: 1.1893 - val_accuracy: 0.7277
Epoch 22/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1265 -
accuracy: 0.9564 - val_loss: 1.3704 - val_accuracy: 0.7392
Epoch 23/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1142 -
accuracy: 0.9610 - val_loss: 1.4467 - val_accuracy: 0.7337
Epoch 24/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1125 -
accuracy: 0.9612 - val_loss: 1.2965 - val_accuracy: 0.7276
Epoch 25/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1135 -
accuracy: 0.9611 - val_loss: 1.3567 - val_accuracy: 0.7387

Accuracy: 73.87%

Iteration No: 27 ended. Search finished for the next optimal point.

Time taken: 221.2561

Function value obtained: -0.7387

Current minimum: -0.7476

Iteration No: 28 started. Searching for the next optimal point.

Epoch 1/25

1635/1635 [=====] - 9s 5ms/step - loss: 1.7342 -
accuracy: 0.3624 - val_loss: 1.3947 - val_accuracy: 0.4789

Epoch 2/25

1635/1635 [=====] - 8s 5ms/step - loss: 1.2502 -
accuracy: 0.5520 - val_loss: 1.1128 - val_accuracy: 0.6012

Epoch 3/25

1635/1635 [=====] - 8s 5ms/step - loss: 1.0001 -
accuracy: 0.6457 - val_loss: 0.9919 - val_accuracy: 0.6479

Epoch 4/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.8370 -
accuracy: 0.7058 - val_loss: 0.8794 - val_accuracy: 0.6995

Epoch 5/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.7198 - accuracy: 0.7484 - val_loss: 0.8535 - val_accuracy: 0.7093

Epoch 6/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.6328 - accuracy: 0.7776 - val_loss: 0.7825 - val_accuracy: 0.7335

Epoch 7/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.5554 - accuracy: 0.8052 - val_loss: 0.8148 - val_accuracy: 0.7356

Epoch 8/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.4937 - accuracy: 0.8291 - val_loss: 0.8510 - val_accuracy: 0.7279

Epoch 9/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.4408 - accuracy: 0.8472 - val_loss: 0.7942 - val_accuracy: 0.7524

Epoch 10/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.3916 - accuracy: 0.8631 - val_loss: 0.8729 - val_accuracy: 0.7341

Epoch 11/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.3607 - accuracy: 0.8743 - val_loss: 0.9120 - val_accuracy: 0.7375

Epoch 12/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.3229 - accuracy: 0.8874 - val_loss: 0.9266 - val_accuracy: 0.7356

Epoch 13/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.2892 - accuracy: 0.8985 - val_loss: 0.9332 - val_accuracy: 0.7435

Epoch 14/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.2598 - accuracy: 0.9095 - val_loss: 1.2173 - val_accuracy: 0.7104

Epoch 15/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.2510 - accuracy: 0.9133 - val_loss: 0.9132 - val_accuracy: 0.7471

Epoch 16/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.2299 - accuracy: 0.9207 - val_loss: 1.0874 - val_accuracy: 0.7248

Epoch 17/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.2138 - accuracy: 0.9260 - val_loss: 1.1138 - val_accuracy: 0.7295

Epoch 18/25
1635/1635 [=====] - 9s 5ms/step - loss: 0.2051 - accuracy: 0.9303 - val_loss: 1.1040 - val_accuracy: 0.7380

Epoch 19/25
1635/1635 [=====] - 9s 5ms/step - loss: 0.1861 - accuracy: 0.9368 - val_loss: 1.1174 - val_accuracy: 0.7459

Epoch 20/25
1635/1635 [=====] - 9s 5ms/step - loss: 0.1715 - accuracy: 0.9425 - val_loss: 1.1799 - val_accuracy: 0.7335

Epoch 21/25
 1635/1635 [=====] - 9s 5ms/step - loss: 0.1638 -
 accuracy: 0.9451 - val_loss: 1.2364 - val_accuracy: 0.7096
 Epoch 22/25
 1635/1635 [=====] - 9s 5ms/step - loss: 0.1647 -
 accuracy: 0.9438 - val_loss: 1.1084 - val_accuracy: 0.7328
 Epoch 23/25
 1635/1635 [=====] - 9s 5ms/step - loss: 0.1513 -
 accuracy: 0.9502 - val_loss: 1.1369 - val_accuracy: 0.7508
 Epoch 24/25
 1635/1635 [=====] - 8s 5ms/step - loss: 0.1404 -
 accuracy: 0.9535 - val_loss: 1.2115 - val_accuracy: 0.7524
 Epoch 25/25
 1635/1635 [=====] - 9s 5ms/step - loss: 0.1344 -
 accuracy: 0.9557 - val_loss: 1.1799 - val_accuracy: 0.7463

Accuracy: 74.63%

Iteration No: 28 ended. Search finished for the next optimal point.

Time taken: 212.6162

Function value obtained: -0.7463

Current minimum: -0.7476

Iteration No: 29 started. Searching for the next optimal point.

Epoch 1/25
 1575/1575 [=====] - 10s 6ms/step - loss: 1.7506 -
 accuracy: 0.3584 - val_loss: 1.9147 - val_accuracy: 0.3529
 Epoch 2/25
 1575/1575 [=====] - 8s 5ms/step - loss: 1.2395 -
 accuracy: 0.5566 - val_loss: 2.2964 - val_accuracy: 0.3604
 Epoch 3/25
 1575/1575 [=====] - 8s 5ms/step - loss: 0.9960 -
 accuracy: 0.6505 - val_loss: 1.9568 - val_accuracy: 0.4177
 Epoch 4/25
 1575/1575 [=====] - 8s 5ms/step - loss: 0.8433 -
 accuracy: 0.7021 - val_loss: 1.0606 - val_accuracy: 0.6468
 Epoch 5/25
 1575/1575 [=====] - 8s 5ms/step - loss: 0.7267 -
 accuracy: 0.7462 - val_loss: 0.8478 - val_accuracy: 0.7060
 Epoch 6/25
 1575/1575 [=====] - 8s 5ms/step - loss: 0.6342 -
 accuracy: 0.7770 - val_loss: 3.1536 - val_accuracy: 0.3413
 Epoch 7/25
 1575/1575 [=====] - 8s 5ms/step - loss: 0.5654 -
 accuracy: 0.8004 - val_loss: 1.8805 - val_accuracy: 0.5264
 Epoch 8/25
 1575/1575 [=====] - 8s 5ms/step - loss: 0.4914 -
 accuracy: 0.8290 - val_loss: 0.8558 - val_accuracy: 0.7275
 Epoch 9/25

1575/1575 [=====] - 8s 5ms/step - loss: 0.4319 - accuracy: 0.8477 - val_loss: 0.9188 - val_accuracy: 0.7179
Epoch 10/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.3846 - accuracy: 0.8650 - val_loss: 0.9194 - val_accuracy: 0.7328
Epoch 11/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.3445 - accuracy: 0.8814 - val_loss: 0.8824 - val_accuracy: 0.7409
Epoch 12/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.3124 - accuracy: 0.8908 - val_loss: 1.0385 - val_accuracy: 0.7217
Epoch 13/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.2735 - accuracy: 0.9047 - val_loss: 0.9893 - val_accuracy: 0.7357
Epoch 14/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.2514 - accuracy: 0.9114 - val_loss: 0.9381 - val_accuracy: 0.7463
Epoch 15/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.2300 - accuracy: 0.9198 - val_loss: 1.1031 - val_accuracy: 0.7303
Epoch 16/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.2111 - accuracy: 0.9249 - val_loss: 1.0653 - val_accuracy: 0.7449
Epoch 17/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1942 - accuracy: 0.9322 - val_loss: 1.0713 - val_accuracy: 0.7456
Epoch 18/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1847 - accuracy: 0.9364 - val_loss: 1.1539 - val_accuracy: 0.7356
Epoch 19/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1675 - accuracy: 0.9417 - val_loss: 2.7580 - val_accuracy: 0.5929
Epoch 20/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1593 - accuracy: 0.9463 - val_loss: 1.1608 - val_accuracy: 0.7333
Epoch 21/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1456 - accuracy: 0.9508 - val_loss: 3.6028 - val_accuracy: 0.5347
Epoch 22/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1584 - accuracy: 0.9473 - val_loss: 1.2139 - val_accuracy: 0.7380
Epoch 23/25
1575/1575 [=====] - 9s 6ms/step - loss: 0.1267 - accuracy: 0.9570 - val_loss: 1.2005 - val_accuracy: 0.7496
Epoch 24/25
1575/1575 [=====] - 9s 5ms/step - loss: 0.1126 - accuracy: 0.9623 - val_loss: 1.3771 - val_accuracy: 0.7433
Epoch 25/25

1575/1575 [=====] - 8s 5ms/step - loss: 0.1174 -
accuracy: 0.9610 - val_loss: 1.3094 - val_accuracy: 0.7399

Accuracy: 73.99%

Iteration No: 29 ended. Search finished for the next optimal point.

Time taken: 205.1424

Function value obtained: -0.7399

Current minimum: -0.7476

Iteration No: 30 started. Searching for the next optimal point.

Epoch 1/25

1635/1635 [=====] - 9s 5ms/step - loss: 1.7912 -
accuracy: 0.3279 - val_loss: 1.4616 - val_accuracy: 0.4481

Epoch 2/25

1635/1635 [=====] - 8s 5ms/step - loss: 1.3150 -
accuracy: 0.5203 - val_loss: 1.1543 - val_accuracy: 0.5852

Epoch 3/25

1635/1635 [=====] - 8s 5ms/step - loss: 1.0637 -
accuracy: 0.6208 - val_loss: 1.2916 - val_accuracy: 0.5527

Epoch 4/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.8785 -
accuracy: 0.6904 - val_loss: 1.0187 - val_accuracy: 0.6536

Epoch 5/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.7559 -
accuracy: 0.7362 - val_loss: 0.8476 - val_accuracy: 0.7111

Epoch 6/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.6596 -
accuracy: 0.7699 - val_loss: 0.8062 - val_accuracy: 0.7273

Epoch 7/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.5746 -
accuracy: 0.8009 - val_loss: 1.0466 - val_accuracy: 0.6709

Epoch 8/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.5111 -
accuracy: 0.8203 - val_loss: 0.8191 - val_accuracy: 0.7332

Epoch 9/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.4470 -
accuracy: 0.8448 - val_loss: 0.8083 - val_accuracy: 0.7452

Epoch 10/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.4011 -
accuracy: 0.8614 - val_loss: 0.8676 - val_accuracy: 0.7343

Epoch 11/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.3577 -
accuracy: 0.8740 - val_loss: 0.9130 - val_accuracy: 0.7227

Epoch 12/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.3307 -
accuracy: 0.8863 - val_loss: 1.1291 - val_accuracy: 0.6983

Epoch 13/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.2974 -

accuracy: 0.8971 - val_loss: 0.8845 - val_accuracy: 0.7515
Epoch 14/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.2652 -
accuracy: 0.9083 - val_loss: 0.9922 - val_accuracy: 0.7419
Epoch 15/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.2458 -
accuracy: 0.9149 - val_loss: 0.9933 - val_accuracy: 0.7311
Epoch 16/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.2297 -
accuracy: 0.9204 - val_loss: 1.0548 - val_accuracy: 0.7340
Epoch 17/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.2168 -
accuracy: 0.9253 - val_loss: 1.0240 - val_accuracy: 0.7463
Epoch 18/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1889 -
accuracy: 0.9356 - val_loss: 1.0869 - val_accuracy: 0.7485
Epoch 19/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1831 -
accuracy: 0.9376 - val_loss: 1.1275 - val_accuracy: 0.7477
Epoch 20/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1803 -
accuracy: 0.9394 - val_loss: 1.3242 - val_accuracy: 0.7172
Epoch 21/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1596 -
accuracy: 0.9458 - val_loss: 1.2763 - val_accuracy: 0.7219
Epoch 22/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1559 -
accuracy: 0.9468 - val_loss: 1.1397 - val_accuracy: 0.7480
Epoch 23/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1516 -
accuracy: 0.9498 - val_loss: 1.3124 - val_accuracy: 0.7345
Epoch 24/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1412 -
accuracy: 0.9532 - val_loss: 1.3022 - val_accuracy: 0.7292
Epoch 25/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1369 -
accuracy: 0.9550 - val_loss: 1.3277 - val_accuracy: 0.7395

Accuracy: 73.95%

Iteration No: 30 ended. Search finished for the next optimal point.

Time taken: 210.0004

Function value obtained: -0.7395

Current minimum: -0.7476

Iteration No: 31 started. Searching for the next optimal point.

