```python
#Alexander Buchholz
#CPE695
#Final Project, MovieNNregression
#
#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 regression algorithm is used to
#estimate the %ROI, with mean and standard deviation as metrics 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 KerasRegressor
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)
```

```
#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)

#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, kernel_initializer='normal',
activation='relu'))
    model.add(Dense(1, kernel_initializer='normal'))
    # Compile model
    model.compile(loss='mean_squared_logarithmic_error',
optimizer='adam')
    return model

# evaluate model with standardized dataset
build_fn=baseline_model
estimators = []
estimators.append(('standardize', StandardScaler()))
estimators.append(('mlp', KerasRegressor(build_fn, epochs=50,
batch_size=5, verbose=1)))
pipeline = Pipeline(estimators)

kfold = KFold(n_splits=10)
results = cross_val_score(pipeline, X, Y, cv=kfold)
#since mean squared logarithmic error was used as the loss function,
exponentiate results to get stromy.
results = np.exp(results)
#Evaluate and print mean and standard deviation of the results
print("Standardized: %.2f (%.2f) MSE" % (results.mean(),
results.std()))
```

```
Epoch 1/50
2484/2484 [==============================] - 1s 278us/step - loss:
25.2793
Epoch 2/50
2484/2484 [==============================] - 1s 229us/step - loss:
14.9188
Epoch 3/50
2484/2484 [==============================] - 1s 249us/step - loss:
10.6877
Epoch 4/50
2484/2484 [==============================] - 1s 227us/step - loss:
8.3299
Epoch 5/50
2484/2484 [==============================] - 1s 248us/step - loss:
6.7670
Epoch 6/50
2484/2484 [==============================] - 1s 241us/step - loss:
5.6376
Epoch 7/50
2484/2484 [==============================] - 1s 237us/step - loss:
4.7792
Epoch 8/50
2484/2484 [==============================] - 1s 258us/step - loss:
4.1075
Epoch 9/50
2484/2484 [==============================] - 1s 240us/step - loss:
3.5718
Epoch 10/50
2484/2484 [==============================] - 1s 281us/step - loss:
3.1385
Epoch 11/50
2484/2484 [==============================] - 1s 329us/step - loss:
2.7874
Epoch 12/50
2484/2484 [==============================] - 1s 290us/step - loss:
2.5025
Epoch 13/50
2484/2484 [==============================] - 1s 242us/step - loss:
2.2725
Epoch 14/50
2484/2484 [==============================] - 1s 240us/step - loss:
2.0887
Epoch 15/50
2484/2484 [==============================] - 1s 242us/step - loss:
1.9449
Epoch 16/50
2484/2484 [==============================] - 1s 238us/step - loss:
1.8336
Epoch 17/50
2484/2484 [==============================] - 1s 244us/step - loss:
```

```
1.7493
Epoch 18/50
2484/2484 [==============================] - 1s 238us/step - loss:
1.6874
Epoch 19/50
2484/2484 [==============================] - 1s 240us/step - loss:
1.6428
Epoch 20/50
2484/2484 [==============================] - 1s 238us/step - loss:
1.6121
Epoch 21/50
2484/2484 [==============================] - 1s 252us/step - loss:
1.5916
Epoch 22/50
2484/2484 [==============================] - 1s 251us/step - loss:
1.5783
Epoch 23/50
2484/2484 [==============================] - 1s 238us/step - loss:
1.5700
Epoch 24/50
2484/2484 [==============================] - 1s 248us/step - loss:
1.5647
Epoch 25/50
2484/2484 [==============================] - 1s 240us/step - loss:
1.5615
Epoch 26/50
2484/2484 [==============================] - 1s 240us/step - loss:
1.5596
Epoch 27/50
2484/2484 [==============================] - 1s 240us/step - loss:
1.5584
Epoch 28/50
2484/2484 [==============================] - 1s 239us/step - loss:
1.5577
Epoch 29/50
2484/2484 [==============================] - 1s 242us/step - loss:
1.5573
Epoch 30/50
2484/2484 [==============================] - 1s 239us/step - loss:
1.5569
Epoch 31/50
2484/2484 [==============================] - 1s 253us/step - loss:
1.5567
Epoch 32/50
2484/2484 [==============================] - 1s 240us/step - loss:
1.5566
Epoch 33/50
2484/2484 [==============================] - 1s 240us/step - loss:
1.5566
Epoch 34/50
```

```
2484/2484 [==============================] - 1s 241us/step - loss:
1.5564
Epoch 35/50
2484/2484 [==============================] - 1s 238us/step - loss:
