

```

#Final Project, MovieNNclassification
#
#This program uses the Keras Python library built on Tensorflow and
#IMDB movie data to train a Neural Network to predict
#movie Return On Investment (ROI) given genre, director, ratings, and
#actors. In this case, a classification algorithm is
#used to predict if a movie will have a positive ROI, with accuracy as
#a metric of success.
#
#The code written here was written by myself, but also used a
#combination of the methodologies shown in the following
#Machine Learning Master tutorials:
#https://machinelearningmastery.com/regression-tutorial-keras-deep-
#learning-library-python/
#https://machinelearningmastery.com/multi-class-classification-
#tutorial-keras-deep-learning-library/

from pandas import read_csv
from keras.models import Sequential
from keras.layers import Dense
from keras.wrappers.scikit_learn import KerasClassifier
from keras.utils import np_utils
from sklearn.model_selection import cross_val_score
from sklearn.model_selection import KFold
from sklearn.preprocessing import StandardScaler
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import LabelEncoder
import numpy as np
import pandas as pd

# load CSV dataset
dataframe = read_csv("CPE 695_Group Project_Clean Data - 2760
Movies.csv", delim_whitespace=False, header=None)
dataset = dataframe.values

# split into input (X) and output (Y) variables. Ignore the first
# element (the label) for each column.
genre = dataset[1:,4]
rating = dataset[1:,5].astype(float)
director = dataset[1:,6]
actor1 = dataset[1:,7]
actor2 = dataset[1:,8]

#Convert to np.array and remove commas in the ROI values
Y = np.array(dataset[1:,12])
Y = np.array([x.replace(',', '') for x in Y])
Y = Y.astype(float)
Y[Y<100]=0
Y[Y>=100]=1

```

```

#Encode genre, director, actor1, and actor2 as integer values so that
they can be correctly processed
encoder_genre = LabelEncoder()
encoder_director = LabelEncoder()
encoder_actor1 = LabelEncoder()
encoder_actor2 = LabelEncoder()

encoder_genre.fit(genre)
encoder_director.fit(director)
encoder_actor1.fit(actor1)
encoder_actor2.fit(actor2)

encoded_genre = encoder_genre.transform(genre)
encoded_director = encoder_director.transform(director)
encoded_actor1 = encoder_actor1.transform(actor1)
encoded_actor2 = encoder_actor2.transform(actor2)

#one-hot-encoding
dummy_Y = np_utils.to_categorical(Y)

#Combine the newly encoded columns with the rating to form the input
matrix.
X = np.stack((encoded_genre, rating, encoded_director, encoded_actor1,
encoded_actor2),axis=-1)

# define base model
def baseline_model():
    # create model
    model = Sequential()
    model.add(Dense(10, input_dim=5, activation='relu'))
    model.add(Dense(2, activation='softmax'))
    # Compile model
    model.compile(loss='categorical_crossentropy', optimizer='adam',
metrics=['accuracy'])
    return model

estimator = KerasClassifier(build_fn=baseline_model, epochs=50,
batch_size=5, verbose=1)
kfold = KFold(n_splits=10, shuffle=True)
results = cross_val_score(estimator, X, dummy_Y, cv=kfold)
print("Baseline: %.2f%% (%.2f%%)" % (results.mean()*100,
results.std()*100))

```

Using TensorFlow backend.

```

Epoch 1/50
2484/2484 [=====] - 1s 259us/step - loss:
42.0667 - accuracy: 0.6944
Epoch 2/50
2484/2484 [=====] - 1s 254us/step - loss:

```

10.4290 - accuracy: 0.7359
Epoch 3/50
2484/2484 [=====] - 1s 222us/step - loss:
8.0519 - accuracy: 0.7279
Epoch 4/50
2484/2484 [=====] - 1s 307us/step - loss:
5.5918 - accuracy: 0.7315
Epoch 5/50
2484/2484 [=====] - 1s 285us/step - loss:
4.3857 - accuracy: 0.7355
Epoch 6/50
2484/2484 [=====] - 1s 252us/step - loss:
4.1680 - accuracy: 0.7246
Epoch 7/50
2484/2484 [=====] - 1s 237us/step - loss:
3.5069 - accuracy: 0.7391
Epoch 8/50
2484/2484 [=====] - 1s 263us/step - loss:
3.4117 - accuracy: 0.7258
Epoch 9/50
2484/2484 [=====] - 1s 253us/step - loss:
3.1196 - accuracy: 0.7407
Epoch 10/50
2484/2484 [=====] - 1s 228us/step - loss:
2.9144 - accuracy: 0.7327
Epoch 11/50
2484/2484 [=====] - 1s 231us/step - loss:
2.8610 - accuracy: 0.7367
Epoch 12/50
2484/2484 [=====] - 1s 234us/step - loss:
2.3914 - accuracy: 0.7363
Epoch 13/50
2484/2484 [=====] - 1s 242us/step - loss:
2.5022 - accuracy: 0.7323
Epoch 14/50
2484/2484 [=====] - 1s 231us/step - loss:
2.1267 - accuracy: 0.7407
Epoch 15/50
2484/2484 [=====] - 1s 232us/step - loss:
2.3473 - accuracy: 0.7351
Epoch 16/50
2484/2484 [=====] - 1s 242us/step - loss:
2.2102 - accuracy: 0.7347
Epoch 17/50
2484/2484 [=====] - 1s 234us/step - loss:
1.9759 - accuracy: 0.7355
Epoch 18/50
2484/2484 [=====] - 1s 239us/step - loss:
1.6717 - accuracy: 0.7383
Epoch 19/50

2484/2484 [=====] - 1s 233us/step - loss:
1.8250 - accuracy: 0.7363
Epoch 20/50
2484/2484 [=====] - 1s 252us/step - loss:
1.3597 - accuracy: 0.7428
Epoch 21/50
2484/2484 [=====] - 1s 238us/step - loss:
1.7697 - accuracy: 0.7448
Epoch 22/50
2484/2484 [=====] - 1s 278us/step - loss:
1.6426 - accuracy: 0.7347
Epoch 23/50
2484/2484 [=====] - 1s 238us/step - loss:
1.3232 - accuracy: 0.7411
Epoch 24/50
2484/2484 [=====] - 1s 249us/step - loss:
1.3955 - accuracy: 0.7387
Epoch 25/50
2484/2484 [=====] - 1s 235us/step - loss:
1.3719 - accuracy: 0.7331
Epoch 26/50
2484/2484 [=====] - 1s 242us/step - loss:
1.4048 - accuracy: 0.7464
Epoch 27/50
2484/2484 [=====] - 1s 234us/step - loss:
1.1539 - accuracy: 0.7424
Epoch 28/50
2484/2484 [=====] - 1s 247us/step - loss:
1.2886 - accuracy: 0.7528
Epoch 29/50
2484/2484 [=====] - 1s 237us/step - loss:
1.2648 - accuracy: 0.7589
Epoch 30/50
2484/2484 [=====] - 1s 320us/step - loss:
1.2340 - accuracy: 0.7452
Epoch 31/50
2484/2484 [=====] - 1s 300us/step - loss:
1.3032 - accuracy: 0.7560
Epoch 32/50
2484/2484 [=====] - 1s 261us/step - loss:
1.2093 - accuracy: 0.7552
Epoch 33/50
2484/2484 [=====] - 1s 239us/step - loss:
1.1691 - accuracy: 0.7480
Epoch 34/50
2484/2484 [=====] - 1s 235us/step - loss:
1.3632 - accuracy: 0.7299
Epoch 35/50
2484/2484 [=====] - 1s 233us/step - loss:
1.3612 - accuracy: 0.7375