Epoch 1/25

1250/1250 [=====] - 8s 5ms/step - loss: 1.8503 -
accuracy: 0.3138 - val_loss: 1.4476 - val_accuracy: 0.4755

Epoch 2/25
1250/1250 [=====] - 6s 5ms/step - loss: 1.2894 - accuracy: 0.5331 - val_loss: 1.1662 - val_accuracy: 0.5888

Epoch 3/25
1250/1250 [=====] - 6s 5ms/step - loss: 1.0359 - accuracy: 0.6342 - val_loss: 1.0756 - val_accuracy: 0.6329

Epoch 4/25
1250/1250 [=====] - 6s 5ms/step - loss: 0.8660 - accuracy: 0.6965 - val_loss: 0.8433 - val_accuracy: 0.7020

Epoch 5/25
1250/1250 [=====] - 6s 5ms/step - loss: 0.7459 - accuracy: 0.7402 - val_loss: 0.8246 - val_accuracy: 0.7168

Epoch 6/25
1250/1250 [=====] - 7s 5ms/step - loss: 0.6446 - accuracy: 0.7765 - val_loss: 0.8375 - val_accuracy: 0.7197

Epoch 7/25
1250/1250 [=====] - 6s 5ms/step - loss: 0.5742 - accuracy: 0.7985 - val_loss: 0.8066 - val_accuracy: 0.7323

Epoch 8/25
1250/1250 [=====] - 7s 5ms/step - loss: 0.5107 - accuracy: 0.8217 - val_loss: 0.8436 - val_accuracy: 0.7265

Epoch 9/25
1250/1250 [=====] - 6s 5ms/step - loss: 0.4507 - accuracy: 0.8410 - val_loss: 0.8302 - val_accuracy: 0.7331

Epoch 10/25
1250/1250 [=====] - 6s 5ms/step - loss: 0.4032 - accuracy: 0.8581 - val_loss: 0.8785 - val_accuracy: 0.7393

Epoch 11/25
1250/1250 [=====] - 6s 5ms/step - loss: 0.3702 - accuracy: 0.8730 - val_loss: 0.8418 - val_accuracy: 0.7389

Epoch 12/25
1250/1250 [=====] - 6s 5ms/step - loss: 0.3315 - accuracy: 0.8835 - val_loss: 0.9759 - val_accuracy: 0.7353

Epoch 13/25
1250/1250 [=====] - 7s 5ms/step - loss: 0.3066 - accuracy: 0.8939 - val_loss: 0.9037 - val_accuracy: 0.7389

Epoch 14/25
1250/1250 [=====] - 7s 5ms/step - loss: 0.2754 - accuracy: 0.9047 - val_loss: 0.9052 - val_accuracy: 0.7536

Epoch 15/25
1250/1250 [=====] - 7s 5ms/step - loss: 0.2575 - accuracy: 0.9114 - val_loss: 1.0150 - val_accuracy: 0.7305

Epoch 16/25
1250/1250 [=====] - 6s 5ms/step - loss: 0.2386 - accuracy: 0.9193 - val_loss: 0.9717 - val_accuracy: 0.7347

Epoch 17/25
1250/1250 [=====] - 6s 5ms/step - loss: 0.2137 - accuracy: 0.9276 - val_loss: 1.0518 - val_accuracy: 0.7368

Epoch 18/25
 1250/1250 [=====] - 6s 5ms/step - loss: 0.2008 -
 accuracy: 0.9312 - val_loss: 1.1955 - val_accuracy: 0.7375
 Epoch 19/25
 1250/1250 [=====] - 6s 5ms/step - loss: 0.1960 -
 accuracy: 0.9352 - val_loss: 1.0639 - val_accuracy: 0.7431
 Epoch 20/25
 1250/1250 [=====] - 6s 5ms/step - loss: 0.1738 -
 accuracy: 0.9424 - val_loss: 1.1123 - val_accuracy: 0.7393
 Epoch 21/25
 1250/1250 [=====] - 6s 5ms/step - loss: 0.1668 -
 accuracy: 0.9449 - val_loss: 1.2355 - val_accuracy: 0.7429
 Epoch 22/25
 1250/1250 [=====] - 7s 5ms/step - loss: 0.1672 -
 accuracy: 0.9455 - val_loss: 1.2119 - val_accuracy: 0.7451
 Epoch 23/25
 1250/1250 [=====] - 6s 5ms/step - loss: 0.1570 -
 accuracy: 0.9474 - val_loss: 1.3104 - val_accuracy: 0.7429
 Epoch 24/25
 1250/1250 [=====] - 6s 5ms/step - loss: 0.1491 -
 accuracy: 0.9520 - val_loss: 1.2211 - val_accuracy: 0.7507
 Epoch 25/25
 1250/1250 [=====] - 7s 5ms/step - loss: 0.1477 -
 accuracy: 0.9516 - val_loss: 1.3020 - val_accuracy: 0.7497

Accuracy: 74.97%

Iteration No: 31 ended. Search finished for the next optimal point.

Time taken: 164.3829

Function value obtained: -0.7497

Current minimum: -0.7497

Iteration No: 32 started. Searching for the next optimal point.

Epoch 1/25
 1417/1417 [=====] - 8s 5ms/step - loss: 1.7911 -
 accuracy: 0.3337 - val_loss: 1.4278 - val_accuracy: 0.4849
 Epoch 2/25
 1417/1417 [=====] - 7s 5ms/step - loss: 1.2917 -
 accuracy: 0.5315 - val_loss: 1.1847 - val_accuracy: 0.5855
 Epoch 3/25
 1417/1417 [=====] - 7s 5ms/step - loss: 1.0496 -
 accuracy: 0.6258 - val_loss: 0.9422 - val_accuracy: 0.6676
 Epoch 4/25
 1417/1417 [=====] - 7s 5ms/step - loss: 0.8804 -
 accuracy: 0.6920 - val_loss: 0.8782 - val_accuracy: 0.6928
 Epoch 5/25
 1417/1417 [=====] - 7s 5ms/step - loss: 0.7558 -
 accuracy: 0.7362 - val_loss: 0.8712 - val_accuracy: 0.6920
 Epoch 6/25

1417/1417 [=====] - 7s 5ms/step - loss: 0.6624 - accuracy: 0.7688 - val_loss: 0.8416 - val_accuracy: 0.7187
Epoch 7/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.5815 - accuracy: 0.7985 - val_loss: 0.9424 - val_accuracy: 0.6908
Epoch 8/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.5268 - accuracy: 0.8169 - val_loss: 0.8366 - val_accuracy: 0.7272
Epoch 9/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.4666 - accuracy: 0.8370 - val_loss: 0.7998 - val_accuracy: 0.7436
Epoch 10/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.4239 - accuracy: 0.8538 - val_loss: 0.9103 - val_accuracy: 0.7412
Epoch 11/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.3823 - accuracy: 0.8657 - val_loss: 0.8539 - val_accuracy: 0.7449
Epoch 12/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.3491 - accuracy: 0.8798 - val_loss: 0.9173 - val_accuracy: 0.7345
Epoch 13/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.3295 - accuracy: 0.8862 - val_loss: 0.9391 - val_accuracy: 0.7359
Epoch 14/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.2979 - accuracy: 0.8964 - val_loss: 0.9644 - val_accuracy: 0.7385
Epoch 15/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.2761 - accuracy: 0.9045 - val_loss: 0.9549 - val_accuracy: 0.7432
Epoch 16/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.2553 - accuracy: 0.9114 - val_loss: 1.0118 - val_accuracy: 0.7485
Epoch 17/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.2429 - accuracy: 0.9185 - val_loss: 1.0313 - val_accuracy: 0.7387
Epoch 18/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.2333 - accuracy: 0.9215 - val_loss: 0.9978 - val_accuracy: 0.7437
Epoch 19/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.2161 - accuracy: 0.9274 - val_loss: 1.1299 - val_accuracy: 0.7325
Epoch 20/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.2118 - accuracy: 0.9289 - val_loss: 1.2178 - val_accuracy: 0.7084
Epoch 21/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.1953 - accuracy: 0.9345 - val_loss: 1.1514 - val_accuracy: 0.7244
Epoch 22/25

1417/1417 [=====] - 7s 5ms/step - loss: 0.1920 -
accuracy: 0.9378 - val_loss: 1.3755 - val_accuracy: 0.7067
Epoch 23/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.1834 -
accuracy: 0.9399 - val_loss: 1.1805 - val_accuracy: 0.7333
Epoch 24/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.1679 -
accuracy: 0.9443 - val_loss: 1.2857 - val_accuracy: 0.7361
Epoch 25/25
1417/1417 [=====] - 7s 5ms/step - loss: 0.1739 -
accuracy: 0.9423 - val_loss: 1.2019 - val_accuracy: 0.7327

Accuracy: 73.27%

Iteration No: 32 ended. Search finished for the next optimal point.

Time taken: 182.8941

Function value obtained: -0.7327

Current minimum: -0.7497

Iteration No: 33 started. Searching for the next optimal point.

Epoch 1/25

1466/1466 [=====] - 9s 5ms/step - loss: 1.8722 -
accuracy: 0.2903 - val_loss: 1.4653 - val_accuracy: 0.4499

Epoch 2/25

1466/1466 [=====] - 8s 5ms/step - loss: 1.3406 -
accuracy: 0.5111 - val_loss: 1.2552 - val_accuracy: 0.5479

Epoch 3/25

1466/1466 [=====] - 8s 5ms/step - loss: 1.0946 -
accuracy: 0.6111 - val_loss: 1.1270 - val_accuracy: 0.6105

Epoch 4/25

1466/1466 [=====] - 8s 5ms/step - loss: 0.9303 -
accuracy: 0.6706 - val_loss: 1.2747 - val_accuracy: 0.5517

Epoch 5/25

1466/1466 [=====] - 8s 5ms/step - loss: 0.8078 -
accuracy: 0.7180 - val_loss: 0.8998 - val_accuracy: 0.6928

Epoch 6/25

1466/1466 [=====] - 8s 5ms/step - loss: 0.7068 -
accuracy: 0.7557 - val_loss: 1.0129 - val_accuracy: 0.6603

Epoch 7/25

1466/1466 [=====] - 8s 5ms/step - loss: 0.6285 -
accuracy: 0.7825 - val_loss: 0.8183 - val_accuracy: 0.7200

Epoch 8/25

1466/1466 [=====] - 8s 5ms/step - loss: 0.5578 -
accuracy: 0.8092 - val_loss: 0.8747 - val_accuracy: 0.7157

Epoch 9/25

1466/1466 [=====] - 8s 5ms/step - loss: 0.5008 -
accuracy: 0.8263 - val_loss: 0.8583 - val_accuracy: 0.7265

Epoch 10/25

1466/1466 [=====] - 8s 5ms/step - loss: 0.4524 -

accuracy: 0.8446 - val_loss: 0.8616 - val_accuracy: 0.7327
Epoch 11/25
1466/1466 [=====] - 8s 5ms/step - loss: 0.4133 -
accuracy: 0.8573 - val_loss: 1.0007 - val_accuracy: 0.7055
Epoch 12/25
1466/1466 [=====] - 8s 5ms/step - loss: 0.3820 -
accuracy: 0.8704 - val_loss: 0.8671 - val_accuracy: 0.7387
Epoch 13/25
1466/1466 [=====] - 8s 5ms/step - loss: 0.3492 -
accuracy: 0.8804 - val_loss: 1.0059 - val_accuracy: 0.7193
Epoch 14/25
1466/1466 [=====] - 8s 5ms/step - loss: 0.3157 -
accuracy: 0.8927 - val_loss: 0.9188 - val_accuracy: 0.7423
Epoch 15/25
1466/1466 [=====] - 8s 5ms/step - loss: 0.2987 -
accuracy: 0.8994 - val_loss: 1.1690 - val_accuracy: 0.6840
Epoch 16/25
1466/1466 [=====] - 8s 5ms/step - loss: 0.2729 -
accuracy: 0.9076 - val_loss: 1.0936 - val_accuracy: 0.7223
Epoch 17/25
1466/1466 [=====] - 8s 5ms/step - loss: 0.2673 -
accuracy: 0.9098 - val_loss: 1.0459 - val_accuracy: 0.7317
Epoch 18/25
1466/1466 [=====] - 8s 5ms/step - loss: 0.2432 -
accuracy: 0.9186 - val_loss: 1.0474 - val_accuracy: 0.7432
Epoch 19/25
1466/1466 [=====] - 8s 5ms/step - loss: 0.2393 -
accuracy: 0.9207 - val_loss: 0.9854 - val_accuracy: 0.7388
Epoch 20/25
1466/1466 [=====] - 7s 5ms/step - loss: 0.2346 -
accuracy: 0.9224 - val_loss: 1.0109 - val_accuracy: 0.7523
Epoch 21/25
1466/1466 [=====] - 7s 5ms/step - loss: 0.2143 -
accuracy: 0.9295 - val_loss: 1.0164 - val_accuracy: 0.7413
Epoch 22/25
1466/1466 [=====] - 8s 5ms/step - loss: 0.2095 -
accuracy: 0.9328 - val_loss: 1.0536 - val_accuracy: 0.7421
Epoch 23/25
1466/1466 [=====] - 7s 5ms/step - loss: 0.2042 -
accuracy: 0.9341 - val_loss: 1.3090 - val_accuracy: 0.7091
Epoch 24/25
1466/1466 [=====] - 7s 5ms/step - loss: 0.2118 -
accuracy: 0.9328 - val_loss: 1.1256 - val_accuracy: 0.7429
Epoch 25/25
1466/1466 [=====] - 8s 5ms/step - loss: 0.2111 -
accuracy: 0.9337 - val_loss: 1.3354 - val_accuracy: 0.7165

Accuracy: 71.65%

Iteration No: 33 ended. Search finished for the next optimal point.
Time taken: 192.0177
Function value obtained: -0.7165
Current minimum: -0.7497
Iteration No: 34 started. Searching for the next optimal point.

Epoch 1/25
1635/1635 [=====] - 9s 5ms/step - loss: 1.7616 -
accuracy: 0.3511 - val_loss: 1.5146 - val_accuracy: 0.4396

Epoch 2/25
1635/1635 [=====] - 8s 5ms/step - loss: 1.3025 -
accuracy: 0.5302 - val_loss: 1.3557 - val_accuracy: 0.4937

Epoch 3/25
1635/1635 [=====] - 8s 5ms/step - loss: 1.0682 -
accuracy: 0.6240 - val_loss: 0.9781 - val_accuracy: 0.6560

Epoch 4/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.9107 -
accuracy: 0.6796 - val_loss: 1.2226 - val_accuracy: 0.5839

Epoch 5/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.7876 -
accuracy: 0.7248 - val_loss: 0.9728 - val_accuracy: 0.6673

Epoch 6/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.6943 -
accuracy: 0.7585 - val_loss: 0.9242 - val_accuracy: 0.6831

Epoch 7/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.6123 -
accuracy: 0.7867 - val_loss: 0.8793 - val_accuracy: 0.7036

Epoch 8/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.5365 -
accuracy: 0.8118 - val_loss: 0.8773 - val_accuracy: 0.7128

Epoch 9/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.4748 -
accuracy: 0.8336 - val_loss: 0.8062 - val_accuracy: 0.7404

Epoch 10/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.4128 -
accuracy: 0.8560 - val_loss: 0.9010 - val_accuracy: 0.7360

Epoch 11/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.3666 -
accuracy: 0.8725 - val_loss: 0.9140 - val_accuracy: 0.7281

Epoch 12/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.3190 -
accuracy: 0.8875 - val_loss: 1.1067 - val_accuracy: 0.7049

Epoch 13/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.2777 -
accuracy: 0.9022 - val_loss: 1.0672 - val_accuracy: 0.7133

Epoch 14/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.2475 -
accuracy: 0.9155 - val_loss: 1.2098 - val_accuracy: 0.7036

Epoch 15/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.2253 - accuracy: 0.9198 - val_loss: 1.1050 - val_accuracy: 0.7256
Epoch 16/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.2033 - accuracy: 0.9276 - val_loss: 1.4839 - val_accuracy: 0.6988
Epoch 17/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1892 - accuracy: 0.9342 - val_loss: 1.2571 - val_accuracy: 0.7271
Epoch 18/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1643 - accuracy: 0.9430 - val_loss: 1.1541 - val_accuracy: 0.7359
Epoch 19/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1514 - accuracy: 0.9466 - val_loss: 1.3160 - val_accuracy: 0.7144
Epoch 20/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1408 - accuracy: 0.9514 - val_loss: 1.2957 - val_accuracy: 0.7223
Epoch 21/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1340 - accuracy: 0.9532 - val_loss: 1.2213 - val_accuracy: 0.7359
Epoch 22/25
1635/1635 [=====] - 9s 5ms/step - loss: 0.1177 - accuracy: 0.9587 - val_loss: 1.2814 - val_accuracy: 0.7353
Epoch 23/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1141 - accuracy: 0.9610 - val_loss: 1.4483 - val_accuracy: 0.7265
Epoch 24/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1046 - accuracy: 0.9628 - val_loss: 1.5571 - val_accuracy: 0.7201
Epoch 25/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.0925 - accuracy: 0.9684 - val_loss: 1.4250 - val_accuracy: 0.7344

Accuracy: 73.44%

Iteration No: 34 ended. Search finished for the next optimal point.