1.5563
Epoch 36/50
2484/2484 [==============================] - 1s 300us/step - loss:
1.5563
Epoch 37/50
2484/2484 [==============================] - 1s 350us/step - loss:
1.5563
Epoch 38/50
2484/2484 [==============================] - 1s 272us/step - loss:
1.5561
Epoch 39/50
2484/2484 [==============================] - 1s 242us/step - loss:
1.5561
Epoch 40/50
2484/2484 [==============================] - 1s 245us/step - loss:
1.5561
Epoch 41/50
2484/2484 [==============================] - 1s 242us/step - loss:
1.5560
Epoch 42/50
2484/2484 [==============================] - 1s 242us/step - loss:
1.5560
Epoch 43/50
2484/2484 [==============================] - 1s 241us/step - loss:
1.5559
Epoch 44/50
2484/2484 [==============================] - 1s 274us/step - loss:
1.5559
Epoch 45/50
2484/2484 [==============================] - 1s 242us/step - loss:
1.5558
Epoch 46/50
2484/2484 [==============================] - 1s 237us/step - loss:
1.5558
Epoch 47/50
2484/2484 [==============================] - 1s 242us/step - loss:
1.5558
Epoch 48/50
2484/2484 [==============================] - 1s 242us/step - loss:
1.5557
Epoch 49/50
2484/2484 [==============================] - 1s 238us/step - loss:
1.5557
Epoch 50/50
2484/2484 [==============================] - 1s 243us/step - loss:
1.5557
```

```
276/276 [==============================] - 0s 159us/step
Epoch 1/50
2484/2484 [==============================] - 1s 275us/step - loss:
25.2469
Epoch 2/50
2484/2484 [==============================] - 1s 243us/step - loss:
14.4726
Epoch 3/50
2484/2484 [==============================] - 1s 291us/step - loss:
10.2564
Epoch 4/50
2484/2484 [==============================] - 1s 271us/step - loss:
7.9481
Epoch 5/50
2484/2484 [==============================] - 1s 285us/step - loss:
6.4298
Epoch 6/50
2484/2484 [==============================] - 1s 269us/step - loss:
5.3369
Epoch 7/50
2484/2484 [==============================] - 1s 262us/step - loss:
4.5079
Epoch 8/50
2484/2484 [==============================] - 1s 256us/step - loss:
3.8595
Epoch 9/50
2484/2484 [==============================] - 1s 269us/step - loss:
3.3432
Epoch 10/50
2484/2484 [==============================] - 1s 342us/step - loss:
2.9277
Epoch 11/50
2484/2484 [==============================] - 1s 341us/step - loss:
2.5930
Epoch 12/50
2484/2484 [==============================] - 1s 287us/step - loss:
2.3231
Epoch 13/50
2484/2484 [==============================] - 1s 255us/step - loss:
2.1077
Epoch 14/50
2484/2484 [==============================] - 1s 261us/step - loss:
1.9367
Epoch 15/50
2484/2484 [==============================] - 1s 262us/step - loss:
1.8041
Epoch 16/50
2484/2484 [==============================] - 1s 260us/step - loss:
1.7025
Epoch 17/50
```

```
2484/2484 [==============================] - 1s 265us/step - loss:
1.6263
Epoch 18/50
2484/2484 [==============================] - 1s 256us/step - loss:
1.5708
Epoch 19/50
2484/2484 [==============================] - 1s 255us/step - loss:
1.5322
Epoch 20/50
2484/2484 [==============================] - 1s 259us/step - loss:
1.5062
Epoch 21/50
2484/2484 [==============================] - 1s 256us/step - loss:
1.4896
Epoch 22/50
2484/2484 [==============================] - 1s 283us/step - loss:
1.4790
Epoch 23/50
2484/2484 [==============================] - 1s 289us/step - loss:
1.4723
Epoch 24/50
2484/2484 [==============================] - 1s 288us/step - loss:
1.4685
Epoch 25/50
2484/2484 [==============================] - 1s 263us/step - loss:
1.4660
Epoch 26/50
2484/2484 [==============================] - 1s 262us/step - loss:
1.4647
Epoch 27/50
2484/2484 [==============================] - 1s 260us/step - loss:
1.4638
Epoch 28/50
2484/2484 [==============================] - 1s 267us/step - loss:
1.4633
Epoch 29/50
2484/2484 [==============================] - 1s 250us/step - loss:
1.4630
Epoch 30/50
2484/2484 [==============================] - 1s 232us/step - loss:
1.4630
Epoch 31/50
2484/2484 [==============================] - 1s 232us/step - loss:
1.4627
Epoch 32/50
2484/2484 [==============================] - 1s 231us/step - loss:
1.4626
Epoch 33/50
2484/2484 [==============================] - 1s 246us/step - loss:
1.4624
```

```
Epoch 34/50