Epoch 36/50
2484/2484 [=====] - 1s 235us/step - loss:
1.1153 - accuracy: 0.7444
Epoch 37/50
2484/2484 [=====] - 1s 234us/step - loss:
1.1561 - accuracy: 0.7335
Epoch 38/50
2484/2484 [=====] - 1s 235us/step - loss:
1.0881 - accuracy: 0.7568
Epoch 39/50
2484/2484 [=====] - 1s 231us/step - loss:
1.2268 - accuracy: 0.7496
Epoch 40/50
2484/2484 [=====] - 1s 237us/step - loss:
1.1427 - accuracy: 0.7448
Epoch 41/50
2484/2484 [=====] - 1s 286us/step - loss:
1.1467 - accuracy: 0.7492
Epoch 42/50
2484/2484 [=====] - 1s 253us/step - loss:
0.9069 - accuracy: 0.7609
Epoch 43/50
2484/2484 [=====] - 1s 258us/step - loss:
1.1381 - accuracy: 0.7456
Epoch 44/50
2484/2484 [=====] - 1s 248us/step - loss:
0.9873 - accuracy: 0.7488
Epoch 45/50
2484/2484 [=====] - 1s 256us/step - loss:
1.1356 - accuracy: 0.7544
Epoch 46/50
2484/2484 [=====] - 1s 259us/step - loss:
1.2619 - accuracy: 0.7440
Epoch 47/50
2484/2484 [=====] - 1s 256us/step - loss:
1.0800 - accuracy: 0.7432
Epoch 48/50
2484/2484 [=====] - 1s 267us/step - loss:
1.1184 - accuracy: 0.7464
Epoch 49/50
2484/2484 [=====] - 1s 242us/step - loss:
1.1651 - accuracy: 0.7556
Epoch 50/50
2484/2484 [=====] - 1s 242us/step - loss:
0.8651 - accuracy: 0.7653
276/276 [=====] - 0s 185us/step
Epoch 1/50
2484/2484 [=====] - 1s 287us/step - loss:
55.9427 - accuracy: 0.6405
Epoch 2/50

2484/2484 [=====] - 1s 270us/step - loss:
1.3258 - accuracy: 0.7411
Epoch 3/50
2484/2484 [=====] - 1s 269us/step - loss:
1.2103 - accuracy: 0.7540
Epoch 4/50
2484/2484 [=====] - 1s 338us/step - loss:
0.9937 - accuracy: 0.7560
Epoch 5/50
2484/2484 [=====] - 1s 391us/step - loss:
1.1773 - accuracy: 0.7468
Epoch 6/50
2484/2484 [=====] - 1s 297us/step - loss:
1.2769 - accuracy: 0.7444
Epoch 7/50
2484/2484 [=====] - 1s 259us/step - loss:
0.9997 - accuracy: 0.7504
Epoch 8/50
2484/2484 [=====] - 1s 230us/step - loss:
1.0100 - accuracy: 0.7560
Epoch 9/50
2484/2484 [=====] - 1s 231us/step - loss:
1.0320 - accuracy: 0.7540
Epoch 10/50
2484/2484 [=====] - 1s 227us/step - loss:
1.0726 - accuracy: 0.7444
Epoch 11/50
2484/2484 [=====] - 1s 225us/step - loss:
0.9717 - accuracy: 0.7528
Epoch 12/50
2484/2484 [=====] - 1s 229us/step - loss:
0.9648 - accuracy: 0.7665
Epoch 13/50
2484/2484 [=====] - 1s 225us/step - loss:
0.9429 - accuracy: 0.7564
Epoch 14/50
2484/2484 [=====] - 1s 227us/step - loss:
0.8475 - accuracy: 0.7605
Epoch 15/50
2484/2484 [=====] - 1s 225us/step - loss:
1.1080 - accuracy: 0.7544
Epoch 16/50
2484/2484 [=====] - 1s 225us/step - loss:
0.8418 - accuracy: 0.7629
Epoch 17/50
2484/2484 [=====] - 1s 232us/step - loss:
1.0048 - accuracy: 0.7589
Epoch 18/50
2484/2484 [=====] - 1s 223us/step - loss:
0.9832 - accuracy: 0.7564

Epoch 19/50
2484/2484 [=====] - 1s 222us/step - loss:
0.9335 - accuracy: 0.7504
Epoch 20/50
2484/2484 [=====] - 1s 222us/step - loss:
0.9513 - accuracy: 0.7548
Epoch 21/50
2484/2484 [=====] - 1s 226us/step - loss:
1.0618 - accuracy: 0.7524
Epoch 22/50
2484/2484 [=====] - 1s 237us/step - loss:
1.0751 - accuracy: 0.7492
Epoch 23/50
2484/2484 [=====] - 1s 228us/step - loss:
1.0479 - accuracy: 0.7464
Epoch 24/50
2484/2484 [=====] - 1s 220us/step - loss:
0.9482 - accuracy: 0.7576
Epoch 25/50
2484/2484 [=====] - 1s 224us/step - loss:
0.9481 - accuracy: 0.7524
Epoch 26/50
2484/2484 [=====] - 1s 221us/step - loss:
0.8737 - accuracy: 0.7593
Epoch 27/50
2484/2484 [=====] - 1s 226us/step - loss:
1.0999 - accuracy: 0.7593
Epoch 28/50
2484/2484 [=====] - 1s 217us/step - loss:
0.8351 - accuracy: 0.7617
Epoch 29/50
2484/2484 [=====] - 1s 211us/step - loss:
0.8628 - accuracy: 0.7621
Epoch 30/50
2484/2484 [=====] - 1s 210us/step - loss:
0.8164 - accuracy: 0.7633
Epoch 31/50
2484/2484 [=====] - 1s 289us/step - loss:
1.0602 - accuracy: 0.7512
Epoch 32/50
2484/2484 [=====] - 1s 275us/step - loss:
1.0164 - accuracy: 0.7576
Epoch 33/50
2484/2484 [=====] - 1s 233us/step - loss:
0.9063 - accuracy: 0.7544
Epoch 34/50
2484/2484 [=====] - 1s 212us/step - loss:
1.0898 - accuracy: 0.7568
Epoch 35/50
2484/2484 [=====] - 1s 215us/step - loss:

1.0495 - accuracy: 0.75680s - loss: 0.914
Epoch 36/50
2484/2484 [=====] - 1s 212us/step - loss:
0.9284 - accuracy: 0.7488
Epoch 37/50
2484/2484 [=====] - 1s 209us/step - loss:
0.8154 - accuracy: 0.7637
Epoch 38/50
2484/2484 [=====] - 1s 211us/step - loss:
0.8892 - accuracy: 0.7605
Epoch 39/50
2484/2484 [=====] - 1s 214us/step - loss:
0.9172 - accuracy: 0.7564
Epoch 40/50
2484/2484 [=====] - 1s 222us/step - loss:
0.8787 - accuracy: 0.7657
Epoch 41/50
2484/2484 [=====] - 1s 211us/step - loss:
0.9439 - accuracy: 0.7625
Epoch 42/50
2484/2484 [=====] - 1s 212us/step - loss:
0.8746 - accuracy: 0.7685
Epoch 43/50
2484/2484 [=====] - 1s 212us/step - loss:
0.7446 - accuracy: 0.7733
Epoch 44/50
2484/2484 [=====] - 1s 211us/step - loss:
0.8346 - accuracy: 0.7589
Epoch 45/50
2484/2484 [=====] - 1s 211us/step - loss:
0.9117 - accuracy: 0.7581
Epoch 46/50
2484/2484 [=====] - 1s 210us/step - loss:
0.8296 - accuracy: 0.7685
Epoch 47/50
2484/2484 [=====] - 1s 211us/step - loss:
0.7396 - accuracy: 0.7681
Epoch 48/50
2484/2484 [=====] - 1s 209us/step - loss:
0.9464 - accuracy: 0.7520
Epoch 49/50
2484/2484 [=====] - 1s 213us/step - loss:
0.9981 - accuracy: 0.7589
Epoch 50/50
2484/2484 [=====] - 1s 213us/step - loss:
0.8610 - accuracy: 0.7657
276/276 [=====] - 0s 156us/step
Epoch 1/50
2484/2484 [=====] - 1s 237us/step - loss:
59.4429 - accuracy: 0.7484