Time taken: 209.4702

Function value obtained: -0.7344

Current minimum: -0.7497

Iteration No: 35 started. Searching for the next optimal point.

Epoch 1/25

1700/1700 [=====] - 9s 5ms/step - loss: 1.8309 - accuracy: 0.3240 - val_loss: 1.6175 - val_accuracy: 0.4105

Epoch 2/25

1700/1700 [=====] - 8s 5ms/step - loss: 1.3850 - accuracy: 0.4965 - val_loss: 1.2532 - val_accuracy: 0.5549

Epoch 3/25


```

1700/1700 [=====] - 8s 5ms/step - loss: 1.1311 -
accuracy: 0.5945 - val_loss: 1.0427 - val_accuracy: 0.6351
Epoch 4/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.9509 -
accuracy: 0.6634 - val_loss: 0.9184 - val_accuracy: 0.6757
Epoch 5/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.8156 -
accuracy: 0.7166 - val_loss: 0.8496 - val_accuracy: 0.7084
Epoch 6/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.7110 -
accuracy: 0.7508 - val_loss: 0.8601 - val_accuracy: 0.7051
Epoch 7/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.6270 -
accuracy: 0.7815 - val_loss: 0.8347 - val_accuracy: 0.7243
Epoch 8/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.5517 -
accuracy: 0.8082 - val_loss: 0.8316 - val_accuracy: 0.7293
Epoch 9/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.4762 -
accuracy: 0.8341 - val_loss: 0.7711 - val_accuracy: 0.7427
Epoch 10/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.4169 -
accuracy: 0.8519 - val_loss: 0.8941 - val_accuracy: 0.7189
Epoch 11/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.3650 -
accuracy: 0.8715 - val_loss: 0.8866 - val_accuracy: 0.7349
Epoch 12/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.3237 -
accuracy: 0.8867 - val_loss: 0.9041 - val_accuracy: 0.7333
Epoch 13/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.2867 -
accuracy: 0.8987 - val_loss: 1.0062 - val_accuracy: 0.7343
Epoch 14/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.2680 -
accuracy: 0.9053 - val_loss: 1.0716 - val_accuracy: 0.7304
Epoch 15/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.2400 -
accuracy: 0.9131 - val_loss: 1.0512 - val_accuracy: 0.7165
Epoch 16/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.2072 -
accuracy: 0.9268 - val_loss: 1.1152 - val_accuracy: 0.7360
Epoch 17/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.1936 -
accuracy: 0.9327 - val_loss: 1.1539 - val_accuracy: 0.7353
Epoch 18/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.1750 -
accuracy: 0.9388 - val_loss: 1.2212 - val_accuracy: 0.7227
Epoch 19/25

```

1700/1700 [=====] - 8s 5ms/step - loss: 0.1715 -
accuracy: 0.9396 - val_loss: 1.2727 - val_accuracy: 0.7197
Epoch 20/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.1568 -
accuracy: 0.9462 - val_loss: 1.1221 - val_accuracy: 0.7405
Epoch 21/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.1308 -
accuracy: 0.9551 - val_loss: 1.2377 - val_accuracy: 0.7263
Epoch 22/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.1240 -
accuracy: 0.9571 - val_loss: 1.3679 - val_accuracy: 0.7381
Epoch 23/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.1184 -
accuracy: 0.9593 - val_loss: 1.4129 - val_accuracy: 0.7311
Epoch 24/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.1174 -
accuracy: 0.9598 - val_loss: 1.6024 - val_accuracy: 0.7101
Epoch 25/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.1083 -
accuracy: 0.9633 - val_loss: 1.3612 - val_accuracy: 0.7476

Accuracy: 74.76%

Iteration No: 35 ended. Search finished for the next optimal point.

Time taken: 199.9626

Function value obtained: -0.7476

Current minimum: -0.7497

Iteration No: 36 started. Searching for the next optimal point.

Epoch 1/25

644/644 [=====] - 7s 9ms/step - loss: 2.2388 -
accuracy: 0.1515 - val_loss: 2.2007 - val_accuracy: 0.1460

Epoch 2/25

644/644 [=====] - 5s 8ms/step - loss: 2.1429 -
accuracy: 0.1661 - val_loss: 2.0989 - val_accuracy: 0.1813

Epoch 3/25

644/644 [=====] - 5s 8ms/step - loss: 2.0666 -
accuracy: 0.2076 - val_loss: 2.0686 - val_accuracy: 0.2091

Epoch 4/25

644/644 [=====] - 5s 8ms/step - loss: 1.9949 -
accuracy: 0.2459 - val_loss: 1.9614 - val_accuracy: 0.2620

Epoch 5/25

644/644 [=====] - 5s 8ms/step - loss: 1.9140 -
accuracy: 0.2775 - val_loss: 1.9246 - val_accuracy: 0.2787

Epoch 6/25

644/644 [=====] - 5s 8ms/step - loss: 1.8189 -
accuracy: 0.3166 - val_loss: 1.7826 - val_accuracy: 0.3444

Epoch 7/25

644/644 [=====] - 5s 8ms/step - loss: 1.7279 -

accuracy: 0.3514 - val_loss: 1.6686 - val_accuracy: 0.3896
Epoch 8/25
644/644 [=====] - 5s 8ms/step - loss: 1.6466 -
accuracy: 0.3799 - val_loss: 1.6069 - val_accuracy: 0.3999
Epoch 9/25
644/644 [=====] - 5s 8ms/step - loss: 1.5874 -
accuracy: 0.4006 - val_loss: 1.5779 - val_accuracy: 0.3989
Epoch 10/25
644/644 [=====] - 5s 8ms/step - loss: 1.5306 -
accuracy: 0.4182 - val_loss: 1.5072 - val_accuracy: 0.4327
Epoch 11/25
644/644 [=====] - 5s 8ms/step - loss: 1.4836 -
accuracy: 0.4364 - val_loss: 1.4873 - val_accuracy: 0.4360
Epoch 12/25
644/644 [=====] - 5s 8ms/step - loss: 1.4365 -
accuracy: 0.4512 - val_loss: 1.4421 - val_accuracy: 0.4539
Epoch 13/25
644/644 [=====] - 5s 8ms/step - loss: 1.4036 -
accuracy: 0.4651 - val_loss: 1.4403 - val_accuracy: 0.4519
Epoch 14/25
644/644 [=====] - 5s 8ms/step - loss: 1.3633 -
accuracy: 0.4801 - val_loss: 1.4274 - val_accuracy: 0.4521
Epoch 15/25
644/644 [=====] - 5s 8ms/step - loss: 1.3289 -
accuracy: 0.4945 - val_loss: 1.3638 - val_accuracy: 0.4783
Epoch 16/25
644/644 [=====] - 5s 8ms/step - loss: 1.2948 -
accuracy: 0.5057 - val_loss: 1.3218 - val_accuracy: 0.4997
Epoch 17/25
644/644 [=====] - 5s 8ms/step - loss: 1.2669 -
accuracy: 0.5213 - val_loss: 1.3104 - val_accuracy: 0.5025
Epoch 18/25
644/644 [=====] - 5s 8ms/step - loss: 1.2338 -
accuracy: 0.5332 - val_loss: 1.2775 - val_accuracy: 0.5205
Epoch 19/25
644/644 [=====] - 5s 8ms/step - loss: 1.2016 -
accuracy: 0.5476 - val_loss: 1.2772 - val_accuracy: 0.5296
Epoch 20/25
644/644 [=====] - 5s 8ms/step - loss: 1.1687 -
accuracy: 0.5650 - val_loss: 1.2240 - val_accuracy: 0.5440
Epoch 21/25
644/644 [=====] - 5s 8ms/step - loss: 1.1374 -
accuracy: 0.5788 - val_loss: 1.2145 - val_accuracy: 0.5559
Epoch 22/25
644/644 [=====] - 5s 8ms/step - loss: 1.1007 -
accuracy: 0.5912 - val_loss: 1.2480 - val_accuracy: 0.5391
Epoch 23/25
644/644 [=====] - 5s 8ms/step - loss: 1.0748 -

accuracy: 0.6000 - val_loss: 1.2061 - val_accuracy: 0.5583
Epoch 24/25
644/644 [=====] - 5s 8ms/step - loss: 1.0493 -
accuracy: 0.6097 - val_loss: 1.1603 - val_accuracy: 0.5763
Epoch 25/25
644/644 [=====] - 5s 8ms/step - loss: 1.0205 -
accuracy: 0.6216 - val_loss: 1.1590 - val_accuracy: 0.5852

Accuracy: 58.52%

Iteration No: 36 ended. Search finished for the next optimal point.

Time taken: 135.4227

Function value obtained: -0.5852

Current minimum: -0.7497

Iteration No: 37 started. Searching for the next optimal point.

Epoch 1/25

1575/1575 [=====] - 9s 5ms/step - loss: 1.8247 -
accuracy: 0.3218 - val_loss: 2.1457 - val_accuracy: 0.2975

Epoch 2/25

1575/1575 [=====] - 8s 5ms/step - loss: 1.3326 -
accuracy: 0.5158 - val_loss: 3.4352 - val_accuracy: 0.2192

Epoch 3/25

1575/1575 [=====] - 8s 5ms/step - loss: 1.0966 -
accuracy: 0.6106 - val_loss: 1.7790 - val_accuracy: 0.4563

Epoch 4/25

1575/1575 [=====] - 8s 5ms/step - loss: 0.9154 -
accuracy: 0.6769 - val_loss: 1.0683 - val_accuracy: 0.6337

Epoch 5/25

1575/1575 [=====] - 8s 5ms/step - loss: 0.7917 -
accuracy: 0.7226 - val_loss: 0.9116 - val_accuracy: 0.6887

Epoch 6/25

1575/1575 [=====] - 8s 5ms/step - loss: 0.6929 -
accuracy: 0.7569 - val_loss: 2.0008 - val_accuracy: 0.4708

Epoch 7/25

1575/1575 [=====] - 8s 5ms/step - loss: 0.6072 -
accuracy: 0.7886 - val_loss: 5.1566 - val_accuracy: 0.2724

Epoch 8/25

1575/1575 [=====] - 8s 5ms/step - loss: 0.5589 -
accuracy: 0.8042 - val_loss: 3.2854 - val_accuracy: 0.3827

Epoch 9/25

1575/1575 [=====] - 8s 5ms/step - loss: 0.4850 -
accuracy: 0.8316 - val_loss: 0.9735 - val_accuracy: 0.6943

Epoch 10/25

1575/1575 [=====] - 8s 5ms/step - loss: 0.4248 -
accuracy: 0.8505 - val_loss: 0.9449 - val_accuracy: 0.7187

Epoch 11/25

1575/1575 [=====] - 8s 5ms/step - loss: 0.3776 -
accuracy: 0.8687 - val_loss: 1.1205 - val_accuracy: 0.6885

Epoch 12/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.3319 -
accuracy: 0.8830 - val_loss: 2.2380 - val_accuracy: 0.5005
Epoch 13/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.3123 -
accuracy: 0.8914 - val_loss: 2.0635 - val_accuracy: 0.5959
Epoch 14/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.2800 -
accuracy: 0.9027 - val_loss: 0.9827 - val_accuracy: 0.7368
Epoch 15/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.2568 -
accuracy: 0.9095 - val_loss: 1.0345 - val_accuracy: 0.7255
Epoch 16/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.2272 -
accuracy: 0.9197 - val_loss: 0.9604 - val_accuracy: 0.7456
Epoch 17/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.2076 -
accuracy: 0.9267 - val_loss: 1.1525 - val_accuracy: 0.7232
Epoch 18/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1979 -
accuracy: 0.9316 - val_loss: 2.0891 - val_accuracy: 0.6135
Epoch 19/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1893 -
accuracy: 0.9340 - val_loss: 1.2304 - val_accuracy: 0.7303
Epoch 20/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1714 -
accuracy: 0.9414 - val_loss: 3.2671 - val_accuracy: 0.5227
Epoch 21/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1748 -
accuracy: 0.9407 - val_loss: 1.1220 - val_accuracy: 0.7445
Epoch 22/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1445 -
accuracy: 0.9516 - val_loss: 1.3200 - val_accuracy: 0.7320
Epoch 23/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1391 -
accuracy: 0.9531 - val_loss: 1.2720 - val_accuracy: 0.7417
Epoch 24/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1288 -
accuracy: 0.9560 - val_loss: 1.2480 - val_accuracy: 0.7387
Epoch 25/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1226 -
accuracy: 0.9590 - val_loss: 21.6302 - val_accuracy: 0.2039

Accuracy: 20.39%

Iteration No: 37 ended. Search finished for the next optimal point.

Time taken: 204.1255

Function value obtained: -0.2039

Current minimum: -0.7497

Iteration No: 38 started. Searching for the next optimal point.