2484/2484 [==============================] - 1s 301us/step - loss:
1.4623
Epoch 35/50
2484/2484 [==============================] - 1s 322us/step - loss:
1.4622
Epoch 36/50
2484/2484 [==============================] - 1s 262us/step - loss:
1.4622
Epoch 37/50
2484/2484 [==============================] - 1s 235us/step - loss:
1.4622
Epoch 38/50
2484/2484 [==============================] - 1s 240us/step - loss:
1.4622
Epoch 39/50
2484/2484 [==============================] - 1s 234us/step - loss:
1.4621
Epoch 40/50
2484/2484 [==============================] - 1s 234us/step - loss:
1.4620
Epoch 41/50
2484/2484 [==============================] - 1s 234us/step - loss:
1.4619
Epoch 42/50
2484/2484 [==============================] - 1s 234us/step - loss:
1.4618
Epoch 43/50
2484/2484 [==============================] - 1s 232us/step - loss:
1.4619
Epoch 44/50
2484/2484 [==============================] - 1s 238us/step - loss:
1.4619
Epoch 45/50
2484/2484 [==============================] - 1s 229us/step - loss:
1.4617
Epoch 46/50
2484/2484 [==============================] - 1s 243us/step - loss:
1.4617
Epoch 47/50
2484/2484 [==============================] - 1s 219us/step - loss:
1.4617
Epoch 48/50
2484/2484 [==============================] - 1s 231us/step - loss:
1.4617
Epoch 49/50
2484/2484 [==============================] - 1s 224us/step - loss:
1.4617
Epoch 50/50
2484/2484 [==============================] - 1s 231us/step - loss:
```

```
1.4615
276/276 [==============================] - 0s 149us/step
Epoch 1/50
2484/2484 [==============================] - 1s 262us/step - loss:
25.1589
Epoch 2/50
2484/2484 [==============================] - 1s 231us/step - loss:
15.1857
Epoch 3/50
2484/2484 [==============================] - 1s 235us/step - loss:
10.9972
Epoch 4/50
2484/2484 [==============================] - 1s 306us/step - loss:
8.6036
Epoch 5/50
2484/2484 [==============================] - 1s 229us/step - loss:
7.0021
Epoch 6/50
2484/2484 [==============================] - 1s 221us/step - loss:
5.8372
Epoch 7/50
2484/2484 [==============================] - 1s 233us/step - loss:
4.9472
Epoch 8/50
2484/2484 [==============================] - 1s 229us/step - loss:
4.2485
Epoch 9/50
2484/2484 [==============================] - 1s 225us/step - loss:
3.6892
Epoch 10/50
2484/2484 [==============================] - 1s 318us/step - loss:
3.2365
Epoch 11/50
2484/2484 [==============================] - 1s 309us/step - loss:
2.8687
Epoch 12/50
2484/2484 [==============================] - 1s 244us/step - loss:
2.5692
Epoch 13/50
2484/2484 [==============================] - 1s 225us/step - loss:
2.3270
Epoch 14/50
2484/2484 [==============================] - 1s 225us/step - loss:
2.1325
Epoch 15/50
2484/2484 [==============================] - 1s 236us/step - loss:
1.9788
Epoch 16/50
2484/2484 [==============================] - 1s 242us/step - loss:
1.8588
```

```
Epoch 17/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.7671
Epoch 18/50
2484/2484 [==============================] - 1s 225us/step - loss:
1.6986
Epoch 19/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.6490
Epoch 20/50
2484/2484 [==============================] - 1s 222us/step - loss:
1.6138
Epoch 21/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.5897
Epoch 22/50
2484/2484 [==============================] - 1s 223us/step - loss:
1.5741
Epoch 23/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.5642
Epoch 24/50
2484/2484 [==============================] - 1s 225us/step - loss:
1.5577
Epoch 25/50
2484/2484 [==============================] - 1s 224us/step - loss:
1.5537
Epoch 26/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.5512
Epoch 27/50
2484/2484 [==============================] - 1s 222us/step - loss:
1.5497
Epoch 28/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.5488
Epoch 29/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.5481
Epoch 30/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.5477
Epoch 31/50
2484/2484 [==============================] - 1s 224us/step - loss:
1.5475
Epoch 32/50
2484/2484 [==============================] - 1s 225us/step - loss:
1.5472
Epoch 33/50
2484/2484 [==============================] - 1s 234us/step - loss:
```

```
1.5472
Epoch 34/50
2484/2484 [==============================] - 1s 225us/step - loss:
1.5471