Epoch 2/50
2484/2484 [=====] - 1s 211us/step - loss:
8.2060 - accuracy: 0.7504
Epoch 3/50
2484/2484 [=====] - 1s 213us/step - loss:
5.0868 - accuracy: 0.7375
Epoch 4/50
2484/2484 [=====] - 1s 210us/step - loss:
3.7308 - accuracy: 0.7379
Epoch 5/50
2484/2484 [=====] - 1s 217us/step - loss:
3.1680 - accuracy: 0.7339
Epoch 6/50
2484/2484 [=====] - 1s 212us/step - loss:
2.5658 - accuracy: 0.7295
Epoch 7/50
2484/2484 [=====] - 1s 212us/step - loss:
2.3150 - accuracy: 0.7395
Epoch 8/50
2484/2484 [=====] - 1s 226us/step - loss:
2.0932 - accuracy: 0.7339
Epoch 9/50
2484/2484 [=====] - 1s 298us/step - loss:
1.7286 - accuracy: 0.7399
Epoch 10/50
2484/2484 [=====] - 1s 292us/step - loss:
1.6053 - accuracy: 0.7452
Epoch 11/50
2484/2484 [=====] - 1s 246us/step - loss:
1.4813 - accuracy: 0.7331
Epoch 12/50
2484/2484 [=====] - 1s 216us/step - loss:
1.2627 - accuracy: 0.7492
Epoch 13/50
2484/2484 [=====] - 1s 217us/step - loss:
1.1891 - accuracy: 0.7528
Epoch 14/50
2484/2484 [=====] - 1s 214us/step - loss:
1.1949 - accuracy: 0.7544
Epoch 15/50
2484/2484 [=====] - 1s 214us/step - loss:
1.0875 - accuracy: 0.7484
Epoch 16/50
2484/2484 [=====] - 1s 215us/step - loss:
1.0083 - accuracy: 0.7520
Epoch 17/50
2484/2484 [=====] - 1s 213us/step - loss:
1.0140 - accuracy: 0.7500
Epoch 18/50
2484/2484 [=====] - 1s 213us/step - loss:

0.9671 - accuracy: 0.7556
Epoch 19/50
2484/2484 [=====] - 1s 217us/step - loss:
0.8892 - accuracy: 0.7637
Epoch 20/50
2484/2484 [=====] - 1s 215us/step - loss:
0.9433 - accuracy: 0.7548
Epoch 21/50
2484/2484 [=====] - 1s 217us/step - loss:
0.8452 - accuracy: 0.7617
Epoch 22/50
2484/2484 [=====] - 1s 213us/step - loss:
0.9169 - accuracy: 0.7419
Epoch 23/50
2484/2484 [=====] - 1s 213us/step - loss:
0.8223 - accuracy: 0.7701
Epoch 24/50
2484/2484 [=====] - 1s 212us/step - loss:
0.8455 - accuracy: 0.7649
Epoch 25/50
2484/2484 [=====] - 1s 213us/step - loss:
0.8180 - accuracy: 0.7621
Epoch 26/50
2484/2484 [=====] - 1s 228us/step - loss:
0.8148 - accuracy: 0.77170s - loss: 0.691
Epoch 27/50
2484/2484 [=====] - 1s 215us/step - loss:
0.7916 - accuracy: 0.7689
Epoch 28/50
2484/2484 [=====] - 1s 219us/step - loss:
0.8239 - accuracy: 0.7661
Epoch 29/50
2484/2484 [=====] - 1s 296us/step - loss:
0.8126 - accuracy: 0.7770
Epoch 30/50
2484/2484 [=====] - 1s 301us/step - loss:
0.7775 - accuracy: 0.7709
Epoch 31/50
2484/2484 [=====] - 1s 277us/step - loss:
0.7853 - accuracy: 0.7778
Epoch 32/50
2484/2484 [=====] - 1s 276us/step - loss:
0.7459 - accuracy: 0.7758
Epoch 33/50
2484/2484 [=====] - 1s 254us/step - loss:
0.7780 - accuracy: 0.7725
Epoch 34/50
2484/2484 [=====] - 1s 252us/step - loss:
0.7807 - accuracy: 0.7754
Epoch 35/50

2484/2484 [=====] - 1s 260us/step - loss:
0.7849 - accuracy: 0.7653
Epoch 36/50
2484/2484 [=====] - 1s 335us/step - loss:
0.6914 - accuracy: 0.7882
Epoch 37/50
2484/2484 [=====] - 1s 371us/step - loss:
0.7313 - accuracy: 0.7798
Epoch 38/50
2484/2484 [=====] - 1s 311us/step - loss:
0.7358 - accuracy: 0.7725
Epoch 39/50
2484/2484 [=====] - 1s 249us/step - loss:
0.7966 - accuracy: 0.7677
Epoch 40/50
2484/2484 [=====] - 1s 274us/step - loss:
0.6903 - accuracy: 0.7830
Epoch 41/50
2484/2484 [=====] - 1s 299us/step - loss:
0.6914 - accuracy: 0.7758
Epoch 42/50
2484/2484 [=====] - 1s 259us/step - loss:
0.7418 - accuracy: 0.7762
Epoch 43/50
2484/2484 [=====] - 1s 253us/step - loss:
0.7658 - accuracy: 0.7681
Epoch 44/50
2484/2484 [=====] - 1s 265us/step - loss:
0.7317 - accuracy: 0.7895
Epoch 45/50
2484/2484 [=====] - 1s 267us/step - loss:
0.6586 - accuracy: 0.7882
Epoch 46/50
2484/2484 [=====] - 1s 261us/step - loss:
0.6875 - accuracy: 0.7838
Epoch 47/50
2484/2484 [=====] - 1s 262us/step - loss:
0.6398 - accuracy: 0.7882
Epoch 48/50
2484/2484 [=====] - 1s 287us/step - loss:
0.6990 - accuracy: 0.7794
Epoch 49/50
2484/2484 [=====] - 1s 283us/step - loss:
0.7101 - accuracy: 0.7810
Epoch 50/50
2484/2484 [=====] - 1s 288us/step - loss:
0.7316 - accuracy: 0.7717
276/276 [=====] - 0s 239us/step
Epoch 1/50
2484/2484 [=====] - 1s 324us/step - loss:

33.7227 - accuracy: 0.7267
Epoch 2/50
2484/2484 [=====] - 1s 285us/step - loss:
1.6565 - accuracy: 0.7283
Epoch 3/50
2484/2484 [=====] - 1s 287us/step - loss:
0.9225 - accuracy: 0.7605
Epoch 4/50

2484/2484 [=====] - 1s 258us/step - loss:
1.0290 - accuracy: 0.7452
Epoch 5/50
2484/2484 [=====] - 1s 223us/step - loss:
0.8784 - accuracy: 0.7488
Epoch 6/50
2484/2484 [=====] - 1s 219us/step - loss:
0.7702 - accuracy: 0.7661
Epoch 7/50
2484/2484 [=====] - 1s 240us/step - loss:
0.7555 - accuracy: 0.7754
Epoch 8/50
2484/2484 [=====] - 1s 258us/step - loss:
0.7626 - accuracy: 0.7665
Epoch 9/50
2484/2484 [=====] - 1s 314us/step - loss:
0.7698 - accuracy: 0.7721
Epoch 10/50
2484/2484 [=====] - 1s 279us/step - loss:
0.7956 - accuracy: 0.7625
Epoch 11/50
2484/2484 [=====] - 1s 241us/step - loss:
0.7405 - accuracy: 0.7733
Epoch 12/50
2484/2484 [=====] - 1s 243us/step - loss:
0.7567 - accuracy: 0.7669
Epoch 13/50
2484/2484 [=====] - 1s 234us/step - loss:
0.8094 - accuracy: 0.7576
Epoch 14/50
2484/2484 [=====] - 1s 233us/step - loss:
0.8016 - accuracy: 0.7645
Epoch 15/50
2484/2484 [=====] - 1s 230us/step - loss:
0.8089 - accuracy: 0.7738
Epoch 16/50
2484/2484 [=====] - 1s 226us/step - loss:
0.8040 - accuracy: 0.7729
Epoch 17/50
2484/2484 [=====] - 1s 227us/step - loss:
0.7956 - accuracy: 0.7613