Epoch 1/25

1635/1635 [=====] - 8s 5ms/step - loss: 2.1648 -
accuracy: 0.1973 - val_loss: 2.0831 - val_accuracy: 0.2579

Epoch 2/25

1635/1635 [=====] - 7s 4ms/step - loss: 1.9160 -
accuracy: 0.3127 - val_loss: 1.8491 - val_accuracy: 0.3327

Epoch 3/25

1635/1635 [=====] - 7s 4ms/step - loss: 1.7422 -
accuracy: 0.3694 - val_loss: 1.7492 - val_accuracy: 0.3583

Epoch 4/25

1635/1635 [=====] - 7s 4ms/step - loss: 1.6031 -
accuracy: 0.4187 - val_loss: 1.5596 - val_accuracy: 0.4357

Epoch 5/25

1635/1635 [=====] - 7s 4ms/step - loss: 1.5010 -
accuracy: 0.4547 - val_loss: 1.4869 - val_accuracy: 0.4648

Epoch 6/25

1635/1635 [=====] - 7s 5ms/step - loss: 1.4184 -
accuracy: 0.4836 - val_loss: 1.4197 - val_accuracy: 0.4856

Epoch 7/25

1635/1635 [=====] - 7s 5ms/step - loss: 1.3632 -
accuracy: 0.5062 - val_loss: 1.3616 - val_accuracy: 0.5124

Epoch 8/25

1635/1635 [=====] - 7s 4ms/step - loss: 1.3141 -
accuracy: 0.5265 - val_loss: 1.3399 - val_accuracy: 0.5185

Epoch 9/25

1635/1635 [=====] - 7s 5ms/step - loss: 1.2738 -
accuracy: 0.5408 - val_loss: 1.4107 - val_accuracy: 0.5052

Epoch 10/25

1635/1635 [=====] - 7s 4ms/step - loss: 1.2347 -
accuracy: 0.5547 - val_loss: 1.2846 - val_accuracy: 0.5415

Epoch 11/25

1635/1635 [=====] - 7s 4ms/step - loss: 1.1967 -
accuracy: 0.5695 - val_loss: 1.2453 - val_accuracy: 0.5633

Epoch 12/25

1635/1635 [=====] - 7s 4ms/step - loss: 1.1605 -
accuracy: 0.5798 - val_loss: 1.2200 - val_accuracy: 0.5703

Epoch 13/25

1635/1635 [=====] - 7s 5ms/step - loss: 1.1266 -
accuracy: 0.5952 - val_loss: 1.1717 - val_accuracy: 0.5877

Epoch 14/25

1635/1635 [=====] - 7s 4ms/step - loss: 1.0912 -
accuracy: 0.6073 - val_loss: 1.1589 - val_accuracy: 0.5871

Epoch 15/25

1635/1635 [=====] - 7s 4ms/step - loss: 1.0593 -
accuracy: 0.6218 - val_loss: 1.1560 - val_accuracy: 0.5820

Epoch 16/25

1635/1635 [=====] - 7s 4ms/step - loss: 1.0289 -
accuracy: 0.6320 - val_loss: 1.1228 - val_accuracy: 0.6036
Epoch 17/25
1635/1635 [=====] - 7s 5ms/step - loss: 0.9962 -
accuracy: 0.6431 - val_loss: 1.1122 - val_accuracy: 0.6044
Epoch 18/25
1635/1635 [=====] - 7s 4ms/step - loss: 0.9699 -
accuracy: 0.6554 - val_loss: 1.1620 - val_accuracy: 0.5925
Epoch 19/25
1635/1635 [=====] - 7s 4ms/step - loss: 0.9430 -
accuracy: 0.6648 - val_loss: 1.0795 - val_accuracy: 0.6211
Epoch 20/25
1635/1635 [=====] - 7s 5ms/step - loss: 0.9196 -
accuracy: 0.6728 - val_loss: 1.0440 - val_accuracy: 0.6281
Epoch 21/25
1635/1635 [=====] - 7s 4ms/step - loss: 0.8984 -
accuracy: 0.6805 - val_loss: 1.0646 - val_accuracy: 0.6212
Epoch 22/25
1635/1635 [=====] - 7s 4ms/step - loss: 0.8759 -
accuracy: 0.6888 - val_loss: 1.0344 - val_accuracy: 0.6321
Epoch 23/25
1635/1635 [=====] - 7s 4ms/step - loss: 0.8585 -
accuracy: 0.6970 - val_loss: 1.0827 - val_accuracy: 0.6216
Epoch 24/25
1635/1635 [=====] - 7s 5ms/step - loss: 0.8399 -
accuracy: 0.7026 - val_loss: 1.0112 - val_accuracy: 0.6415
Epoch 25/25
1635/1635 [=====] - 7s 4ms/step - loss: 0.8213 -
accuracy: 0.7096 - val_loss: 1.0145 - val_accuracy: 0.6409

Accuracy: 64.09%

Iteration No: 38 ended. Search finished for the next optimal point.

Time taken: 184.0359

Function value obtained: -0.6409

Current minimum: -0.7497

Iteration No: 39 started. Searching for the next optimal point.

Epoch 1/25

1329/1329 [=====] - 9s 6ms/step - loss: 1.8470 -
accuracy: 0.3111 - val_loss: 1.9787 - val_accuracy: 0.2596

Epoch 2/25

1329/1329 [=====] - 7s 5ms/step - loss: 1.3336 -
accuracy: 0.5195 - val_loss: 2.3021 - val_accuracy: 0.2629

Epoch 3/25

1329/1329 [=====] - 7s 5ms/step - loss: 1.0869 -
accuracy: 0.6154 - val_loss: 1.5738 - val_accuracy: 0.4584

Epoch 4/25

1329/1329 [=====] - 7s 6ms/step - loss: 0.9163 -

accuracy: 0.6785 - val_loss: 1.2837 - val_accuracy: 0.5892
 Epoch 5/25
 1329/1329 [=====] - 7s 5ms/step - loss: 0.7867 -
 accuracy: 0.7250 - val_loss: 2.0531 - val_accuracy: 0.3828
 Epoch 6/25
 1329/1329 [=====] - 7s 5ms/step - loss: 0.6908 -
 accuracy: 0.7600 - val_loss: 3.3838 - val_accuracy: 0.3611
 Epoch 7/25
 1329/1329 [=====] - 7s 5ms/step - loss: 0.6140 -
 accuracy: 0.7887 - val_loss: 0.7814 - val_accuracy: 0.7391
 Epoch 8/25
 1329/1329 [=====] - 7s 5ms/step - loss: 0.5410 -
 accuracy: 0.8128 - val_loss: 1.5199 - val_accuracy: 0.5656
 Epoch 9/25
 1329/1329 [=====] - 7s 6ms/step - loss: 0.4816 -
 accuracy: 0.8314 - val_loss: 1.4430 - val_accuracy: 0.6012
 Epoch 10/25
 1329/1329 [=====] - 7s 5ms/step - loss: 0.4328 -
 accuracy: 0.8484 - val_loss: 0.8690 - val_accuracy: 0.7279
 Epoch 11/25
 1329/1329 [=====] - 7s 5ms/step - loss: 0.3815 -
 accuracy: 0.8674 - val_loss: 0.9419 - val_accuracy: 0.7252
 Epoch 12/25
 1329/1329 [=====] - 7s 5ms/step - loss: 0.3440 -
 accuracy: 0.8792 - val_loss: 1.3491 - val_accuracy: 0.6712
 Epoch 13/25
 1329/1329 [=====] - 7s 5ms/step - loss: 0.3211 -
 accuracy: 0.8888 - val_loss: 1.2152 - val_accuracy: 0.6825
 Epoch 14/25
 1329/1329 [=====] - 7s 6ms/step - loss: 0.2822 -
 accuracy: 0.9026 - val_loss: 1.1432 - val_accuracy: 0.6996
 Epoch 15/25
 1329/1329 [=====] - 7s 6ms/step - loss: 0.2639 -
 accuracy: 0.9092 - val_loss: 1.1028 - val_accuracy: 0.7179
 Epoch 16/25
 1329/1329 [=====] - 7s 5ms/step - loss: 0.2454 -
 accuracy: 0.9155 - val_loss: 1.3506 - val_accuracy: 0.6809
 Epoch 17/25
 1329/1329 [=====] - 7s 5ms/step - loss: 0.2360 -
 accuracy: 0.9174 - val_loss: 1.0732 - val_accuracy: 0.7355
 Epoch 18/25
 1329/1329 [=====] - 7s 6ms/step - loss: 0.2072 -
 accuracy: 0.9273 - val_loss: 1.9837 - val_accuracy: 0.6027
 Epoch 19/25
 1329/1329 [=====] - 7s 5ms/step - loss: 0.2161 -
 accuracy: 0.9269 - val_loss: 2.2079 - val_accuracy: 0.6135
 Epoch 20/25
 1329/1329 [=====] - 8s 6ms/step - loss: 0.1832 -

accuracy: 0.9384 - val_loss: 1.4934 - val_accuracy: 0.6953
Epoch 21/25
1329/1329 [=====] - 7s 5ms/step - loss: 0.1706 -
accuracy: 0.9408 - val_loss: 8.1921 - val_accuracy: 0.2212
Epoch 22/25
1329/1329 [=====] - 7s 5ms/step - loss: 0.2374 -
accuracy: 0.9234 - val_loss: 1.2858 - val_accuracy: 0.7269
Epoch 23/25
1329/1329 [=====] - 7s 6ms/step - loss: 0.1562 -
accuracy: 0.9484 - val_loss: 1.1835 - val_accuracy: 0.7508
Epoch 24/25
1329/1329 [=====] - 7s 6ms/step - loss: 0.1483 -
accuracy: 0.9510 - val_loss: 1.4935 - val_accuracy: 0.7151
Epoch 25/25
1329/1329 [=====] - 7s 6ms/step - loss: 0.1398 -
accuracy: 0.9537 - val_loss: 1.2423 - val_accuracy: 0.7400

Accuracy: 74.00%

Iteration No: 39 ended. Search finished for the next optimal point.

Time taken: 185.7548

Function value obtained: -0.7400

Current minimum: -0.7497

Iteration No: 40 started. Searching for the next optimal point.

Epoch 1/25
1575/1575 [=====] - 8s 5ms/step - loss: 1.8429 -
accuracy: 0.3115 - val_loss: 1.7221 - val_accuracy: 0.3205
Epoch 2/25
1575/1575 [=====] - 8s 5ms/step - loss: 1.3190 -
accuracy: 0.5181 - val_loss: 1.4316 - val_accuracy: 0.5025
Epoch 3/25
1575/1575 [=====] - 8s 5ms/step - loss: 1.0749 -
accuracy: 0.6169 - val_loss: 1.5649 - val_accuracy: 0.4993
Epoch 4/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.9136 -
accuracy: 0.6797 - val_loss: 1.9415 - val_accuracy: 0.3864
Epoch 5/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.8066 -
accuracy: 0.7172 - val_loss: 1.6839 - val_accuracy: 0.5303
Epoch 6/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.7089 -
accuracy: 0.7508 - val_loss: 1.1548 - val_accuracy: 0.6245
Epoch 7/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.6302 -
accuracy: 0.7807 - val_loss: 0.9614 - val_accuracy: 0.6817
Epoch 8/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.5657 -
accuracy: 0.8016 - val_loss: 2.4663 - val_accuracy: 0.4084

Epoch 9/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.5131 - accuracy: 0.8219 - val_loss: 0.9177 - val_accuracy: 0.7065

Epoch 10/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.4554 - accuracy: 0.8418 - val_loss: 0.8765 - val_accuracy: 0.7259

Epoch 11/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.4122 - accuracy: 0.8534 - val_loss: 1.0182 - val_accuracy: 0.6964

Epoch 12/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.3714 - accuracy: 0.8710 - val_loss: 1.2553 - val_accuracy: 0.6704

Epoch 13/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.3362 - accuracy: 0.8825 - val_loss: 1.0115 - val_accuracy: 0.7227

Epoch 14/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.3078 - accuracy: 0.8923 - val_loss: 1.7747 - val_accuracy: 0.6063

Epoch 15/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.2847 - accuracy: 0.8986 - val_loss: 1.1001 - val_accuracy: 0.7140

Epoch 16/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.2529 - accuracy: 0.9100 - val_loss: 1.2033 - val_accuracy: 0.7041

Epoch 17/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.2389 - accuracy: 0.9144 - val_loss: 5.2065 - val_accuracy: 0.3876

Epoch 18/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.2377 - accuracy: 0.9161 - val_loss: 1.2315 - val_accuracy: 0.7140

Epoch 19/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.2107 - accuracy: 0.9260 - val_loss: 2.3318 - val_accuracy: 0.5823

Epoch 20/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1938 - accuracy: 0.9321 - val_loss: 1.3863 - val_accuracy: 0.7020

Epoch 21/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1869 - accuracy: 0.9345 - val_loss: 4.9737 - val_accuracy: 0.4507

Epoch 22/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.2018 - accuracy: 0.9300 - val_loss: 3.5073 - val_accuracy: 0.4960

Epoch 23/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1700 - accuracy: 0.9421 - val_loss: 1.5054 - val_accuracy: 0.7041

Epoch 24/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.1468 - accuracy: 0.9488 - val_loss: 1.5581 - val_accuracy: 0.7100

Epoch 25/25

1575/1575 [=====] - 8s 5ms/step - loss: 0.1438 -
accuracy: 0.9511 - val_loss: 1.5593 - val_accuracy: 0.7076

Accuracy: 70.76%

Iteration No: 40 ended. Search finished for the next optimal point.

Time taken: 196.8008

Function value obtained: -0.7076

Current minimum: -0.7497

Iteration No: 41 started. Searching for the next optimal point.