Epoch 35/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.5471
Epoch 36/50
2484/2484 [==============================] - 1s 224us/step - loss:
1.5471
Epoch 37/50
2484/2484 [==============================] - 1s 256us/step - loss:
1.5470
Epoch 38/50
2484/2484 [==============================] - 1s 322us/step - loss:
1.5469
Epoch 39/50
2484/2484 [==============================] - 1s 275us/step - loss:
1.5471
Epoch 40/50
2484/2484 [==============================] - 1s 225us/step - loss:
1.5469
Epoch 41/50
2484/2484 [==============================] - 1s 229us/step - loss:
1.5470
Epoch 42/50
2484/2484 [==============================] - 1s 224us/step - loss:
1.5471
Epoch 43/50
2484/2484 [==============================] - 1s 223us/step - loss:
1.5469
Epoch 44/50
2484/2484 [==============================] - 1s 222us/step - loss:
1.5471
Epoch 45/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.5470
Epoch 46/50
2484/2484 [==============================] - 1s 223us/step - loss:
1.5469
Epoch 47/50
2484/2484 [==============================] - 1s 248us/step - loss:
1.5468
Epoch 48/50
2484/2484 [==============================] - 1s 222us/step - loss:
1.5470
Epoch 49/50
2484/2484 [==============================] - 1s 225us/step - loss:
1.5469
Epoch 50/50
```

```
2484/2484 [==============================] - 1s 234us/step - loss:
1.5469
276/276 [==============================] - 0s 141us/step
Epoch 1/50
2484/2484 [==============================] - 1s 256us/step - loss:
26.1283
Epoch 2/50
2484/2484 [==============================] - 1s 226us/step - loss:
15.8021
Epoch 3/50
2484/2484 [==============================] - 1s 224us/step - loss:
11.4734
Epoch 4/50
2484/2484 [==============================] - 1s 225us/step - loss:
9.0400
Epoch 5/50
2484/2484 [==============================] - 1s 225us/step - loss:
7.4036
Epoch 6/50
2484/2484 [==============================] - 1s 227us/step - loss:
6.2055
Epoch 7/50
2484/2484 [==============================] - 1s 221us/step - loss:
5.2868
Epoch 8/50
2484/2484 [==============================] - 1s 227us/step - loss:
4.5610
Epoch 9/50
2484/2484 [==============================] - 1s 238us/step - loss:
3.9755
Epoch 10/50
2484/2484 [==============================] - 1s 246us/step - loss:
3.4993
Epoch 11/50
2484/2484 [==============================] - 1s 242us/step - loss:
3.1099
Epoch 12/50
2484/2484 [==============================] - 1s 236us/step - loss:
2.7910
Epoch 13/50
2484/2484 [==============================] - 1s 227us/step - loss:
2.5292
Epoch 14/50
2484/2484 [==============================] - 1s 328us/step - loss:
2.3167
Epoch 15/50
2484/2484 [==============================] - 1s 296us/step - loss:
2.1455
Epoch 16/50
2484/2484 [==============================] - 1s 258us/step - loss:
```

```
2.0097
Epoch 17/50
2484/2484 [==============================] - 1s 225us/step - loss:
1.9032
Epoch 18/50
2484/2484 [==============================] - 1s 242us/step - loss:
1.8213
Epoch 19/50
2484/2484 [==============================] - 1s 227us/step - loss:
1.7606
Epoch 20/50
2484/2484 [==============================] - 1s 231us/step - loss:
1.7163
Epoch 21/50
2484/2484 [==============================] - 1s 227us/step - loss:
1.6849
Epoch 22/50
2484/2484 [==============================] - 1s 229us/step - loss:
1.6628
Epoch 23/50
2484/2484 [==============================] - 1s 223us/step - loss:
1.6479
Epoch 24/50
2484/2484 [==============================] - 1s 225us/step - loss:
1.6383
Epoch 25/50
2484/2484 [==============================] - 1s 225us/step - loss:
1.6320
Epoch 26/50
2484/2484 [==============================] - 1s 226us/step - loss:
1.6281
Epoch 27/50
2484/2484 [==============================] - 1s 226us/step - loss:
1.6256
Epoch 28/50
2484/2484 [==============================] - 1s 229us/step - loss:
1.6240
Epoch 29/50
2484/2484 [==============================] - 1s 227us/step - loss:
1.6229
Epoch 30/50
2484/2484 [==============================] - 1s 253us/step - loss:
1.6223
Epoch 31/50
2484/2484 [==============================] - 1s 259us/step - loss:
1.6219
Epoch 32/50
2484/2484 [==============================] - 1s 255us/step - loss:
1.6215
Epoch 33/50
```

```
2484/2484 [==============================] - 1s 271us/step - loss:
1.6212
Epoch 34/50