Epoch 18/50
2484/2484 [=====] - 1s 225us/step - loss:
0.8424 - accuracy: 0.7540
Epoch 19/50
2484/2484 [=====] - 1s 231us/step - loss:
0.7977 - accuracy: 0.7649
Epoch 20/50
2484/2484 [=====] - 1s 227us/step - loss:
0.6890 - accuracy: 0.7697
Epoch 21/50
2484/2484 [=====] - 1s 235us/step - loss:
0.7384 - accuracy: 0.7605
Epoch 22/50
2484/2484 [=====] - 1s 229us/step - loss:
0.7354 - accuracy: 0.7721
Epoch 23/50
2484/2484 [=====] - 1s 225us/step - loss:
0.8328 - accuracy: 0.7548
Epoch 24/50
2484/2484 [=====] - 1s 221us/step - loss:
0.7748 - accuracy: 0.7693
Epoch 25/50
2484/2484 [=====] - 1s 229us/step - loss:
0.7299 - accuracy: 0.7786
Epoch 26/50
2484/2484 [=====] - 1s 225us/step - loss:
0.6677 - accuracy: 0.7729
Epoch 27/50
2484/2484 [=====] - 1s 224us/step - loss:
0.6846 - accuracy: 0.7818
Epoch 28/50
2484/2484 [=====] - 1s 226us/step - loss:
0.6690 - accuracy: 0.7890
Epoch 29/50
2484/2484 [=====] - 1s 223us/step - loss:
0.7083 - accuracy: 0.7713
Epoch 30/50
2484/2484 [=====] - 1s 227us/step - loss:
0.6675 - accuracy: 0.7842
Epoch 31/50
2484/2484 [=====] - 1s 220us/step - loss:
0.6531 - accuracy: 0.7870
Epoch 32/50
2484/2484 [=====] - 1s 216us/step - loss:
0.7280 - accuracy: 0.7766
Epoch 33/50
2484/2484 [=====] - 1s 222us/step - loss:
0.7128 - accuracy: 0.7750
Epoch 34/50
2484/2484 [=====] - 1s 217us/step - loss:

0.6443 - accuracy: 0.7842
Epoch 35/50
2484/2484 [=====] - 1s 218us/step - loss:
0.6458 - accuracy: 0.7802
Epoch 36/50
2484/2484 [=====] - 1s 279us/step - loss:
0.6702 - accuracy: 0.7762
Epoch 37/50
2484/2484 [=====] - 1s 296us/step - loss:
0.5801 - accuracy: 0.7967
Epoch 38/50
2484/2484 [=====] - 1s 260us/step - loss:
0.6843 - accuracy: 0.7742
Epoch 39/50
2484/2484 [=====] - 1s 219us/step - loss:
0.6314 - accuracy: 0.7935
Epoch 40/50
2484/2484 [=====] - 1s 223us/step - loss:
0.6382 - accuracy: 0.7907
Epoch 41/50
2484/2484 [=====] - 1s 217us/step - loss:
0.6761 - accuracy: 0.7782
Epoch 42/50
2484/2484 [=====] - 1s 223us/step - loss:
0.6494 - accuracy: 0.7810
Epoch 43/50
2484/2484 [=====] - 1s 221us/step - loss:
0.6666 - accuracy: 0.7854
Epoch 44/50
2484/2484 [=====] - 1s 217us/step - loss:
0.6052 - accuracy: 0.7911
Epoch 45/50
2484/2484 [=====] - 1s 218us/step - loss:
0.7089 - accuracy: 0.7810
Epoch 46/50
2484/2484 [=====] - 1s 219us/step - loss:
0.6394 - accuracy: 0.7899
Epoch 47/50
2484/2484 [=====] - 1s 220us/step - loss:
0.6226 - accuracy: 0.7882
Epoch 48/50
2484/2484 [=====] - 1s 219us/step - loss:
0.6244 - accuracy: 0.7923
Epoch 49/50
2484/2484 [=====] - 1s 219us/step - loss:
0.6023 - accuracy: 0.7915
Epoch 50/50
2484/2484 [=====] - 1s 218us/step - loss:
0.6286 - accuracy: 0.7927
276/276 [=====] - 0s 159us/step

Epoch 1/50
2484/2484 [=====] - 1s 240us/step - loss:
14.5576 - accuracy: 0.6795
Epoch 2/50
2484/2484 [=====] - 1s 219us/step - loss:
1.6274 - accuracy: 0.7363
Epoch 3/50
2484/2484 [=====] - 1s 220us/step - loss:
1.1602 - accuracy: 0.7645
Epoch 4/50
2484/2484 [=====] - 1s 220us/step - loss:
1.0763 - accuracy: 0.7609
Epoch 5/50
2484/2484 [=====] - 1s 220us/step - loss:
0.9391 - accuracy: 0.7778
Epoch 6/50
2484/2484 [=====] - 1s 229us/step - loss:
0.8438 - accuracy: 0.7733
Epoch 7/50
2484/2484 [=====] - 1s 220us/step - loss:
0.9103 - accuracy: 0.7629
Epoch 8/50
2484/2484 [=====] - 1s 218us/step - loss:
0.7604 - accuracy: 0.7729
Epoch 9/50
2484/2484 [=====] - 1s 221us/step - loss:
0.7384 - accuracy: 0.7770
Epoch 10/50
2484/2484 [=====] - 1s 220us/step - loss:
0.8708 - accuracy: 0.7693
Epoch 11/50
2484/2484 [=====] - 1s 221us/step - loss:
0.7368 - accuracy: 0.7758
Epoch 12/50
2484/2484 [=====] - 1s 220us/step - loss:
0.7638 - accuracy: 0.7794
Epoch 13/50
2484/2484 [=====] - 1s 262us/step - loss:
0.6837 - accuracy: 0.7903
Epoch 14/50
2484/2484 [=====] - 1s 309us/step - loss:
0.6684 - accuracy: 0.7806
Epoch 15/50
2484/2484 [=====] - 1s 270us/step - loss:
0.6792 - accuracy: 0.7850
Epoch 16/50
2484/2484 [=====] - 1s 256us/step - loss:
0.7035 - accuracy: 0.7858
Epoch 17/50
2484/2484 [=====] - 1s 220us/step - loss:

0.7840 - accuracy: 0.7778
Epoch 18/50
2484/2484 [=====] - 1s 271us/step - loss:
0.7930 - accuracy: 0.7721
Epoch 19/50
2484/2484 [=====] - 1s 231us/step - loss:
0.6912 - accuracy: 0.7890
Epoch 20/50
2484/2484 [=====] - 1s 222us/step - loss:
0.6397 - accuracy: 0.7979
Epoch 21/50
2484/2484 [=====] - 1s 230us/step - loss:
0.6732 - accuracy: 0.7878
Epoch 22/50
2484/2484 [=====] - 1s 225us/step - loss:
0.6779 - accuracy: 0.7822
Epoch 23/50
2484/2484 [=====] - 1s 229us/step - loss:
0.7220 - accuracy: 0.7782
Epoch 24/50
2484/2484 [=====] - 1s 221us/step - loss:
0.6390 - accuracy: 0.7923
Epoch 25/50
2484/2484 [=====] - 1s 221us/step - loss:
0.6606 - accuracy: 0.7838
Epoch 26/50
2484/2484 [=====] - 1s 219us/step - loss:
0.6334 - accuracy: 0.7862
Epoch 27/50
2484/2484 [=====] - 1s 218us/step - loss:
0.6835 - accuracy: 0.7846
Epoch 28/50
2484/2484 [=====] - 1s 219us/step - loss:
0.7186 - accuracy: 0.7770
Epoch 29/50
2484/2484 [=====] - 1s 228us/step - loss:
0.6381 - accuracy: 0.7758
Epoch 30/50
2484/2484 [=====] - 1s 227us/step - loss:
0.7051 - accuracy: 0.7838
Epoch 31/50
2484/2484 [=====] - 1s 251us/step - loss:
0.6363 - accuracy: 0.7955
Epoch 32/50
2484/2484 [=====] - 1s 227us/step - loss:
0.6207 - accuracy: 0.7947
Epoch 33/50
2484/2484 [=====] - 1s 225us/step - loss:
0.7468 - accuracy: 0.7838
Epoch 34/50