Epoch 1/25

1700/1700 [=====] - 9s 5ms/step - loss: 1.9218 -
accuracy: 0.2913 - val_loss: 1.5684 - val_accuracy: 0.4279

Epoch 2/25

1700/1700 [=====] - 8s 5ms/step - loss: 1.3843 -
accuracy: 0.4966 - val_loss: 1.3030 - val_accuracy: 0.5215

Epoch 3/25

1700/1700 [=====] - 8s 5ms/step - loss: 1.1703 -
accuracy: 0.5819 - val_loss: 1.1929 - val_accuracy: 0.5757

Epoch 4/25

1700/1700 [=====] - 8s 5ms/step - loss: 1.0043 -
accuracy: 0.6451 - val_loss: 1.0082 - val_accuracy: 0.6459

Epoch 5/25

1700/1700 [=====] - 8s 5ms/step - loss: 0.8731 -
accuracy: 0.6948 - val_loss: 0.8855 - val_accuracy: 0.6929

Epoch 6/25

1700/1700 [=====] - 8s 5ms/step - loss: 0.7599 -
accuracy: 0.7327 - val_loss: 0.8813 - val_accuracy: 0.6977

Epoch 7/25

1700/1700 [=====] - 8s 5ms/step - loss: 0.6668 -
accuracy: 0.7662 - val_loss: 0.8796 - val_accuracy: 0.7073

Epoch 8/25

1700/1700 [=====] - 8s 5ms/step - loss: 0.5828 -
accuracy: 0.7947 - val_loss: 0.8912 - val_accuracy: 0.7093

Epoch 9/25

1700/1700 [=====] - 8s 5ms/step - loss: 0.5122 -
accuracy: 0.8204 - val_loss: 0.9047 - val_accuracy: 0.7035

Epoch 10/25

1700/1700 [=====] - 8s 5ms/step - loss: 0.4438 -
accuracy: 0.8443 - val_loss: 0.9409 - val_accuracy: 0.7103

Epoch 11/25

1700/1700 [=====] - 8s 5ms/step - loss: 0.3870 -
accuracy: 0.8626 - val_loss: 1.0686 - val_accuracy: 0.6927

Epoch 12/25

1700/1700 [=====] - 8s 5ms/step - loss: 0.3478 -
accuracy: 0.8771 - val_loss: 0.9519 - val_accuracy: 0.7209

Epoch 13/25

```

1700/1700 [=====] - 8s 5ms/step - loss: 0.3105 -
accuracy: 0.8905 - val_loss: 0.9910 - val_accuracy: 0.7225
Epoch 14/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.2715 -
accuracy: 0.9036 - val_loss: 1.0137 - val_accuracy: 0.7216
Epoch 15/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.2487 -
accuracy: 0.9123 - val_loss: 1.0762 - val_accuracy: 0.7223
Epoch 16/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.2234 -
accuracy: 0.9224 - val_loss: 1.1265 - val_accuracy: 0.7128
Epoch 17/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.2122 -
accuracy: 0.9254 - val_loss: 1.4010 - val_accuracy: 0.6949
Epoch 18/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.1815 -
accuracy: 0.9363 - val_loss: 1.3655 - val_accuracy: 0.7097
Epoch 19/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.1840 -
accuracy: 0.9353 - val_loss: 1.4325 - val_accuracy: 0.7017
Epoch 20/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.1633 -
accuracy: 0.9429 - val_loss: 1.3785 - val_accuracy: 0.7193
Epoch 21/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.1434 -
accuracy: 0.9508 - val_loss: 1.3213 - val_accuracy: 0.7223
Epoch 22/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.1405 -
accuracy: 0.9512 - val_loss: 1.4295 - val_accuracy: 0.7249
Epoch 23/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.1278 -
accuracy: 0.9556 - val_loss: 1.3666 - val_accuracy: 0.7379
Epoch 24/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.1190 -
accuracy: 0.9576 - val_loss: 1.3763 - val_accuracy: 0.7333
Epoch 25/25
1700/1700 [=====] - 8s 5ms/step - loss: 0.1065 -
accuracy: 0.9626 - val_loss: 1.4549 - val_accuracy: 0.7220

```

Accuracy: 72.20%

Iteration No: 41 ended. Search finished for the next optimal point.

Time taken: 206.7634

Function value obtained: -0.7220

Current minimum: -0.7497

Iteration No: 42 started. Searching for the next optimal point.

Epoch 1/25

```

1575/1575 [=====] - 9s 5ms/step - loss: 2.0806 -

```

accuracy: 0.2216 - val_loss: 2.8810 - val_accuracy: 0.1111
 Epoch 2/25
 1575/1575 [=====] - 8s 5ms/step - loss: 1.7257 -
 accuracy: 0.3713 - val_loss: 1.7985 - val_accuracy: 0.3496
 Epoch 3/25
 1575/1575 [=====] - 8s 5ms/step - loss: 1.5551 -
 accuracy: 0.4301 - val_loss: 3.9757 - val_accuracy: 0.1445
 Epoch 4/25
 1575/1575 [=====] - 8s 5ms/step - loss: 1.4576 -
 accuracy: 0.4702 - val_loss: 1.8780 - val_accuracy: 0.3791
 Epoch 5/25
 1575/1575 [=====] - 8s 5ms/step - loss: 1.3740 -
 accuracy: 0.5012 - val_loss: 2.6664 - val_accuracy: 0.2324
 Epoch 6/25
 1575/1575 [=====] - 8s 5ms/step - loss: 1.3016 -
 accuracy: 0.5309 - val_loss: 1.5841 - val_accuracy: 0.4368
 Epoch 7/25
 1575/1575 [=====] - 8s 5ms/step - loss: 1.2334 -
 accuracy: 0.5568 - val_loss: 1.8222 - val_accuracy: 0.3799
 Epoch 8/25
 1575/1575 [=====] - 8s 5ms/step - loss: 1.1736 -
 accuracy: 0.5796 - val_loss: 1.2579 - val_accuracy: 0.5541
 Epoch 9/25
 1575/1575 [=====] - 8s 5ms/step - loss: 1.1156 -
 accuracy: 0.6025 - val_loss: 1.4061 - val_accuracy: 0.5015
 Epoch 10/25
 1575/1575 [=====] - 8s 5ms/step - loss: 1.0641 -
 accuracy: 0.6226 - val_loss: 1.3467 - val_accuracy: 0.5119
 Epoch 11/25
 1575/1575 [=====] - 8s 5ms/step - loss: 1.0106 -
 accuracy: 0.6396 - val_loss: 1.6988 - val_accuracy: 0.4407
 Epoch 12/25
 1575/1575 [=====] - 8s 5ms/step - loss: 0.9665 -
 accuracy: 0.6585 - val_loss: 2.2766 - val_accuracy: 0.3599
 Epoch 13/25
 1575/1575 [=====] - 8s 5ms/step - loss: 0.9241 -
 accuracy: 0.6718 - val_loss: 1.4312 - val_accuracy: 0.5423
 Epoch 14/25
 1575/1575 [=====] - 8s 5ms/step - loss: 0.8808 -
 accuracy: 0.6880 - val_loss: 1.9503 - val_accuracy: 0.4363
 Epoch 15/25
 1575/1575 [=====] - 8s 5ms/step - loss: 0.8415 -
 accuracy: 0.7021 - val_loss: 1.6319 - val_accuracy: 0.5075
 Epoch 16/25
 1575/1575 [=====] - 8s 5ms/step - loss: 0.8019 -
 accuracy: 0.7175 - val_loss: 1.2796 - val_accuracy: 0.5811
 Epoch 17/25
 1575/1575 [=====] - 8s 5ms/step - loss: 0.7663 -

accuracy: 0.7303 - val_loss: 0.9722 - val_accuracy: 0.6679
Epoch 18/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.7336 -
accuracy: 0.7405 - val_loss: 2.7545 - val_accuracy: 0.3469
Epoch 19/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.6974 -
accuracy: 0.7546 - val_loss: 1.7407 - val_accuracy: 0.4872
Epoch 20/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.6618 -
accuracy: 0.7658 - val_loss: 1.5100 - val_accuracy: 0.5413
Epoch 21/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.6273 -
accuracy: 0.7799 - val_loss: 3.8266 - val_accuracy: 0.3441
Epoch 22/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.5938 -
accuracy: 0.7932 - val_loss: 1.0225 - val_accuracy: 0.6631
Epoch 23/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.5573 -
accuracy: 0.8040 - val_loss: 1.2626 - val_accuracy: 0.6108
Epoch 24/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.5280 -
accuracy: 0.8143 - val_loss: 1.4065 - val_accuracy: 0.5924
Epoch 25/25
1575/1575 [=====] - 8s 5ms/step - loss: 0.4923 -
accuracy: 0.8269 - val_loss: 1.3399 - val_accuracy: 0.6147

Accuracy: 61.47%

Iteration No: 42 ended. Search finished for the next optimal point.

Time taken: 205.9118

Function value obtained: -0.6147

Current minimum: -0.7497

Iteration No: 43 started. Searching for the next optimal point.

Epoch 1/25
1771/1771 [=====] - 9s 5ms/step - loss: 1.8688 -
accuracy: 0.2956 - val_loss: 1.5568 - val_accuracy: 0.4236
Epoch 2/25
1771/1771 [=====] - 8s 4ms/step - loss: 1.3749 -
accuracy: 0.4960 - val_loss: 1.2941 - val_accuracy: 0.5327
Epoch 3/25
1771/1771 [=====] - 8s 4ms/step - loss: 1.1280 -
accuracy: 0.5942 - val_loss: 1.2039 - val_accuracy: 0.5884
Epoch 4/25
1771/1771 [=====] - 8s 5ms/step - loss: 0.9579 -
accuracy: 0.6612 - val_loss: 0.9813 - val_accuracy: 0.6575
Epoch 5/25
1771/1771 [=====] - 8s 4ms/step - loss: 0.8355 -
accuracy: 0.7064 - val_loss: 0.9381 - val_accuracy: 0.6721

Epoch 6/25
1771/1771 [=====] - 8s 5ms/step - loss: 0.7420 - accuracy: 0.7397 - val_loss: 0.9525 - val_accuracy: 0.6685

Epoch 7/25
1771/1771 [=====] - 8s 5ms/step - loss: 0.6583 - accuracy: 0.7709 - val_loss: 0.9422 - val_accuracy: 0.6788

Epoch 8/25
1771/1771 [=====] - 8s 4ms/step - loss: 0.5876 - accuracy: 0.7947 - val_loss: 0.8179 - val_accuracy: 0.7288

Epoch 9/25
1771/1771 [=====] - 8s 4ms/step - loss: 0.5214 - accuracy: 0.8178 - val_loss: 0.9119 - val_accuracy: 0.7095

Epoch 10/25
1771/1771 [=====] - 8s 4ms/step - loss: 0.4726 - accuracy: 0.8330 - val_loss: 0.9349 - val_accuracy: 0.7111

Epoch 11/25
1771/1771 [=====] - 8s 4ms/step - loss: 0.4229 - accuracy: 0.8501 - val_loss: 0.8959 - val_accuracy: 0.7264

Epoch 12/25
1771/1771 [=====] - 8s 4ms/step - loss: 0.3795 - accuracy: 0.8650 - val_loss: 1.0560 - val_accuracy: 0.6953

Epoch 13/25
1771/1771 [=====] - 8s 4ms/step - loss: 0.3410 - accuracy: 0.8799 - val_loss: 1.0586 - val_accuracy: 0.7072

Epoch 14/25
1771/1771 [=====] - 8s 4ms/step - loss: 0.3082 - accuracy: 0.8912 - val_loss: 1.0740 - val_accuracy: 0.7099

Epoch 15/25
1771/1771 [=====] - 8s 4ms/step - loss: 0.2941 - accuracy: 0.8964 - val_loss: 1.1369 - val_accuracy: 0.7163

Epoch 16/25
1771/1771 [=====] - 8s 5ms/step - loss: 0.2597 - accuracy: 0.9074 - val_loss: 1.1652 - val_accuracy: 0.7008

Epoch 17/25
1771/1771 [=====] - 8s 5ms/step - loss: 0.2453 - accuracy: 0.9139 - val_loss: 1.3276 - val_accuracy: 0.6937

Epoch 18/25
1771/1771 [=====] - 8s 5ms/step - loss: 0.2228 - accuracy: 0.9214 - val_loss: 1.3266 - val_accuracy: 0.7101

Epoch 19/25
1771/1771 [=====] - 8s 5ms/step - loss: 0.2109 - accuracy: 0.9252 - val_loss: 1.2452 - val_accuracy: 0.7087

Epoch 20/25
1771/1771 [=====] - 8s 5ms/step - loss: 0.2043 - accuracy: 0.9284 - val_loss: 1.3974 - val_accuracy: 0.7036

Epoch 21/25
1771/1771 [=====] - 8s 4ms/step - loss: 0.1848 - accuracy: 0.9360 - val_loss: 1.3938 - val_accuracy: 0.7056

Epoch 22/25
1771/1771 [=====] - 8s 5ms/step - loss: 0.1747 -
accuracy: 0.9391 - val_loss: 1.3835 - val_accuracy: 0.7116
Epoch 23/25
1771/1771 [=====] - 8s 5ms/step - loss: 0.1610 -
accuracy: 0.9434 - val_loss: 1.4805 - val_accuracy: 0.7011
Epoch 24/25
1771/1771 [=====] - 8s 5ms/step - loss: 0.1620 -
accuracy: 0.9445 - val_loss: 1.4821 - val_accuracy: 0.7060
Epoch 25/25
1771/1771 [=====] - 8s 5ms/step - loss: 0.1451 -
accuracy: 0.9501 - val_loss: 1.5851 - val_accuracy: 0.7055

Accuracy: 70.55%

Iteration No: 43 ended. Search finished for the next optimal point.

Time taken: 202.9789

Function value obtained: -0.7055

Current minimum: -0.7497

Iteration No: 44 started. Searching for the next optimal point.

Epoch 1/25
1371/1371 [=====] - 8s 5ms/step - loss: 1.8228 -
accuracy: 0.3180 - val_loss: 1.3934 - val_accuracy: 0.4733
Epoch 2/25
1371/1371 [=====] - 7s 5ms/step - loss: 1.2969 -
accuracy: 0.5287 - val_loss: 1.1395 - val_accuracy: 0.5912
Epoch 3/25
1371/1371 [=====] - 7s 5ms/step - loss: 1.0700 -
accuracy: 0.6210 - val_loss: 1.0987 - val_accuracy: 0.6099
Epoch 4/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.9238 -
accuracy: 0.6753 - val_loss: 1.0474 - val_accuracy: 0.6501
Epoch 5/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.8154 -
accuracy: 0.7155 - val_loss: 0.9554 - val_accuracy: 0.6816
Epoch 6/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.7325 -
accuracy: 0.7456 - val_loss: 0.9916 - val_accuracy: 0.6731
Epoch 7/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.6679 -
accuracy: 0.7698 - val_loss: 0.8907 - val_accuracy: 0.7039
Epoch 8/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.6080 -
accuracy: 0.7904 - val_loss: 0.9283 - val_accuracy: 0.7029
Epoch 9/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.5668 -
accuracy: 0.8047 - val_loss: 0.9213 - val_accuracy: 0.7036
Epoch 10/25

1371/1371 [=====] - 7s 5ms/step - loss: 0.5219 - accuracy: 0.8234 - val_loss: 0.9638 - val_accuracy: 0.7041
Epoch 11/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.4941 - accuracy: 0.8331 - val_loss: 1.0067 - val_accuracy: 0.6927
Epoch 12/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.4714 - accuracy: 0.8404 - val_loss: 1.0096 - val_accuracy: 0.7059
Epoch 13/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.4391 - accuracy: 0.8524 - val_loss: 1.1461 - val_accuracy: 0.6852
Epoch 14/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.4236 - accuracy: 0.8576 - val_loss: 1.0635 - val_accuracy: 0.6967
Epoch 15/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.4101 - accuracy: 0.8632 - val_loss: 1.1470 - val_accuracy: 0.6968
Epoch 16/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.4036 - accuracy: 0.8665 - val_loss: 1.1226 - val_accuracy: 0.7019
Epoch 17/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.3808 - accuracy: 0.8754 - val_loss: 1.2930 - val_accuracy: 0.6648
Epoch 18/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.3872 - accuracy: 0.8758 - val_loss: 1.1936 - val_accuracy: 0.7093
Epoch 19/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.3644 - accuracy: 0.8835 - val_loss: 1.2361 - val_accuracy: 0.6935
Epoch 20/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.3696 - accuracy: 0.8811 - val_loss: 1.2268 - val_accuracy: 0.6935
Epoch 21/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.3598 - accuracy: 0.8871 - val_loss: 1.1918 - val_accuracy: 0.6947
Epoch 22/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.3447 - accuracy: 0.8914 - val_loss: 1.3970 - val_accuracy: 0.6667
Epoch 23/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.3451 - accuracy: 0.8939 - val_loss: 1.4618 - val_accuracy: 0.6735
Epoch 24/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.3730 - accuracy: 0.8863 - val_loss: 1.3223 - val_accuracy: 0.6909
Epoch 25/25
1371/1371 [=====] - 7s 5ms/step - loss: 0.4154 - accuracy: 0.8758 - val_loss: 1.2394 - val_accuracy: 0.6772

Accuracy: 67.72%

Iteration No: 44 ended. Search finished for the next optimal point.