2484/2484 [==============================] - 1s 255us/step - loss:
1.6210
Epoch 35/50
2484/2484 [==============================] - 1s 258us/step - loss:
1.6207
Epoch 36/50
2484/2484 [==============================] - 1s 252us/step - loss:
1.6206
Epoch 37/50
2484/2484 [==============================] - 1s 263us/step - loss:
1.6205 0s - l
Epoch 38/50
2484/2484 [==============================] - 1s 226us/step - loss:
1.6204
Epoch 39/50

2484/2484 [==============================] - 1s 223us/step - loss:
1.6204
Epoch 40/50
2484/2484 [==============================] - 1s 283us/step - loss:
1.6202
Epoch 41/50
2484/2484 [==============================] - 1s 310us/step - loss:
1.6201
Epoch 42/50
2484/2484 [==============================] - 1s 250us/step - loss:
1.6201
Epoch 43/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.6201
Epoch 44/50
2484/2484 [==============================] - 1s 228us/step - loss:
1.6200
Epoch 45/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.6200
Epoch 46/50
2484/2484 [==============================] - 1s 223us/step - loss:
1.6199
Epoch 47/50
2484/2484 [==============================] - 1s 249us/step - loss:
1.6199
Epoch 48/50
2484/2484 [==============================] - 1s 234us/step - loss:
1.6198
Epoch 49/50
2484/2484 [==============================] - 1s 221us/step - loss:
```

```
1.6197
Epoch 50/50
2484/2484 [==============================] - 1s 234us/step - loss:
1.6197
276/276 [==============================] - 0s 134us/step
Epoch 1/50
2484/2484 [==============================] - 1s 256us/step - loss:
25.4676
Epoch 2/50
2484/2484 [==============================] - 1s 221us/step - loss:
14.8023
Epoch 3/50
2484/2484 [==============================] - 1s 218us/step - loss:
10.5558
Epoch 4/50
2484/2484 [==============================] - 1s 216us/step - loss:
8.2126
Epoch 5/50
2484/2484 [==============================] - 1s 219us/step - loss:
6.6653
Epoch 6/50
2484/2484 [==============================] - 1s 219us/step - loss:
5.5476
Epoch 7/50
2484/2484 [==============================] - 1s 219us/step - loss:
4.7008
Epoch 8/50
2484/2484 [==============================] - 1s 256us/step - loss:
4.0394
Epoch 9/50
2484/2484 [==============================] - 1s 261us/step - loss:
3.5127
Epoch 10/50
2484/2484 [==============================] - 1s 252us/step - loss:
3.0886
Epoch 11/50
2484/2484 [==============================] - 1s 219us/step - loss:
2.7454
Epoch 12/50
2484/2484 [==============================] - 1s 221us/step - loss:
2.4689
Epoch 13/50
2484/2484 [==============================] - 1s 221us/step - loss:
2.2476
Epoch 14/50
2484/2484 [==============================] - 1s 221us/step - loss:
2.0718
Epoch 15/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.9344
```

```
Epoch 16/50
2484/2484 [==============================] - 1s 232us/step - loss:
1.8292
Epoch 17/50
2484/2484 [==============================] - 1s 324us/step - loss:
1.7500 0s
Epoch 18/50
2484/2484 [==============================] - 1s 267us/step - loss:
1.6914
Epoch 19/50
2484/2484 [==============================] - 1s 242us/step - loss:
1.6500
Epoch 20/50
2484/2484 [==============================] - 1s 219us/step - loss:
1.6215
Epoch 21/50
2484/2484 [==============================] - 1s 223us/step - loss:
1.6028
Epoch 22/50
2484/2484 [==============================] - 1s 224us/step - loss:
1.5910
Epoch 23/50
2484/2484 [==============================] - 1s 224us/step - loss:
1.5837
Epoch 24/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.5790
Epoch 25/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.5763
Epoch 26/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.5746
Epoch 27/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.5736
Epoch 28/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.5730
Epoch 29/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.5726
Epoch 30/50
2484/2484 [==============================] - 1s 222us/step - loss:
1.5724
Epoch 31/50
2484/2484 [==============================] - 1s 218us/step - loss:
1.5720
Epoch 32/50
2484/2484 [==============================] - 1s 222us/step - loss:
```

```
1.5721
Epoch 33/50
2484/2484 [==============================] - 1s 222us/step - loss:
1.5718
Epoch 34/50
2484/2484 [==============================] - 1s 230us/step - loss:
1.5717