2484/2484 [=====] - 1s 242us/step - loss:
0.6519 - accuracy: 0.7846
Epoch 35/50
2484/2484 [=====] - 1s 245us/step - loss:
0.6005 - accuracy: 0.7967
Epoch 36/50
2484/2484 [=====] - 1s 227us/step - loss:
0.7204 - accuracy: 0.7858
Epoch 37/50
2484/2484 [=====] - 1s 227us/step - loss:
0.6028 - accuracy: 0.8003
Epoch 38/50
2484/2484 [=====] - 1s 236us/step - loss:
0.6621 - accuracy: 0.7991
Epoch 39/50
2484/2484 [=====] - 1s 229us/step - loss:
0.6554 - accuracy: 0.7939
Epoch 40/50
2484/2484 [=====] - 1s 285us/step - loss:
0.6726 - accuracy: 0.7858
Epoch 41/50
2484/2484 [=====] - 1s 341us/step - loss:
0.6391 - accuracy: 0.7963
Epoch 42/50
2484/2484 [=====] - 1s 271us/step - loss:
0.6884 - accuracy: 0.7822
Epoch 43/50
2484/2484 [=====] - 1s 240us/step - loss:
0.6334 - accuracy: 0.7895
Epoch 44/50
2484/2484 [=====] - 1s 228us/step - loss:
0.6010 - accuracy: 0.7939
Epoch 45/50
2484/2484 [=====] - 1s 228us/step - loss:
0.6583 - accuracy: 0.7899
Epoch 46/50
2484/2484 [=====] - 1s 224us/step - loss:
0.6485 - accuracy: 0.7923
Epoch 47/50
2484/2484 [=====] - 1s 225us/step - loss:
0.6731 - accuracy: 0.8003
Epoch 48/50
2484/2484 [=====] - 1s 229us/step - loss:
0.6087 - accuracy: 0.8027
Epoch 49/50
2484/2484 [=====] - 1s 228us/step - loss:
0.6430 - accuracy: 0.8015
Epoch 50/50
2484/2484 [=====] - 1s 227us/step - loss:
0.6370 - accuracy: 0.7975

276/276 [=====] - 0s 156us/step
Epoch 1/50
2484/2484 [=====] - 1s 250us/step - loss:
55.0980 - accuracy: 0.7267
Epoch 2/50
2484/2484 [=====] - 1s 226us/step - loss:
7.0457 - accuracy: 0.7403
Epoch 3/50
2484/2484 [=====] - 1s 231us/step - loss:
1.9718 - accuracy: 0.7496
Epoch 4/50
2484/2484 [=====] - 1s 231us/step - loss:
1.2870 - accuracy: 0.7428
Epoch 5/50
2484/2484 [=====] - 1s 229us/step - loss:
1.0775 - accuracy: 0.7480
Epoch 6/50
2484/2484 [=====] - 1s 261us/step - loss:
0.8668 - accuracy: 0.7564
Epoch 7/50
2484/2484 [=====] - 1s 252us/step - loss:
0.7846 - accuracy: 0.7625
Epoch 8/50
2484/2484 [=====] - 1s 258us/step - loss:
0.7138 - accuracy: 0.7693
Epoch 9/50
2484/2484 [=====] - 1s 256us/step - loss:
0.8271 - accuracy: 0.7657
Epoch 10/50
2484/2484 [=====] - 1s 260us/step - loss:
0.7957 - accuracy: 0.7669
Epoch 11/50
2484/2484 [=====] - 1s 254us/step - loss:
0.7455 - accuracy: 0.7665
Epoch 12/50
2484/2484 [=====] - 1s 265us/step - loss:
0.7588 - accuracy: 0.7665
Epoch 13/50
2484/2484 [=====] - 1s 252us/step - loss:
0.7778 - accuracy: 0.7637
Epoch 14/50
2484/2484 [=====] - 1s 245us/step - loss:
0.7920 - accuracy: 0.7649
Epoch 15/50
2484/2484 [=====] - 1s 246us/step - loss:
0.8292 - accuracy: 0.7669
Epoch 16/50
2484/2484 [=====] - 1s 332us/step - loss:
0.7944 - accuracy: 0.7693
Epoch 17/50

2484/2484 [=====] - 1s 296us/step - loss:
0.7370 - accuracy: 0.7617
Epoch 18/50
2484/2484 [=====] - 1s 262us/step - loss:
0.7768 - accuracy: 0.7649
Epoch 19/50
2484/2484 [=====] - 1s 237us/step - loss:
0.6502 - accuracy: 0.7903
Epoch 20/50
2484/2484 [=====] - 1s 251us/step - loss:
0.7378 - accuracy: 0.7778
Epoch 21/50
2484/2484 [=====] - 1s 234us/step - loss:
0.6811 - accuracy: 0.7782
Epoch 22/50
2484/2484 [=====] - 1s 252us/step - loss:
0.6786 - accuracy: 0.7806
Epoch 23/50
2484/2484 [=====] - 1s 237us/step - loss:
0.6240 - accuracy: 0.7826
Epoch 24/50
2484/2484 [=====] - 1s 229us/step - loss:
0.7186 - accuracy: 0.7713
Epoch 25/50
2484/2484 [=====] - 1s 228us/step - loss:
0.7032 - accuracy: 0.7790
Epoch 26/50
2484/2484 [=====] - 1s 228us/step - loss:
0.7009 - accuracy: 0.7738
Epoch 27/50
2484/2484 [=====] - 1s 229us/step - loss:
0.7256 - accuracy: 0.7770
Epoch 28/50
2484/2484 [=====] - 1s 222us/step - loss:
0.7533 - accuracy: 0.7705
Epoch 29/50
2484/2484 [=====] - 1s 229us/step - loss:
0.6682 - accuracy: 0.7830
Epoch 30/50
2484/2484 [=====] - 1s 227us/step - loss:
0.6895 - accuracy: 0.7669
Epoch 31/50
2484/2484 [=====] - 1s 229us/step - loss:
0.7067 - accuracy: 0.7750
Epoch 32/50
2484/2484 [=====] - 1s 291us/step - loss:
0.7907 - accuracy: 0.7581
Epoch 33/50
2484/2484 [=====] - 1s 230us/step - loss:
0.7783 - accuracy: 0.7625

Epoch 34/50
2484/2484 [=====] - 1s 219us/step - loss:
0.6339 - accuracy: 0.7907
Epoch 35/50
2484/2484 [=====] - 1s 215us/step - loss:
0.6851 - accuracy: 0.7818
Epoch 36/50
2484/2484 [=====] - 1s 236us/step - loss:
0.6930 - accuracy: 0.7657
Epoch 37/50
2484/2484 [=====] - 1s 257us/step - loss:
0.6578 - accuracy: 0.7866
Epoch 38/50
2484/2484 [=====] - 1s 255us/step - loss:
0.6791 - accuracy: 0.7899
Epoch 39/50
2484/2484 [=====] - 1s 249us/step - loss:
0.6298 - accuracy: 0.7858
Epoch 40/50
2484/2484 [=====] - 1s 220us/step - loss:
0.6813 - accuracy: 0.7746
Epoch 41/50
2484/2484 [=====] - 0s 201us/step - loss:
0.6288 - accuracy: 0.7826
Epoch 42/50
2484/2484 [=====] - 1s 259us/step - loss:
0.6092 - accuracy: 0.7890
Epoch 43/50
2484/2484 [=====] - 1s 277us/step - loss:
0.6921 - accuracy: 0.7742
Epoch 44/50
2484/2484 [=====] - 1s 227us/step - loss:
0.6551 - accuracy: 0.7834
Epoch 45/50
2484/2484 [=====] - 0s 196us/step - loss:
0.6322 - accuracy: 0.7866
Epoch 46/50
2484/2484 [=====] - 1s 205us/step - loss:
0.6469 - accuracy: 0.7886
Epoch 47/50
2484/2484 [=====] - 0s 199us/step - loss:
0.7429 - accuracy: 0.7717
Epoch 48/50
2484/2484 [=====] - 0s 198us/step - loss:
0.6700 - accuracy: 0.7826
Epoch 49/50
2484/2484 [=====] - 0s 196us/step - loss:
0.6277 - accuracy: 0.7915
Epoch 50/50
2484/2484 [=====] - 0s 200us/step - loss:

0.7024 - accuracy: 0.7758
276/276 [=====] - 0s 156us/step
Epoch 1/50
2484/2484 [=====] - 1s 257us/step - loss:
50.6776 - accuracy: 0.7798
Epoch 2/50
2484/2484 [=====] - 1s 225us/step - loss:
3.7950 - accuracy: 0.7484
Epoch 3/50
2484/2484 [=====] - 1s 201us/step - loss:
1.1715 - accuracy: 0.7637
Epoch 4/50
2484/2484 [=====] - 0s 192us/step - loss:
0.8041 - accuracy: 0.7790
Epoch 5/50
2484/2484 [=====] - 0s 194us/step - loss:
0.9180 - accuracy: 0.7520
Epoch 6/50
2484/2484 [=====] - 0s 191us/step - loss:
0.8261 - accuracy: 0.7568
Epoch 7/50
2484/2484 [=====] - 1s 206us/step - loss:
0.7726 - accuracy: 0.7633
Epoch 8/50

2484/2484 [=====] - 0s 192us/step - loss:
0.7026 - accuracy: 0.7842
Epoch 9/50
2484/2484 [=====] - 0s 194us/step - loss:
0.8015 - accuracy: 0.7653
Epoch 10/50
2484/2484 [=====] - 0s 190us/step - loss:
0.7745 - accuracy: 0.7625
Epoch 11/50
2484/2484 [=====] - 0s 195us/step - loss:
0.8544 - accuracy: 0.7693
Epoch 12/50
2484/2484 [=====] - 0s 192us/step - loss:
0.6696 - accuracy: 0.7862
Epoch 13/50
2484/2484 [=====] - 0s 192us/step - loss:
0.8038 - accuracy: 0.7601
Epoch 14/50
2484/2484 [=====] - 0s 195us/step - loss:
0.7606 - accuracy: 0.7766
Epoch 15/50
2484/2484 [=====] - 0s 191us/step - loss:
0.7748 - accuracy: 0.7738
Epoch 16/50
2484/2484 [=====] - 0s 192us/step - loss:

0.7643 - accuracy: 0.7762
Epoch 17/50
2484/2484 [=====] - 1s 202us/step - loss:
0.7075 - accuracy: 0.7830
Epoch 18/50
2484/2484 [=====] - 0s 192us/step - loss:
0.6950 - accuracy: 0.7738
Epoch 19/50
2484/2484 [=====] - 0s 197us/step - loss:
0.7636 - accuracy: 0.7709
Epoch 20/50
2484/2484 [=====] - 0s 192us/step - loss:
0.7670 - accuracy: 0.7786
Epoch 21/50
2484/2484 [=====] - 0s 191us/step - loss:
0.6154 - accuracy: 0.7862
Epoch 22/50
2484/2484 [=====] - 1s 229us/step - loss:
0.7245 - accuracy: 0.7733
Epoch 23/50
2484/2484 [=====] - 1s 276us/step - loss:
0.7806 - accuracy: 0.7657
Epoch 24/50
2484/2484 [=====] - 1s 229us/step - loss:
0.6675 - accuracy: 0.7794
Epoch 25/50
2484/2484 [=====] - 1s 205us/step - loss:
0.6501 - accuracy: 0.7858
Epoch 26/50
2484/2484 [=====] - 0s 195us/step - loss:
0.8470 - accuracy: 0.7645
Epoch 27/50
2484/2484 [=====] - 1s 206us/step - loss:
0.7243 - accuracy: 0.7721
Epoch 28/50
2484/2484 [=====] - 0s 197us/step - loss:
0.6946 - accuracy: 0.7822
Epoch 29/50
2484/2484 [=====] - 0s 196us/step - loss:
0.6723 - accuracy: 0.7834
Epoch 30/50
2484/2484 [=====] - 0s 197us/step - loss:
0.7927 - accuracy: 0.7709
Epoch 31/50
2484/2484 [=====] - 0s 200us/step - loss:
0.6820 - accuracy: 0.7766
Epoch 32/50
2484/2484 [=====] - 1s 254us/step - loss:
0.6463 - accuracy: 0.7850
Epoch 33/50

2484/2484 [=====] - 1s 237us/step - loss:
0.7031 - accuracy: 0.7729
Epoch 34/50
2484/2484 [=====] - 1s 215us/step - loss:
0.7090 - accuracy: 0.7738
Epoch 35/50
2484/2484 [=====] - 1s 216us/step - loss:
0.7102 - accuracy: 0.7826
Epoch 36/50
2484/2484 [=====] - 1s 222us/step - loss:
0.7463 - accuracy: 0.7742
Epoch 37/50
2484/2484 [=====] - 1s 213us/step - loss:
0.6519 - accuracy: 0.7862
Epoch 38/50
2484/2484 [=====] - 1s 230us/step - loss:
0.6187 - accuracy: 0.7939
Epoch 39/50
2484/2484 [=====] - 1s 219us/step - loss:
0.7101 - accuracy: 0.7766
Epoch 40/50
2484/2484 [=====] - 1s 231us/step - loss:
0.6831 - accuracy: 0.7842
Epoch 41/50
2484/2484 [=====] - 1s 218us/step - loss:
0.6557 - accuracy: 0.7858
Epoch 42/50
2484/2484 [=====] - 1s 251us/step - loss:
0.5999 - accuracy: 0.7907
Epoch 43/50
2484/2484 [=====] - 1s 233us/step - loss:
0.7143 - accuracy: 0.7766
Epoch 44/50
2484/2484 [=====] - 1s 234us/step - loss:
0.7599 - accuracy: 0.7762
Epoch 45/50
2484/2484 [=====] - 1s 250us/step - loss:
0.7792 - accuracy: 0.7842
Epoch 46/50
2484/2484 [=====] - 1s 245us/step - loss:
0.7202 - accuracy: 0.7693
Epoch 47/50
2484/2484 [=====] - 1s 229us/step - loss:
0.6231 - accuracy: 0.7927
Epoch 48/50
2484/2484 [=====] - 1s 230us/step - loss:
0.7428 - accuracy: 0.7669
Epoch 49/50
2484/2484 [=====] - 1s 249us/step - loss:
0.7066 - accuracy: 0.78860s - loss: 0.8

Epoch 50/50
2484/2484 [=====] - 1s 273us/step - loss:
0.6265 - accuracy: 0.7935
276/276 [=====] - 0s 257us/step
Epoch 1/50
2484/2484 [=====] - 1s 345us/step - loss:
227.7507 - accuracy: 0.5890
Epoch 2/50
2484/2484 [=====] - 1s 256us/step - loss:
9.6678 - accuracy: 0.7122
Epoch 3/50
2484/2484 [=====] - 1s 297us/step - loss:
4.2967 - accuracy: 0.7226
Epoch 4/50
2484/2484 [=====] - 1s 243us/step - loss:
2.8178 - accuracy: 0.7283
Epoch 5/50
2484/2484 [=====] - 1s 223us/step - loss:
1.8809 - accuracy: 0.7311
Epoch 6/50
2484/2484 [=====] - 1s 219us/step - loss:
1.7373 - accuracy: 0.7448
Epoch 7/50
2484/2484 [=====] - 1s 221us/step - loss:
1.5169 - accuracy: 0.7428
Epoch 8/50
2484/2484 [=====] - 1s 230us/step - loss:
1.4339 - accuracy: 0.7359
Epoch 9/50
2484/2484 [=====] - 1s 227us/step - loss:
1.5421 - accuracy: 0.7407
Epoch 10/50
2484/2484 [=====] - 1s 276us/step - loss:
1.2645 - accuracy: 0.7524
Epoch 11/50
2484/2484 [=====] - 1s 289us/step - loss:
1.3662 - accuracy: 0.7351
Epoch 12/50
2484/2484 [=====] - 1s 277us/step - loss:
1.5031 - accuracy: 0.7395
Epoch 13/50
2484/2484 [=====] - 1s 285us/step - loss:
1.5830 - accuracy: 0.74240s - loss: 1
Epoch 14/50
2484/2484 [=====] - 1s 269us/step - loss:
1.2628 - accuracy: 0.7593
Epoch 15/50
2484/2484 [=====] - 1s 259us/step - loss:
1.7442 - accuracy: 0.7391
Epoch 16/50