Time taken: 174.3320

Function value obtained: -0.6772

Current minimum: -0.7497

Iteration No: 45 started. Searching for the next optimal point.

Epoch 1/25

1771/1771 [=====] - 10s 6ms/step - loss: 1.9524 -
accuracy: 0.2479 - val_loss: 2.0080 - val_accuracy: 0.2789

Epoch 2/25

1771/1771 [=====] - 9s 5ms/step - loss: 1.5180 -
accuracy: 0.4380 - val_loss: 1.4506 - val_accuracy: 0.4648

Epoch 3/25

1771/1771 [=====] - 10s 5ms/step - loss: 1.2667 -
accuracy: 0.5396 - val_loss: 1.1928 - val_accuracy: 0.5768

Epoch 4/25

1771/1771 [=====] - 9s 5ms/step - loss: 1.0886 -
accuracy: 0.6155 - val_loss: 1.0696 - val_accuracy: 0.6239

Epoch 5/25

1771/1771 [=====] - 9s 5ms/step - loss: 0.9546 -
accuracy: 0.6651 - val_loss: 0.9257 - val_accuracy: 0.6784

Epoch 6/25

1771/1771 [=====] - 9s 5ms/step - loss: 0.8444 -
accuracy: 0.7084 - val_loss: 1.1392 - val_accuracy: 0.6393

Epoch 7/25

1771/1771 [=====] - 9s 5ms/step - loss: 0.7483 -
accuracy: 0.7449 - val_loss: 0.8436 - val_accuracy: 0.7228

Epoch 8/25

1771/1771 [=====] - 9s 5ms/step - loss: 0.6760 -
accuracy: 0.7686 - val_loss: 0.8152 - val_accuracy: 0.7304

Epoch 9/25

1771/1771 [=====] - 9s 5ms/step - loss: 0.6094 -
accuracy: 0.7930 - val_loss: 0.8200 - val_accuracy: 0.7252

Epoch 10/25

1771/1771 [=====] - 10s 5ms/step - loss: 0.5428 -
accuracy: 0.8160 - val_loss: 0.8275 - val_accuracy: 0.7336

Epoch 11/25

1771/1771 [=====] - 10s 5ms/step - loss: 0.4889 -
accuracy: 0.8350 - val_loss: 0.8121 - val_accuracy: 0.7379

Epoch 12/25

1771/1771 [=====] - 9s 5ms/step - loss: 0.4403 -
accuracy: 0.8527 - val_loss: 0.9531 - val_accuracy: 0.7187

Epoch 13/25

1771/1771 [=====] - 9s 5ms/step - loss: 0.4054 -
accuracy: 0.8632 - val_loss: 0.8197 - val_accuracy: 0.7461

Epoch 14/25

1771/1771 [=====] - 9s 5ms/step - loss: 0.3572 -

accuracy: 0.8813 - val_loss: 0.8208 - val_accuracy: 0.7492
Epoch 15/25
1771/1771 [=====] - 10s 5ms/step - loss: 0.3317 -
accuracy: 0.8901 - val_loss: 0.8893 - val_accuracy: 0.7408
Epoch 16/25
1771/1771 [=====] - 10s 5ms/step - loss: 0.3017 -
accuracy: 0.9003 - val_loss: 0.8745 - val_accuracy: 0.7489
Epoch 17/25
1771/1771 [=====] - 10s 5ms/step - loss: 0.2702 -
accuracy: 0.9114 - val_loss: 0.8972 - val_accuracy: 0.7515
Epoch 18/25
1771/1771 [=====] - 10s 5ms/step - loss: 0.2515 -
accuracy: 0.9179 - val_loss: 1.2417 - val_accuracy: 0.7041
Epoch 19/25
1771/1771 [=====] - 10s 6ms/step - loss: 0.2333 -
accuracy: 0.9238 - val_loss: 0.9350 - val_accuracy: 0.7500
Epoch 20/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.2095 -
accuracy: 0.9323 - val_loss: 1.1117 - val_accuracy: 0.7148
Epoch 21/25
1771/1771 [=====] - 10s 6ms/step - loss: 0.1991 -
accuracy: 0.9350 - val_loss: 1.0639 - val_accuracy: 0.7345
Epoch 22/25
1771/1771 [=====] - 10s 5ms/step - loss: 0.1778 -
accuracy: 0.9431 - val_loss: 1.0825 - val_accuracy: 0.7431
Epoch 23/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1639 -
accuracy: 0.9467 - val_loss: 1.1164 - val_accuracy: 0.7460
Epoch 24/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1470 -
accuracy: 0.9519 - val_loss: 1.0643 - val_accuracy: 0.7489
Epoch 25/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1467 -
accuracy: 0.9528 - val_loss: 1.0792 - val_accuracy: 0.7463

Accuracy: 74.63%

Iteration No: 45 ended. Search finished for the next optimal point.

Time taken: 239.8028

Function value obtained: -0.7463

Current minimum: -0.7497

Iteration No: 46 started. Searching for the next optimal point.

Epoch 1/25

1288/1288 [=====] - 9s 6ms/step - loss: 1.9671 -
accuracy: 0.2572 - val_loss: 1.6452 - val_accuracy: 0.3809

Epoch 2/25

1288/1288 [=====] - 7s 6ms/step - loss: 1.4982 -
accuracy: 0.4490 - val_loss: 1.3354 - val_accuracy: 0.5145

Epoch 3/25
1288/1288 [=====] - 7s 6ms/step - loss: 1.2123 - accuracy: 0.5617 - val_loss: 1.1243 - val_accuracy: 0.5936

Epoch 4/25
1288/1288 [=====] - 7s 6ms/step - loss: 1.0112 - accuracy: 0.6393 - val_loss: 0.9531 - val_accuracy: 0.6612

Epoch 5/25
1288/1288 [=====] - 7s 6ms/step - loss: 0.8678 - accuracy: 0.6972 - val_loss: 0.9405 - val_accuracy: 0.6779

Epoch 6/25
1288/1288 [=====] - 7s 6ms/step - loss: 0.7587 - accuracy: 0.7348 - val_loss: 0.9372 - val_accuracy: 0.6756

Epoch 7/25
1288/1288 [=====] - 7s 6ms/step - loss: 0.6701 - accuracy: 0.7700 - val_loss: 0.9922 - val_accuracy: 0.6848

Epoch 8/25
1288/1288 [=====] - 7s 6ms/step - loss: 0.5899 - accuracy: 0.7952 - val_loss: 0.8194 - val_accuracy: 0.7293

Epoch 9/25
1288/1288 [=====] - 7s 6ms/step - loss: 0.5256 - accuracy: 0.8172 - val_loss: 0.8678 - val_accuracy: 0.7309

Epoch 10/25
1288/1288 [=====] - 7s 6ms/step - loss: 0.4667 - accuracy: 0.8415 - val_loss: 0.8232 - val_accuracy: 0.7479

Epoch 11/25
1288/1288 [=====] - 7s 6ms/step - loss: 0.4202 - accuracy: 0.8588 - val_loss: 0.8583 - val_accuracy: 0.7300

Epoch 12/25
1288/1288 [=====] - 7s 6ms/step - loss: 0.3815 - accuracy: 0.8698 - val_loss: 0.8339 - val_accuracy: 0.7379

Epoch 13/25
1288/1288 [=====] - 7s 6ms/step - loss: 0.3346 - accuracy: 0.8865 - val_loss: 0.8686 - val_accuracy: 0.7545

Epoch 14/25
1288/1288 [=====] - 7s 6ms/step - loss: 0.3079 - accuracy: 0.8950 - val_loss: 0.8609 - val_accuracy: 0.7483

Epoch 15/25
1288/1288 [=====] - 7s 6ms/step - loss: 0.2774 - accuracy: 0.9067 - val_loss: 0.9967 - val_accuracy: 0.7285

Epoch 16/25
1288/1288 [=====] - 7s 6ms/step - loss: 0.2480 - accuracy: 0.9171 - val_loss: 0.8997 - val_accuracy: 0.7468

Epoch 17/25
1288/1288 [=====] - 7s 6ms/step - loss: 0.2276 - accuracy: 0.9240 - val_loss: 0.9302 - val_accuracy: 0.7453

Epoch 18/25
1288/1288 [=====] - 7s 6ms/step - loss: 0.2190 - accuracy: 0.9269 - val_loss: 0.9933 - val_accuracy: 0.7431

Epoch 19/25
 1288/1288 [=====] - 7s 6ms/step - loss: 0.1908 - accuracy: 0.9378 - val_loss: 1.0906 - val_accuracy: 0.7381
 Epoch 20/25
 1288/1288 [=====] - 7s 6ms/step - loss: 0.1681 - accuracy: 0.9454 - val_loss: 0.9922 - val_accuracy: 0.7557
 Epoch 21/25
 1288/1288 [=====] - 7s 6ms/step - loss: 0.1720 - accuracy: 0.9441 - val_loss: 1.1312 - val_accuracy: 0.7464
 Epoch 22/25
 1288/1288 [=====] - 7s 6ms/step - loss: 0.1469 - accuracy: 0.9513 - val_loss: 1.0726 - val_accuracy: 0.7516
 Epoch 23/25
 1288/1288 [=====] - 7s 6ms/step - loss: 0.1353 - accuracy: 0.9559 - val_loss: 1.0820 - val_accuracy: 0.7545
 Epoch 24/25
 1288/1288 [=====] - 7s 6ms/step - loss: 0.1239 - accuracy: 0.9594 - val_loss: 1.1366 - val_accuracy: 0.7487
 Epoch 25/25
 1288/1288 [=====] - 7s 6ms/step - loss: 0.1178 - accuracy: 0.9616 - val_loss: 1.0760 - val_accuracy: 0.7575

Accuracy: 75.75%

Iteration No: 46 ended. Search finished for the next optimal point.

Time taken: 186.0764

Function value obtained: -0.7575

Current minimum: -0.7575

Iteration No: 47 started. Searching for the next optimal point.

Epoch 1/25
 1771/1771 [=====] - 10s 5ms/step - loss: 2.2083 - accuracy: 0.1512 - val_loss: 1.8562 - val_accuracy: 0.3253
 Epoch 2/25
 1771/1771 [=====] - 9s 5ms/step - loss: 1.5688 - accuracy: 0.4251 - val_loss: 1.5262 - val_accuracy: 0.4591
 Epoch 3/25
 1771/1771 [=====] - 9s 5ms/step - loss: 1.2498 - accuracy: 0.5488 - val_loss: 1.1589 - val_accuracy: 0.5871
 Epoch 4/25
 1771/1771 [=====] - 9s 5ms/step - loss: 1.0455 - accuracy: 0.6252 - val_loss: 1.0001 - val_accuracy: 0.6500
 Epoch 5/25
 1771/1771 [=====] - 9s 5ms/step - loss: 0.8915 - accuracy: 0.6824 - val_loss: 0.9659 - val_accuracy: 0.6657
 Epoch 6/25
 1771/1771 [=====] - 9s 5ms/step - loss: 0.7623 - accuracy: 0.7318 - val_loss: 0.9325 - val_accuracy: 0.6749
 Epoch 7/25

1771/1771 [=====] - 9s 5ms/step - loss: 0.6640 -
accuracy: 0.7688 - val_loss: 0.9208 - val_accuracy: 0.7007
Epoch 8/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.5831 -
accuracy: 0.7958 - val_loss: 0.9116 - val_accuracy: 0.6911
Epoch 9/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.5092 -
accuracy: 0.8229 - val_loss: 0.8742 - val_accuracy: 0.7204
Epoch 10/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.4540 -
accuracy: 0.8402 - val_loss: 1.0086 - val_accuracy: 0.6968
Epoch 11/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.3979 -
accuracy: 0.8613 - val_loss: 0.8345 - val_accuracy: 0.7369
Epoch 12/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.3620 -
accuracy: 0.8722 - val_loss: 0.9050 - val_accuracy: 0.7308
Epoch 13/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.3192 -
accuracy: 0.8879 - val_loss: 0.9425 - val_accuracy: 0.7321
Epoch 14/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.2996 -
accuracy: 0.8945 - val_loss: 1.0239 - val_accuracy: 0.7340
Epoch 15/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.2683 -
accuracy: 0.9052 - val_loss: 0.9863 - val_accuracy: 0.7357
Epoch 16/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.2441 -
accuracy: 0.9140 - val_loss: 1.0128 - val_accuracy: 0.7487
Epoch 17/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.2276 -
accuracy: 0.9205 - val_loss: 1.1120 - val_accuracy: 0.7313
Epoch 18/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.2091 -
accuracy: 0.9266 - val_loss: 0.9592 - val_accuracy: 0.7513
Epoch 19/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1835 -
accuracy: 0.9366 - val_loss: 1.7228 - val_accuracy: 0.6785
Epoch 20/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1872 -
accuracy: 0.9356 - val_loss: 1.0785 - val_accuracy: 0.7403
Epoch 21/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1659 -
accuracy: 0.9432 - val_loss: 1.2198 - val_accuracy: 0.7248
Epoch 22/25
1771/1771 [=====] - 10s 5ms/step - loss: 0.1572 -
accuracy: 0.9469 - val_loss: 1.2595 - val_accuracy: 0.7252
Epoch 23/25

1771/1771 [=====] - 10s 5ms/step - loss: 0.1473 -
accuracy: 0.9511 - val_loss: 1.2963 - val_accuracy: 0.7387
Epoch 24/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1486 -
accuracy: 0.9491 - val_loss: 1.2630 - val_accuracy: 0.7364
Epoch 25/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.1396 -
accuracy: 0.9537 - val_loss: 1.2345 - val_accuracy: 0.7476

Accuracy: 74.76%

Iteration No: 47 ended. Search finished for the next optimal point.