Epoch 35/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.5715
Epoch 36/50
2484/2484 [==============================] - 1s 223us/step - loss:
1.5716
Epoch 37/50
2484/2484 [==============================] - 1s 222us/step - loss:
1.5714
Epoch 38/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.5715
Epoch 39/50
2484/2484 [==============================] - 1s 222us/step - loss:
1.5714
Epoch 40/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.5713
Epoch 41/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.5714
Epoch 42/50
2484/2484 [==============================] - 1s 219us/step - loss:
1.5713
Epoch 43/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.5713
Epoch 44/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.5713
Epoch 45/50
2484/2484 [==============================] - 1s 304us/step - loss:
1.5711
Epoch 46/50
2484/2484 [==============================] - 1s 288us/step - loss:
1.5711
Epoch 47/50
2484/2484 [==============================] - 1s 245us/step - loss:
1.5710
Epoch 48/50
2484/2484 [==============================] - 1s 223us/step - loss:
1.5710
Epoch 49/50
```

```
2484/2484 [==============================] - 1s 221us/step - loss:
1.5710
Epoch 50/50
2484/2484 [==============================] - 1s 223us/step - loss:
1.5708
276/276 [==============================] - 0s 145us/step
Epoch 1/50
2484/2484 [==============================] - 1s 261us/step - loss:
25.2980
Epoch 2/50
2484/2484 [==============================] - 1s 225us/step - loss:
14.9948
Epoch 3/50
2484/2484 [==============================] - 1s 222us/step - loss:
10.8203
Epoch 4/50
2484/2484 [==============================] - 1s 219us/step - loss:
8.4576
Epoch 5/50
2484/2484 [==============================] - 1s 222us/step - loss:
6.8813
Epoch 6/50
2484/2484 [==============================] - 1s 221us/step - loss:
5.7402
Epoch 7/50
2484/2484 [==============================] - 1s 220us/step - loss:
4.8735
Epoch 8/50
2484/2484 [==============================] - 1s 221us/step - loss:
4.1951
Epoch 9/50
2484/2484 [==============================] - 1s 220us/step - loss:
3.6534
Epoch 10/50
2484/2484 [==============================] - 1s 241us/step - loss:
3.2172
Epoch 11/50
2484/2484 [==============================] - 1s 223us/step - loss:
2.8639
Epoch 12/50
2484/2484 [==============================] - 1s 224us/step - loss:
2.5791
Epoch 13/50
2484/2484 [==============================] - 1s 224us/step - loss:
2.3497
Epoch 14/50
2484/2484 [==============================] - 1s 224us/step - loss:
2.1677
Epoch 15/50
2484/2484 [==============================] - 1s 223us/step - loss:
```

```
2.0252
Epoch 16/50
2484/2484 [==============================] - 1s 222us/step - loss:
1.9153
Epoch 17/50
2484/2484 [==============================] - 1s 227us/step - loss:
1.8321
Epoch 18/50
2484/2484 [==============================] - 1s 225us/step - loss:
1.7704
Epoch 19/50
2484/2484 [==============================] - 1s 232us/step - loss:
1.7265
Epoch 20/50
2484/2484 [==============================] - 1s 234us/step - loss:
1.6964
Epoch 21/50
2484/2484 [==============================] - 1s 248us/step - loss:
1.6763
Epoch 22/50
2484/2484 [==============================] - 1s 328us/step - loss:
1.6630
Epoch 23/50
2484/2484 [==============================] - 1s 295us/step - loss:
1.6547
Epoch 24/50
2484/2484 [==============================] - 1s 258us/step - loss:
1.6500
Epoch 25/50
2484/2484 [==============================] - 1s 233us/step - loss:
1.6472
Epoch 26/50
2484/2484 [==============================] - 1s 234us/step - loss:
1.6452
Epoch 27/50
2484/2484 [==============================] - 1s 238us/step - loss:
1.6440
Epoch 28/50
2484/2484 [==============================] - 1s 226us/step - loss:
1.6431
Epoch 29/50
2484/2484 [==============================] - 1s 223us/step - loss:
1.6427
Epoch 30/50
2484/2484 [==============================] - 1s 224us/step - loss:
1.6424
Epoch 31/50
2484/2484 [==============================] - 1s 256us/step - loss:
1.6421
Epoch 32/50
```

```
2484/2484 [==============================] - 1s 227us/step - loss:
1.6418
Epoch 33/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.6416
Epoch 34/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.6415
Epoch 35/50
2484/2484 [==============================] - 1s 232us/step - loss:
1.6413
Epoch 36/50
2484/2484 [==============================] - 1s 225us/step - loss:
1.6412
Epoch 37/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.6410
Epoch 38/50
2484/2484 [==============================] - 1s 219us/step - loss:
1.6410
Epoch 39/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.6409
Epoch 40/50
2484/2484 [==============================] - 1s 227us/step - loss:
1.6406
Epoch 41/50
2484/2484 [==============================] - 1s 249us/step - loss:
1.6405
Epoch 42/50
2484/2484 [==============================] - 1s 243us/step - loss:
1.6403
Epoch 43/50
2484/2484 [==============================] - 1s 252us/step - loss:
1.6403
Epoch 44/50
2484/2484 [==============================] - 1s 254us/step - loss:
1.6402
Epoch 45/50
2484/2484 [==============================] - 1s 248us/step - loss:
1.6401
Epoch 46/50
2484/2484 [==============================] - 1s 256us/step - loss:
1.6399
Epoch 47/50
2484/2484 [==============================] - 1s 251us/step - loss:
1.6397
Epoch 48/50
2484/2484 [==============================] - 1s 287us/step - loss:
1.6398
```

```
Epoch 49/50
2484/2484 [==============================] - 1s 284us/step - loss:
1.6396
Epoch 50/50
2484/2484 [==============================] - 1s 263us/step - loss:
1.6395
276/276 [==============================] - 0s 130us/step
Epoch 1/50
2484/2484 [==============================] - 1s 263us/step - loss:
24.9859
Epoch 2/50
2484/2484 [==============================] - 1s 226us/step - loss:
14.8677
Epoch 3/50
2484/2484 [==============================] - 1s 221us/step - loss:
10.7349
Epoch 4/50
2484/2484 [==============================] - 1s 222us/step - loss:
8.3867
Epoch 5/50
2484/2484 [==============================] - 1s 253us/step - loss:
6.8155
Epoch 6/50
2484/2484 [==============================] - 1s 229us/step - loss:
5.6794
Epoch 7/50
2484/2484 [==============================] - 1s 235us/step - loss:
4.8161
Epoch 8/50
2484/2484 [==============================] - 1s 233us/step - loss:
4.1409
Epoch 9/50
2484/2484 [==============================] - 1s 222us/step - loss:
3.6053
Epoch 10/50
2484/2484 [==============================] - 1s 219us/step - loss:
3.1745
Epoch 11/50
2484/2484 [==============================] - 1s 226us/step - loss:
2.8262
Epoch 12/50
2484/2484 [==============================] - 1s 219us/step - loss:
2.5460
Epoch 13/50
2484/2484 [==============================] - 1s 219us/step - loss:
2.3217
Epoch 14/50
2484/2484 [==============================] - 1s 221us/step - loss:
2.1435
Epoch 15/50
```

```
2484/2484 [==============================] - 1s 217us/step - loss:
2.0042
Epoch 16/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.8974
Epoch 17/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.8175
Epoch 18/50
2484/2484 [==============================] - 1s 218us/step - loss:
1.7582
Epoch 19/50
2484/2484 [==============================] - 1s 230us/step - loss:
1.7156
Epoch 20/50
2484/2484 [==============================] - 1s 222us/step - loss:
1.6868
Epoch 21/50
2484/2484 [==============================] - 1s 217us/step - loss:
1.6676
Epoch 22/50
2484/2484 [==============================] - 1s 219us/step - loss:
1.6556
Epoch 23/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.6480
Epoch 24/50
2484/2484 [==============================] - 1s 219us/step - loss:
1.6431
Epoch 25/50
2484/2484 [==============================] - 1s 276us/step - loss:
1.6402
Epoch 26/50
2484/2484 [==============================] - 1s 303us/step - loss:
1.6384
Epoch 27/50
2484/2484 [==============================] - 1s 242us/step - loss:
1.6374
Epoch 28/50
2484/2484 [==============================] - 1s 218us/step - loss:
1.6365
Epoch 29/50
2484/2484 [==============================] - 1s 224us/step - loss:
1.6361
Epoch 30/50
2484/2484 [==============================] - 1s 219us/step - loss:
1.6356
Epoch 31/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.6354
```

```
Epoch 32/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.6352
Epoch 33/50
2484/2484 [==============================] - 1s 219us/step - loss:
1.6351
Epoch 34/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.6350
Epoch 35/50
2484/2484 [==============================] - 1s 218us/step - loss:
1.6348
Epoch 36/50