2484/2484 [=====] - 1s 261us/step - loss:
1.3522 - accuracy: 0.7395
Epoch 17/50
2484/2484 [=====] - 1s 281us/step - loss:
1.1360 - accuracy: 0.7532
Epoch 18/50
2484/2484 [=====] - 1s 291us/step - loss:
1.3980 - accuracy: 0.7472
Epoch 19/50
2484/2484 [=====] - 1s 288us/step - loss:
1.2269 - accuracy: 0.7403
Epoch 20/50
2484/2484 [=====] - 1s 289us/step - loss:
1.2889 - accuracy: 0.7532
Epoch 21/50
2484/2484 [=====] - 1s 291us/step - loss:
1.4013 - accuracy: 0.7532
Epoch 22/50
2484/2484 [=====] - 1s 286us/step - loss:
1.1632 - accuracy: 0.7512
Epoch 23/50
2484/2484 [=====] - 1s 331us/step - loss:
1.2955 - accuracy: 0.7496
Epoch 24/50
2484/2484 [=====] - 1s 369us/step - loss:
1.4083 - accuracy: 0.7375
Epoch 25/50
2484/2484 [=====] - 1s 302us/step - loss:
1.6135 - accuracy: 0.7403
Epoch 26/50
2484/2484 [=====] - 1s 302us/step - loss:
1.5305 - accuracy: 0.7359
Epoch 27/50
2484/2484 [=====] - 1s 275us/step - loss:
1.4664 - accuracy: 0.7484
Epoch 28/50
2484/2484 [=====] - 1s 268us/step - loss:
1.3120 - accuracy: 0.7367
Epoch 29/50
2484/2484 [=====] - 1s 271us/step - loss:
1.6048 - accuracy: 0.7444
Epoch 30/50
2484/2484 [=====] - 1s 256us/step - loss:
1.2605 - accuracy: 0.7343
Epoch 31/50
2484/2484 [=====] - 1s 276us/step - loss:
1.0950 - accuracy: 0.7601
Epoch 32/50
2484/2484 [=====] - 1s 266us/step - loss:
1.0617 - accuracy: 0.7568

Epoch 33/50
2484/2484 [=====] - 1s 253us/step - loss:
1.2144 - accuracy: 0.7568
Epoch 34/50
2484/2484 [=====] - 1s 257us/step - loss:
1.5496 - accuracy: 0.7492
Epoch 35/50
2484/2484 [=====] - 1s 229us/step - loss:
1.4926 - accuracy: 0.7448
Epoch 36/50
2484/2484 [=====] - 1s 220us/step - loss:
1.7266 - accuracy: 0.7492
Epoch 37/50
2484/2484 [=====] - 1s 217us/step - loss:
1.2556 - accuracy: 0.7452
Epoch 38/50
2484/2484 [=====] - 1s 221us/step - loss:
1.5669 - accuracy: 0.7488
Epoch 39/50
2484/2484 [=====] - 1s 214us/step - loss:
1.4151 - accuracy: 0.7395
Epoch 40/50
2484/2484 [=====] - 1s 230us/step - loss:
0.9694 - accuracy: 0.7669
Epoch 41/50
2484/2484 [=====] - 1s 211us/step - loss:
1.3762 - accuracy: 0.7371
Epoch 42/50
2484/2484 [=====] - 1s 215us/step - loss:
1.1182 - accuracy: 0.7556
Epoch 43/50
2484/2484 [=====] - 1s 214us/step - loss:
1.4875 - accuracy: 0.7319
Epoch 44/50
2484/2484 [=====] - 1s 218us/step - loss:
1.1955 - accuracy: 0.7468
Epoch 45/50
2484/2484 [=====] - 1s 213us/step - loss:
1.3624 - accuracy: 0.7512
Epoch 46/50
2484/2484 [=====] - 1s 217us/step - loss:
1.3921 - accuracy: 0.7496
Epoch 47/50
2484/2484 [=====] - 1s 216us/step - loss:
1.3514 - accuracy: 0.7472
Epoch 48/50
2484/2484 [=====] - 1s 217us/step - loss:
1.5409 - accuracy: 0.7484
Epoch 49/50
2484/2484 [=====] - 1s 258us/step - loss:

1.2912 - accuracy: 0.7476
Epoch 50/50
2484/2484 [=====] - 1s 302us/step - loss:
1.0381 - accuracy: 0.7593
276/276 [=====] - 0s 228us/step
Epoch 1/50
2484/2484 [=====] - 1s 231us/step - loss:
44.2800 - accuracy: 0.6526
Epoch 2/50
2484/2484 [=====] - 1s 213us/step - loss:
8.6927 - accuracy: 0.7428
Epoch 3/50
2484/2484 [=====] - 1s 208us/step - loss:
7.3521 - accuracy: 0.7271
Epoch 4/50
2484/2484 [=====] - 1s 208us/step - loss:
5.7593 - accuracy: 0.7262
Epoch 5/50
2484/2484 [=====] - 1s 216us/step - loss:
3.8097 - accuracy: 0.7387
Epoch 6/50
2484/2484 [=====] - 1s 209us/step - loss:
2.7814 - accuracy: 0.7395
Epoch 7/50
2484/2484 [=====] - 1s 217us/step - loss:
2.2738 - accuracy: 0.7452
Epoch 8/50
2484/2484 [=====] - 1s 211us/step - loss:
2.0470 - accuracy: 0.7395
Epoch 9/50
2484/2484 [=====] - 1s 218us/step - loss:
1.9007 - accuracy: 0.75600s - loss: 1.6039
Epoch 10/50
2484/2484 [=====] - 1s 213us/step - loss:
1.7930 - accuracy: 0.7480
Epoch 11/50
2484/2484 [=====] - 1s 239us/step - loss:
1.7774 - accuracy: 0.7472
Epoch 12/50
2484/2484 [=====] - 1s 229us/step - loss:
1.6611 - accuracy: 0.7424
Epoch 13/50
2484/2484 [=====] - 1s 231us/step - loss:
1.4180 - accuracy: 0.7452
Epoch 14/50
2484/2484 [=====] - 1s 226us/step - loss:
1.3741 - accuracy: 0.7520
Epoch 15/50
2484/2484 [=====] - 1s 234us/step - loss:
1.3245 - accuracy: 0.7480

Epoch 16/50
2484/2484 [=====] - 1s 256us/step - loss:
1.1852 - accuracy: 0.7548
Epoch 17/50
2484/2484 [=====] - 1s 310us/step - loss:
1.3044 - accuracy: 0.7444
Epoch 18/50
2484/2484 [=====] - 1s 269us/step - loss:
1.1064 - accuracy: 0.7536
Epoch 19/50
2484/2484 [=====] - 1s 235us/step - loss:
1.1875 - accuracy: 0.7472
Epoch 20/50
2484/2484 [=====] - 1s 238us/step - loss:
1.0421 - accuracy: 0.7572
Epoch 21/50
2484/2484 [=====] - 1s 231us/step - loss:
1.1641 - accuracy: 0.7444
Epoch 22/50
2484/2484 [=====] - 1s 229us/step - loss:
1.0513 - accuracy: 0.7552
Epoch 23/50
2484/2484 [=====] - 1s 232us/step - loss:
1.1276 - accuracy: 0.7512
Epoch 24/50
2484/2484 [=====] - 1s 249us/step - loss:
1.0198 - accuracy: 0.7609
Epoch 25/50
2484/2484 [=====] - 1s 287us/step - loss:
1.1457 - accuracy: 0.7488
Epoch 26/50
2484/2484 [=====] - 1s 349us/step - loss:
0.9605 - accuracy: 0.7496
Epoch 27/50
2484/2484 [=====] - 1s 299us/step - loss:
0.8489 - accuracy: 0.7581
Epoch 28/50
2484/2484 [=====] - 1s 270us/step - loss:
1.0170 - accuracy: 0.7621
Epoch 29/50
2484/2484 [=====] - 1s 251us/step - loss:
0.9521 - accuracy: 0.7621
Epoch 30/50
2484/2484 [=====] - 1s 245us/step - loss:
0.9290 - accuracy: 0.7653
Epoch 31/50
2484/2484 [=====] - 1s 254us/step - loss:
1.3772 - accuracy: 0.7436
Epoch 32/50
2484/2484 [=====] - 1s 250us/step - loss:

1.0879 - accuracy: 0.7605
Epoch 33/50
2484/2484 [=====] - 1s 269us/step - loss:
1.1136 - accuracy: 0.7476
Epoch 34/50
2484/2484 [=====] - 1s 250us/step - loss:
1.1331 - accuracy: 0.7524
Epoch 35/50
2484/2484 [=====] - 1s 247us/step - loss:
1.2228 - accuracy: 0.7472
Epoch 36/50
2484/2484 [=====] - 1s 248us/step - loss:
0.9679 - accuracy: 0.7528
Epoch 37/50
2484/2484 [=====] - 1s 261us/step - loss:
1.1278 - accuracy: 0.7629
Epoch 38/50
2484/2484 [=====] - 1s 247us/step - loss:
0.9449 - accuracy: 0.7564
Epoch 39/50
2484/2484 [=====] - 1s 274us/step - loss:
0.9090 - accuracy: 0.7601
Epoch 40/50
2484/2484 [=====] - 1s 252us/step - loss:
0.9509 - accuracy: 0.7645
Epoch 41/50
2484/2484 [=====] - 1s 249us/step - loss:
0.8512 - accuracy: 0.7685
Epoch 42/50
2484/2484 [=====] - 1s 245us/step - loss:
1.0820 - accuracy: 0.7488
Epoch 43/50
2484/2484 [=====] - 1s 247us/step - loss:
0.8897 - accuracy: 0.7750
Epoch 44/50
2484/2484 [=====] - 1s 248us/step - loss:
0.9056 - accuracy: 0.7540
Epoch 45/50
2484/2484 [=====] - 1s 244us/step - loss:
0.9623 - accuracy: 0.7532
Epoch 46/50
2484/2484 [=====] - 1s 242us/step - loss:
0.8313 - accuracy: 0.7649
Epoch 47/50
2484/2484 [=====] - 1s 226us/step - loss:
0.8618 - accuracy: 0.7681
Epoch 48/50
2484/2484 [=====] - 1s 217us/step - loss:
0.8462 - accuracy: 0.7669
Epoch 49/50

2484/2484 [=====] - 1s 219us/step - loss:
0.9535 - accuracy: 0.7617
Epoch 50/50
2484/2484 [=====] - 1s 240us/step - loss:
1.0231 - accuracy: 0.7564
276/276 [=====] - 0s 250us/step
Epoch 1/50
2484/2484 [=====] - 1s 300us/step - loss:
61.5772 - accuracy: 0.5390
Epoch 2/50
2484/2484 [=====] - 1s 227us/step - loss:
2.7794 - accuracy: 0.7359
Epoch 3/50
2484/2484 [=====] - 1s 235us/step - loss:
1.1283 - accuracy: 0.7705
Epoch 4/50
2484/2484 [=====] - 1s 242us/step - loss:
0.7554 - accuracy: 0.7810
Epoch 5/50
2484/2484 [=====] - 1s 262us/step - loss:
0.5941 - accuracy: 0.7935
Epoch 6/50
2484/2484 [=====] - 1s 250us/step - loss:
0.5712 - accuracy: 0.8064
Epoch 7/50
2484/2484 [=====] - 1s 258us/step - loss:
0.5534 - accuracy: 0.8108
Epoch 8/50
2484/2484 [=====] - 1s 250us/step - loss:
0.5525 - accuracy: 0.8100
Epoch 9/50
2484/2484 [=====] - 1s 253us/step - loss:
0.5720 - accuracy: 0.8064
Epoch 10/50
2484/2484 [=====] - 1s 254us/step - loss:
0.5385 - accuracy: 0.8160
Epoch 11/50

2484/2484 [=====] - 1s 246us/step - loss:
0.5225 - accuracy: 0.81600s - loss: 0.5
Epoch 12/50
2484/2484 [=====] - 1s 225us/step - loss:
0.5351 - accuracy: 0.8160
Epoch 13/50
2484/2484 [=====] - 1s 218us/step - loss:
0.5133 - accuracy: 0.8221
Epoch 14/50
2484/2484 [=====] - 1s 221us/step - loss:
0.5329 - accuracy: 0.8076
Epoch 15/50

2484/2484 [=====] - 1s 231us/step - loss:
0.5052 - accuracy: 0.8184
Epoch 16/50
2484/2484 [=====] - 1s 218us/step - loss:
0.4914 - accuracy: 0.8209
Epoch 17/50
2484/2484 [=====] - 1s 226us/step - loss:
0.4844 - accuracy: 0.8249
Epoch 18/50
2484/2484 [=====] - 1s 221us/step - loss:
0.4758 - accuracy: 0.8273
Epoch 19/50
2484/2484 [=====] - 1s 221us/step - loss:
0.4737 - accuracy: 0.8269
Epoch 20/50
2484/2484 [=====] - 1s 219us/step - loss:
0.4684 - accuracy: 0.8317
Epoch 21/50
2484/2484 [=====] - 1s 232us/step - loss:
0.4644 - accuracy: 0.8297
Epoch 22/50
2484/2484 [=====] - 1s 260us/step - loss:
0.4583 - accuracy: 0.8325
Epoch 23/50
2484/2484 [=====] - 1s 246us/step - loss:
0.4552 - accuracy: 0.8329
Epoch 24/50
2484/2484 [=====] - 1s 251us/step - loss:
0.4548 - accuracy: 0.8321
Epoch 25/50
2484/2484 [=====] - 1s 250us/step - loss:
0.4518 - accuracy: 0.8337
Epoch 26/50
2484/2484 [=====] - 1s 315us/step - loss:
0.4496 - accuracy: 0.8341
Epoch 27/50
2484/2484 [=====] - 1s 323us/step - loss:
0.4499 - accuracy: 0.8337
Epoch 28/50
2484/2484 [=====] - 1s 300us/step - loss:
0.4493 - accuracy: 0.8337
Epoch 29/50
2484/2484 [=====] - 1s 227us/step - loss:
0.4488 - accuracy: 0.8341
Epoch 30/50
2484/2484 [=====] - 1s 226us/step - loss:
0.4498 - accuracy: 0.8329
Epoch 31/50
2484/2484 [=====] - 1s 236us/step - loss:
0.4504 - accuracy: 0.8329

Epoch 32/50
2484/2484 [=====] - 1s 254us/step - loss:
0.4490 - accuracy: 0.8337
Epoch 33/50
2484/2484 [=====] - 1s 260us/step - loss:
0.4488 - accuracy: 0.8337
Epoch 34/50
2484/2484 [=====] - 1s 250us/step - loss:
0.4497 - accuracy: 0.8337
Epoch 35/50
2484/2484 [=====] - 1s 246us/step - loss:
0.4489 - accuracy: 0.8333
Epoch 36/50
2484/2484 [=====] - 1s 233us/step - loss:
0.4496 - accuracy: 0.8337
Epoch 37/50
2484/2484 [=====] - 1s 254us/step - loss:
0.4490 - accuracy: 0.8329
Epoch 38/50
2484/2484 [=====] - 1s 242us/step - loss:
0.4489 - accuracy: 0.8333
Epoch 39/50
2484/2484 [=====] - 1s 231us/step - loss:
0.4492 - accuracy: 0.8337
Epoch 40/50
2484/2484 [=====] - 1s 239us/step - loss:
0.4489 - accuracy: 0.8337
Epoch 41/50
2484/2484 [=====] - 1s 233us/step - loss:
0.4487 - accuracy: 0.8337
Epoch 42/50
2484/2484 [=====] - 1s 240us/step - loss:
0.4487 - accuracy: 0.8337
Epoch 43/50
2484/2484 [=====] - 1s 236us/step - loss:
0.4499 - accuracy: 0.8341
Epoch 44/50
2484/2484 [=====] - 1s 235us/step - loss:
0.4487 - accuracy: 0.8337
Epoch 45/50
2484/2484 [=====] - 1s 237us/step - loss:
0.4489 - accuracy: 0.8333
Epoch 46/50
2484/2484 [=====] - 1s 238us/step - loss:
0.4495 - accuracy: 0.8341
Epoch 47/50
2484/2484 [=====] - 1s 237us/step - loss:
0.4487 - accuracy: 0.8333
Epoch 48/50
2484/2484 [=====] - 1s 238us/step - loss:


```
0.4492 - accuracy: 0.8333
Epoch 49/50
2484/2484 [=====] - 1s 236us/step - loss:
0.4502 - accuracy: 0.8333
Epoch 50/50
2484/2484 [=====] - 1s 241us/step - loss:
0.4493 - accuracy: 0.8333
276/276 [=====] - 0s 185us/step
Baseline: 76.85% (14.17%)
```