Time taken: 227.8071

Function value obtained: -0.7476

Current minimum: -0.7575

Iteration No: 48 started. Searching for the next optimal point.

Epoch 1/25

1329/1329 [=====] - 7s 5ms/step - loss: 1.9867 -
accuracy: 0.2684 - val_loss: 1.8690 - val_accuracy: 0.3280

Epoch 2/25

1329/1329 [=====] - 7s 5ms/step - loss: 1.4806 -
accuracy: 0.4660 - val_loss: 2.0251 - val_accuracy: 0.3471

Epoch 3/25

1329/1329 [=====] - 7s 5ms/step - loss: 1.2316 -
accuracy: 0.5586 - val_loss: 1.5796 - val_accuracy: 0.4552

Epoch 4/25

1329/1329 [=====] - 7s 5ms/step - loss: 1.0571 -
accuracy: 0.6249 - val_loss: 1.0255 - val_accuracy: 0.6357

Epoch 5/25

1329/1329 [=====] - 7s 5ms/step - loss: 0.9337 -
accuracy: 0.6709 - val_loss: 1.5072 - val_accuracy: 0.5131

Epoch 6/25

1329/1329 [=====] - 7s 5ms/step - loss: 0.8377 -
accuracy: 0.7036 - val_loss: 1.7538 - val_accuracy: 0.4412

Epoch 7/25

1329/1329 [=====] - 7s 5ms/step - loss: 0.7596 -
accuracy: 0.7347 - val_loss: 1.1926 - val_accuracy: 0.6103

Epoch 8/25

1329/1329 [=====] - 7s 5ms/step - loss: 0.6929 -
accuracy: 0.7570 - val_loss: 1.0651 - val_accuracy: 0.6480

Epoch 9/25

1329/1329 [=====] - 7s 5ms/step - loss: 0.6314 -
accuracy: 0.7788 - val_loss: 1.4056 - val_accuracy: 0.5760

Epoch 10/25

1329/1329 [=====] - 7s 5ms/step - loss: 0.5742 -
accuracy: 0.7986 - val_loss: 0.8576 - val_accuracy: 0.7224

Epoch 11/25

1329/1329 [=====] - 7s 5ms/step - loss: 0.5196 -

accuracy: 0.8166 - val_loss: 2.0957 - val_accuracy: 0.5100
Epoch 12/25
1329/1329 [=====] - 7s 5ms/step - loss: 0.4720 -
accuracy: 0.8349 - val_loss: 0.9128 - val_accuracy: 0.7176
Epoch 13/25
1329/1329 [=====] - 7s 5ms/step - loss: 0.4290 -
accuracy: 0.8488 - val_loss: 1.0336 - val_accuracy: 0.6929
Epoch 14/25
1329/1329 [=====] - 7s 5ms/step - loss: 0.3840 -
accuracy: 0.8639 - val_loss: 0.9834 - val_accuracy: 0.7119
Epoch 15/25
1329/1329 [=====] - 7s 5ms/step - loss: 0.3449 -
accuracy: 0.8776 - val_loss: 1.2202 - val_accuracy: 0.6756
Epoch 16/25
1329/1329 [=====] - 7s 5ms/step - loss: 0.3078 -
accuracy: 0.8898 - val_loss: 2.3126 - val_accuracy: 0.5417
Epoch 17/25
1329/1329 [=====] - 7s 5ms/step - loss: 0.2764 -
accuracy: 0.9017 - val_loss: 1.2841 - val_accuracy: 0.6772
Epoch 18/25
1329/1329 [=====] - 7s 5ms/step - loss: 0.2460 -
accuracy: 0.9124 - val_loss: 1.3185 - val_accuracy: 0.6928
Epoch 19/25
1329/1329 [=====] - 7s 5ms/step - loss: 0.2252 -
accuracy: 0.9201 - val_loss: 2.8424 - val_accuracy: 0.5431
Epoch 20/25
1329/1329 [=====] - 7s 5ms/step - loss: 0.2037 -
accuracy: 0.9263 - val_loss: 1.3287 - val_accuracy: 0.7081
Epoch 21/25
1329/1329 [=====] - 7s 5ms/step - loss: 0.1887 -
accuracy: 0.9324 - val_loss: 1.3729 - val_accuracy: 0.6961
Epoch 22/25
1329/1329 [=====] - 7s 5ms/step - loss: 0.1558 -
accuracy: 0.9449 - val_loss: 3.2924 - val_accuracy: 0.5377
Epoch 23/25
1329/1329 [=====] - 7s 5ms/step - loss: 0.1606 -
accuracy: 0.9434 - val_loss: 1.5642 - val_accuracy: 0.6869
Epoch 24/25
1329/1329 [=====] - 7s 5ms/step - loss: 0.1447 -
accuracy: 0.9484 - val_loss: 2.6667 - val_accuracy: 0.5667
Epoch 25/25
1329/1329 [=====] - 7s 5ms/step - loss: 0.1344 -
accuracy: 0.9526 - val_loss: 1.6816 - val_accuracy: 0.7079

Accuracy: 70.79%

Iteration No: 48 ended. Search finished for the next optimal point.
Time taken: 204.0997

Function value obtained: -0.7079

Current minimum: -0.7575

Iteration No: 49 started. Searching for the next optimal point.

Epoch 1/25

1635/1635 [=====] - 9s 5ms/step - loss: 1.7998 -
accuracy: 0.3397 - val_loss: 1.4856 - val_accuracy: 0.4563

Epoch 2/25

1635/1635 [=====] - 8s 5ms/step - loss: 1.2892 -
accuracy: 0.5340 - val_loss: 1.1879 - val_accuracy: 0.5779

Epoch 3/25

1635/1635 [=====] - 8s 5ms/step - loss: 1.0508 -
accuracy: 0.6276 - val_loss: 1.0185 - val_accuracy: 0.6496

Epoch 4/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.8981 -
accuracy: 0.6869 - val_loss: 1.0099 - val_accuracy: 0.6543

Epoch 5/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.7874 -
accuracy: 0.7260 - val_loss: 0.8848 - val_accuracy: 0.6987

Epoch 6/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.7053 -
accuracy: 0.7553 - val_loss: 0.8798 - val_accuracy: 0.7061

Epoch 7/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.6267 -
accuracy: 0.7818 - val_loss: 1.0961 - val_accuracy: 0.6485

Epoch 8/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.5618 -
accuracy: 0.8048 - val_loss: 0.8914 - val_accuracy: 0.7195

Epoch 9/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.5012 -
accuracy: 0.8255 - val_loss: 0.9310 - val_accuracy: 0.7143

Epoch 10/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.4524 -
accuracy: 0.8424 - val_loss: 1.0339 - val_accuracy: 0.6876

Epoch 11/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.3992 -
accuracy: 0.8612 - val_loss: 1.1134 - val_accuracy: 0.6888

Epoch 12/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.3680 -
accuracy: 0.8692 - val_loss: 0.9916 - val_accuracy: 0.7099

Epoch 13/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.3395 -
accuracy: 0.8802 - val_loss: 1.0819 - val_accuracy: 0.7191

Epoch 14/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.3099 -
accuracy: 0.8924 - val_loss: 1.1976 - val_accuracy: 0.6925

Epoch 15/25

1635/1635 [=====] - 8s 5ms/step - loss: 0.2725 -
accuracy: 0.9036 - val_loss: 1.0952 - val_accuracy: 0.7140

Epoch 16/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.2519 - accuracy: 0.9118 - val_loss: 1.2548 - val_accuracy: 0.7067
Epoch 17/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.2220 - accuracy: 0.9230 - val_loss: 1.3774 - val_accuracy: 0.6947
Epoch 18/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.2155 - accuracy: 0.9253 - val_loss: 1.3097 - val_accuracy: 0.6967
Epoch 19/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1931 - accuracy: 0.9323 - val_loss: 1.4537 - val_accuracy: 0.6999
Epoch 20/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1775 - accuracy: 0.9396 - val_loss: 1.4298 - val_accuracy: 0.6924
Epoch 21/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1695 - accuracy: 0.9417 - val_loss: 1.5853 - val_accuracy: 0.6919
Epoch 22/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1630 - accuracy: 0.9440 - val_loss: 1.5926 - val_accuracy: 0.6969
Epoch 23/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1483 - accuracy: 0.9483 - val_loss: 1.4552 - val_accuracy: 0.7193
Epoch 24/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1453 - accuracy: 0.9496 - val_loss: 1.5289 - val_accuracy: 0.7025
Epoch 25/25
1635/1635 [=====] - 8s 5ms/step - loss: 0.1283 - accuracy: 0.9561 - val_loss: 1.6359 - val_accuracy: 0.7193

Accuracy: 71.93%

Iteration No: 49 ended. Search finished for the next optimal point.

Time taken: 204.1656

Function value obtained: -0.7193

Current minimum: -0.7575

Iteration No: 50 started. Searching for the next optimal point.

Epoch 1/25

1771/1771 [=====] - 10s 5ms/step - loss: 1.8339 - accuracy: 0.3187 - val_loss: 1.3495 - val_accuracy: 0.5045

Epoch 2/25

1771/1771 [=====] - 9s 5ms/step - loss: 1.2427 - accuracy: 0.5532 - val_loss: 1.0488 - val_accuracy: 0.6303

Epoch 3/25

1771/1771 [=====] - 9s 5ms/step - loss: 1.0103 - accuracy: 0.6449 - val_loss: 0.9775 - val_accuracy: 0.6475

Epoch 4/25

1771/1771 [=====] - 9s 5ms/step - loss: 0.8838 -
accuracy: 0.6903 - val_loss: 0.8749 - val_accuracy: 0.6988
Epoch 5/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.7940 -
accuracy: 0.7228 - val_loss: 0.8591 - val_accuracy: 0.7089
Epoch 6/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.7400 -
accuracy: 0.7452 - val_loss: 0.8497 - val_accuracy: 0.7013
Epoch 7/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.6949 -
accuracy: 0.7604 - val_loss: 0.9262 - val_accuracy: 0.6908
Epoch 8/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.6586 -
accuracy: 0.7714 - val_loss: 0.8955 - val_accuracy: 0.6969
Epoch 9/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.6382 -
accuracy: 0.7798 - val_loss: 0.9440 - val_accuracy: 0.6969
Epoch 10/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.6123 -
accuracy: 0.7890 - val_loss: 1.0172 - val_accuracy: 0.6864
Epoch 11/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.6100 -
accuracy: 0.7937 - val_loss: 0.8797 - val_accuracy: 0.7132
Epoch 12/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.6084 -
accuracy: 0.7945 - val_loss: 0.9833 - val_accuracy: 0.7127
Epoch 13/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.6167 -
accuracy: 0.7924 - val_loss: 0.9260 - val_accuracy: 0.7184
Epoch 14/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.6258 -
accuracy: 0.7921 - val_loss: 0.9694 - val_accuracy: 0.7116
Epoch 15/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.6285 -
accuracy: 0.7930 - val_loss: 1.0075 - val_accuracy: 0.6867
Epoch 16/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.6416 -
accuracy: 0.7889 - val_loss: 0.9839 - val_accuracy: 0.6869
Epoch 17/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.6290 -
accuracy: 0.7966 - val_loss: 0.9777 - val_accuracy: 0.7179
Epoch 18/25
1771/1771 [=====] - 9s 5ms/step - loss: 0.6337 -
accuracy: 0.7956 - val_loss: 1.0774 - val_accuracy: 0.6753
Epoch 19/25
1771/1771 [=====] - 10s 5ms/step - loss: 0.6796 -
accuracy: 0.7814 - val_loss: 0.9583 - val_accuracy: 0.6984
Epoch 20/25

```

1771/1771 [=====] - 9s 5ms/step - loss: 0.6637 -
accuracy: 0.7887 - val_loss: 0.9436 - val_accuracy: 0.7140
Epoch 21/25
1771/1771 [=====] - 10s 6ms/step - loss: 0.6896 -
accuracy: 0.7826 - val_loss: 1.1270 - val_accuracy: 0.6615
Epoch 22/25
1771/1771 [=====] - 10s 6ms/step - loss: 0.7046 -
accuracy: 0.7764 - val_loss: 1.0469 - val_accuracy: 0.7059

```

Accuracy: 70.59%

Iteration No: 50 ended. Search finished for the next optimal point.
Time taken: 203.6484
Function value obtained: -0.7059
Current minimum: -0.7575

1.1.5 The best results

```

[ ]: gp_result.x
[ ]: [0.04130837784848988, 3, 4, 26, 'relu', 33]
[ ]: print("best accuracy was " + str(round(gp_result.fun *-100,2))+".")

```

best accuracy was 75.75%.

1.1.6 Model results with best tuned parameters

```

[ ]: gp_model = create_model(gp_result.x[0],gp_result.x[1],gp_result.x[2],gp_result.
    ↳x[3],gp_result.x[4])
early_S = tf.keras.callbacks.EarlyStopping(monitor='val_loss', patience=10,
    ↳restore_best_weights= True)
#named blackbox becuae it represents the structure
blackbox = gp_model.fit(x=X_train,
                        y=y_train,
                        epochs=25,
                        batch_size=gp_result.x[5],
                        validation_split=0.15
                        callbacks = [early_S]
                        )
#return the validation accuracy for the last epoch.
accuracy = blackbox.history['val_accuracy'][-1]

```

```

Epoch 1/25
1288/1288 [=====] - 8s 6ms/step - loss: 1.9063 -
accuracy: 0.2749 - val_loss: 1.5787 - val_accuracy: 0.4164
Epoch 2/25
1288/1288 [=====] - 8s 6ms/step - loss: 1.3830 -

```

accuracy: 0.4934 - val_loss: 1.2304 - val_accuracy: 0.5476
 Epoch 3/25
 1288/1288 [=====] - 7s 5ms/step - loss: 1.1391 -
 accuracy: 0.5891 - val_loss: 1.2067 - val_accuracy: 0.5807
 Epoch 4/25
 1288/1288 [=====] - 7s 5ms/step - loss: 0.9758 -
 accuracy: 0.6518 - val_loss: 0.9252 - val_accuracy: 0.6753
 Epoch 5/25
 1288/1288 [=====] - 7s 5ms/step - loss: 0.8534 -
 accuracy: 0.7022 - val_loss: 0.8999 - val_accuracy: 0.6913
 Epoch 6/25
 1288/1288 [=====] - 7s 5ms/step - loss: 0.7470 -
 accuracy: 0.7390 - val_loss: 0.8681 - val_accuracy: 0.7043
 Epoch 7/25
 1288/1288 [=====] - 7s 5ms/step - loss: 0.6662 -
 accuracy: 0.7692 - val_loss: 0.8047 - val_accuracy: 0.7232
 Epoch 8/25
 1288/1288 [=====] - 7s 5ms/step - loss: 0.5923 -
 accuracy: 0.7930 - val_loss: 0.8388 - val_accuracy: 0.7271
 Epoch 9/25
 1288/1288 [=====] - 7s 5ms/step - loss: 0.5270 -
 accuracy: 0.8193 - val_loss: 0.8531 - val_accuracy: 0.7219
 Epoch 10/25
 1288/1288 [=====] - 7s 5ms/step - loss: 0.4784 -
 accuracy: 0.8369 - val_loss: 0.8606 - val_accuracy: 0.7235
 Epoch 11/25
 1288/1288 [=====] - 7s 5ms/step - loss: 0.4247 -
 accuracy: 0.8549 - val_loss: 0.8265 - val_accuracy: 0.7479
 Epoch 12/25
 1288/1288 [=====] - 7s 5ms/step - loss: 0.3787 -
 accuracy: 0.8703 - val_loss: 0.8860 - val_accuracy: 0.7385
 Epoch 13/25
 1288/1288 [=====] - 7s 5ms/step - loss: 0.3588 -
 accuracy: 0.8779 - val_loss: 0.8326 - val_accuracy: 0.7431
 Epoch 14/25
 1288/1288 [=====] - 7s 5ms/step - loss: 0.3191 -
 accuracy: 0.8922 - val_loss: 0.9069 - val_accuracy: 0.7391
 Epoch 15/25
 1288/1288 [=====] - 7s 5ms/step - loss: 0.2960 -
 accuracy: 0.8991 - val_loss: 0.9418 - val_accuracy: 0.7379
 Epoch 16/25
 1288/1288 [=====] - 7s 5ms/step - loss: 0.2668 -
 accuracy: 0.9095 - val_loss: 1.0016 - val_accuracy: 0.7448
 Epoch 17/25
 1288/1288 [=====] - 7s 5ms/step - loss: 0.2466 -
 accuracy: 0.9162 - val_loss: 1.0303 - val_accuracy: 0.7423
 Epoch 18/25
 1288/1288 [=====] - 7s 5ms/step - loss: 0.2188 -

```

accuracy: 0.9262 - val_loss: 1.0051 - val_accuracy: 0.7469
Epoch 19/25
1288/1288 [=====] - 7s 5ms/step - loss: 0.2031 -
accuracy: 0.9317 - val_loss: 0.9918 - val_accuracy: 0.7413
Epoch 20/25
1288/1288 [=====] - 7s 5ms/step - loss: 0.1850 -
accuracy: 0.9379 - val_loss: 1.0877 - val_accuracy: 0.7459
Epoch 21/25
1288/1288 [=====] - 7s 5ms/step - loss: 0.1748 -
accuracy: 0.9416 - val_loss: 1.0770 - val_accuracy: 0.7436
Epoch 22/25
1288/1288 [=====] - 7s 5ms/step - loss: 0.1678 -
accuracy: 0.9460 - val_loss: 1.0959 - val_accuracy: 0.7453
Epoch 23/25
1288/1288 [=====] - 7s 5ms/step - loss: 0.1556 -
accuracy: 0.9493 - val_loss: 1.0595 - val_accuracy: 0.7601
Epoch 24/25
1288/1288 [=====] - 7s 5ms/step - loss: 0.1428 -
accuracy: 0.9522 - val_loss: 1.1435 - val_accuracy: 0.7427
Epoch 25/25
1288/1288 [=====] - 7s 5ms/step - loss: 0.1284 -
accuracy: 0.9575 - val_loss: 1.1145 - val_accuracy: 0.7577

```

```
[ ]: accuracy
```

```
[ ]: 0.7577333450317383
```

```
[ ]: gp_model.evaluate(X_test, y_test)
```

```

313/313 [=====] - 1s 3ms/step - loss: 1.1114 -
accuracy: 0.7520

```

```
[ ]: [1.1113765239715576, 0.7519999742507935]
```

```
[ ]: gp_result.func_vals
```

```
[ ]: gp_result.x_iters
```

1.1.7 Save the results

```

[ ]: df_temp = pd.concat([pd.DataFrame(gp_result.x_iters, columns =
    ↳ ["learning_rate", "num_conv_layers", "num_dense_layers",
        "num_dense_nodes", "activation", "batch_size"]), pd.Series(gp_result.
    ↳ func_vals*100, name="accuracy")], axis=1)

```

```
[ ]: df_temp
```

```
[ ]: df_temp.to_csv("DF_cifar10_bayesian.csv")
```

1.2 PT using Random search

```
[ ]: param_grid = {
    'dim_learning_rate' : list(np.logspace(np.log(0.005), np.log(0.
    ↪2), base = np.exp(1), num = 1000)),
    'dim_num_conv_layers' : list(range(1, 3)),
    'dim_num_dense_layers' : list(range(1, 5)),
    'dim_num_dense_nodes' : list(range(1, 28)),
    'dim_activation' : ['relu', 'sigmoid'],
    'dim_batch_size' : list(range(1, 128))
}
```

```
[ ]: random.seed(50)

# Iterate through the specified number of evaluations
for i in range(5):

    # Randomly sample parameters for gbm
    params = [random.sample(value, 1)[0] for key, value in param_grid.items()]

    print(params)
```

```
[0.03275177220475209, 2, 3, 21, 'relu', 89]
[0.029863672437724486, 2, 1, 18, 'sigmoid', 29]
[0.06437322298735856, 1, 2, 12, 'relu', 126]
[0.01854686888813489, 2, 2, 7, 'relu', 125]
[0.13128416279545488, 2, 4, 21, 'relu', 118]
```

1.2.1 Objective function for random search

```
[ ]: def fitness(learning_rate, num_conv_layers, num_dense_layers,
                num_dense_nodes, activation, batch_size):

    model = create_model(learning_rate=learning_rate,
                          num_conv_layers = num_conv_layers,
                          num_dense_layers=num_dense_layers,
                          num_dense_nodes=num_dense_nodes,
                          activation=activation
                          )

    early_S = tf.keras.callbacks.EarlyStopping(monitor='loss', patience=10)
    #named blackbox becuae it represents the structure
    blackbox = model.fit(x=X_train,
                        y=y_train,
```

```

        epochs=25,
        batch_size=batch_size,
        validation_split=0.15,
        callbacks = [early_S]
    )

    #return the validation accuracy for the last epoch.
    accuracy = blackbox.history['val_accuracy'][-1]

    # Print the classification accuracy.
    print()
    print("Accuracy: {0:.2%}".format(accuracy))
    print()

    # Delete the Keras model with these hyper-parameters from memory.
    del model

    # Clear the Keras session, otherwise it will keep adding new
# models to the same TensorFlow graph each time we create
# a model with a different set of hyper-parameters.
    K.clear_session()
    ops.reset_default_graph()

    return [learning_rate, num_conv_layers, num_dense_layers,
            num_dense_nodes, activation, batch_size, accuracy]

```

1.2.2 Run random search

```

[ ]: random.seed(50)

results = []
best_results = [0, 0, 0, 0, 0, 0, 0]

# Iterate through the specified number of evaluations
for i in range(50):

    print("Iteration: ", i+1)

    # Randomly sample parameters for gbm
    params = [random.sample(value, 1)[0] for key, value in param_grid.items()]

    result = fitness(params[0], params[1], params[2], params[3], params[4], ↵
    ↵params[5])
    results.append(result)
    if(best_results[6] < result[6]):
        best_results = result

```


1.2.3 Results using random search

```
[ ]: results
```

```
[ ]: df_random = pd.DataFrame(results,
                              columns = ['learning_rate', 'num_conv_layers',
                              ↪ 'num_dense_layers',
                              'num_dense_nodes', 'activation', 'batch_size',
                              ↪ 'accuracy'])
```

```
[ ]: df_random.head()
```

```
[ ]:   learning_rate  num_conv_layers  num_dense_layers  num_dense_nodes  \
0      0.032752             2             3             21
1      0.029864             2             1             18
2      0.064373             1             2             12
3      0.018547             2             2              7
4      0.131284             2             4             21

   activation  batch_size  accuracy
0      relu          89  0.668400
1  sigmoid          29  0.704400
2      relu         126  0.586000
3      relu         125  0.644667
4      relu         118  0.670133
```

```
[ ]: df_random.to_csv("df_Cifar10_random.csv")
```

```
[ ]: gp_model = create_model(gp_result.x[0],gp_result.x[1],gp_result.x[2],gp_result.
  ↪ x[3],gp_result.x[4],gp_result.x[6])
gp_model.summary()
```

```
[ ]: model.summary()
```

1.2.4 Retrain the best model architecture for random search

```
[ ]: gp_model.fit(X_train, y_train, batch_size=gp_result.x[5], epochs =20,
  ↪ validation_split=0.15)
gp_model.evaluate(X_train,y_train)
```

```
[ ]: gp_model.evaluate(X_test,y_test)
```

```
313/313 [=====] - 1s 2ms/step - loss: 0.0830 -
accuracy: 0.9836
```

```
[ ]: [0.0829724669456482, 0.9836000204086304]
```

```
[ ]: best_results
```

```
[ ]: [0.029863672437724486, 2, 1, 18, 'sigmoid', 29, 0.7044000029563904]
```

```
[ ]: model =   
      ↪ create_model(best_results[0],best_results[1],best_results[2],best_results[3],best_results[4])  
  
early_S = tf.keras.callbacks.EarlyStopping(monitor='val_loss', patience=10,  
      ↪ restore_best_weights=True)  
#named blackbox becuae it represents the structure  
blackbox = model.fit(x=X_train,  
                     y=y_train,  
                     epochs=25,  
                     batch_size=best_results[5],  
                     validation_split=0.15,  
                     callbacks = [early_S]  
                     )  
#return the validation accuracy for the last epoch.  
accuracy = blackbox.history['val_accuracy'][-1]
```

Epoch 1/25

1466/1466 [=====] - 8s 5ms/step - loss: 1.8827 -
accuracy: 0.3304 - val_loss: 1.9045 - val_accuracy: 0.3384

Epoch 2/25

1466/1466 [=====] - 6s 4ms/step - loss: 1.4924 -
accuracy: 0.4738 - val_loss: 1.3654 - val_accuracy: 0.5209

Epoch 3/25

1466/1466 [=====] - 6s 4ms/step - loss: 1.2761 -
accuracy: 0.5545 - val_loss: 1.3013 - val_accuracy: 0.5347

Epoch 4/25

1466/1466 [=====] - 6s 4ms/step - loss: 1.1056 -
accuracy: 0.6160 - val_loss: 1.0816 - val_accuracy: 0.6251

Epoch 5/25

1466/1466 [=====] - 6s 4ms/step - loss: 0.9817 -
accuracy: 0.6634 - val_loss: 1.0093 - val_accuracy: 0.6565

Epoch 6/25

1466/1466 [=====] - 6s 4ms/step - loss: 0.8834 -
accuracy: 0.6990 - val_loss: 0.9990 - val_accuracy: 0.6576

Epoch 7/25

1466/1466 [=====] - 7s 4ms/step - loss: 0.8063 -
accuracy: 0.7270 - val_loss: 0.9028 - val_accuracy: 0.6916

Epoch 8/25

1466/1466 [=====] - 7s 4ms/step - loss: 0.7335 -
accuracy: 0.7529 - val_loss: 0.9871 - val_accuracy: 0.6643

Epoch 9/25

1466/1466 [=====] - 7s 5ms/step - loss: 0.6697 -
accuracy: 0.7744 - val_loss: 0.8791 - val_accuracy: 0.6948

```

Epoch 10/25
1466/1466 [=====] - 7s 5ms/step - loss: 0.6165 -
accuracy: 0.7922 - val_loss: 0.8506 - val_accuracy: 0.7099
Epoch 11/25
1466/1466 [=====] - 6s 4ms/step - loss: 0.5622 -
accuracy: 0.8122 - val_loss: 0.8444 - val_accuracy: 0.7215
Epoch 12/25
1466/1466 [=====] - 6s 4ms/step - loss: 0.5169 -
accuracy: 0.8282 - val_loss: 0.8457 - val_accuracy: 0.7171
Epoch 13/25
1466/1466 [=====] - 6s 4ms/step - loss: 0.4749 -
accuracy: 0.8426 - val_loss: 0.8672 - val_accuracy: 0.7140
Epoch 14/25
1466/1466 [=====] - 6s 4ms/step - loss: 0.4368 -
accuracy: 0.8555 - val_loss: 0.9235 - val_accuracy: 0.7003
Epoch 15/25
1466/1466 [=====] - 6s 4ms/step - loss: 0.4017 -
accuracy: 0.8686 - val_loss: 0.8754 - val_accuracy: 0.7228
Epoch 16/25
1466/1466 [=====] - 6s 4ms/step - loss: 0.3627 -
accuracy: 0.8811 - val_loss: 0.9365 - val_accuracy: 0.7064
Epoch 17/25
1466/1466 [=====] - 6s 4ms/step - loss: 0.3356 -
accuracy: 0.8910 - val_loss: 0.9734 - val_accuracy: 0.6932
Epoch 18/25
1466/1466 [=====] - 6s 4ms/step - loss: 0.3086 -
accuracy: 0.9002 - val_loss: 0.9340 - val_accuracy: 0.7108
Epoch 19/25
1466/1466 [=====] - 6s 4ms/step - loss: 0.2794 -
accuracy: 0.9127 - val_loss: 0.9494 - val_accuracy: 0.7113
Epoch 20/25
1466/1466 [=====] - 6s 4ms/step - loss: 0.2670 -
accuracy: 0.9164 - val_loss: 0.9962 - val_accuracy: 0.7073
Epoch 21/25
1466/1466 [=====] - 6s 4ms/step - loss: 0.2400 -
accuracy: 0.9273 - val_loss: 1.0974 - val_accuracy: 0.6863

```

```
[ ]: model.evaluate(X_test, y_test)
```

```

313/313 [=====] - 1s 3ms/step - loss: 0.8549 -
accuracy: 0.7141

```

```
[ ]: [0.8549267649650574, 0.7141000032424927]
```