2484/2484 [==============================] - 1s 233us/step - loss:
1.6347
Epoch 37/50
2484/2484 [==============================] - 1s 219us/step - loss:
1.6347
Epoch 38/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.6346
Epoch 39/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.6345
Epoch 40/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.6345
Epoch 41/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.6344
Epoch 42/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.6342
Epoch 43/50
2484/2484 [==============================] - 1s 222us/step - loss:
1.6343
Epoch 44/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.6340
Epoch 45/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.6341
Epoch 46/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.6340
Epoch 47/50
2484/2484 [==============================] - 1s 218us/step - loss:
1.6339
Epoch 48/50
2484/2484 [==============================] - 1s 221us/step - loss:
```

```
1.6339
Epoch 49/50
2484/2484 [==============================] - 1s 227us/step - loss:
1.6339
Epoch 50/50
2484/2484 [==============================] - 1s 219us/step - loss:
1.6338
276/276 [==============================] - 0s 141us/step
Epoch 1/50
2484/2484 [==============================] - 1s 253us/step - loss:
25.4776
Epoch 2/50
2484/2484 [==============================] - 1s 254us/step - loss:
15.7145
Epoch 3/50
2484/2484 [==============================] - 1s 315us/step - loss:
11.4615
Epoch 4/50
2484/2484 [==============================] - 1s 261us/step - loss:
9.0156
Epoch 5/50
2484/2484 [==============================] - 1s 233us/step - loss:
7.3742
Epoch 6/50
2484/2484 [==============================] - 1s 225us/step - loss:
6.1785
Epoch 7/50
2484/2484 [==============================] - 1s 222us/step - loss:
5.2666
Epoch 8/50
2484/2484 [==============================] - 1s 219us/step - loss:
4.5491
Epoch 9/50
2484/2484 [==============================] - 1s 221us/step - loss:
3.9724
Epoch 10/50
2484/2484 [==============================] - 1s 221us/step - loss:
3.5032
Epoch 11/50
2484/2484 [==============================] - 1s 221us/step - loss:
3.1198
Epoch 12/50
2484/2484 [==============================] - 1s 220us/step - loss:
2.8069
Epoch 13/50
2484/2484 [==============================] - 1s 219us/step - loss:
2.5534
Epoch 14/50
2484/2484 [==============================] - 1s 221us/step - loss:
2.3468
```

```
Epoch 15/50
2484/2484 [==============================] - 1s 220us/step - loss:
2.1813
Epoch 16/50
2484/2484 [==============================] - 1s 221us/step - loss:
2.0498
Epoch 17/50
2484/2484 [==============================] - 1s 220us/step - loss:
1.9478
Epoch 18/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.8705
Epoch 19/50
2484/2484 [==============================] - 1s 224us/step - loss:
1.8130
Epoch 20/50
2484/2484 [==============================] - 1s 219us/step - loss:
1.7715
Epoch 21/50
2484/2484 [==============================] - 1s 232us/step - loss:
1.7423
Epoch 22/50
2484/2484 [==============================] - 1s 221us/step - loss:
1.7224
Epoch 23/50
2484/2484 [==============================] - 1s 226us/step - loss:
1.7090
Epoch 24/50
2484/2484 [==============================] - 1s 229us/step - loss:
1.7003
Epoch 25/50
2484/2484 [==============================] - 1s 232us/step - loss:
1.6947
Epoch 26/50
2484/2484 [==============================] - 1s 248us/step - loss:
1.6914
Epoch 27/50

2484/2484 [==============================] - 1s 234us/step - loss:
1.6891
Epoch 28/50
2484/2484 [==============================] - 1s 234us/step - loss:
1.6878
Epoch 29/50
2484/2484 [==============================] - 1s 272us/step - loss:
1.6870
Epoch 30/50
2484/2484 [==============================] - 1s 355us/step - loss:
1.6864
Epoch 31/50
```

```
2484/2484 [==============================] - 1s 385us/step - loss: 
1.6860
Epoch 32/50
2484/2484 [==============================] - 1s 312us/step - loss: 
1.6858
Epoch 33/50
2484/2484 [==============================] - 1s 246us/step - loss: 
1.6856
Epoch 34/50
2484/2484 [==============================] - 1s 240us/step - loss: 
1.6854
Epoch 35/50
2484/2484 [==============================] - 1s 238us/step - loss: 
1.6853
Epoch 36/50
2484/2484 [==============================] - 1s 245us/step - loss: 
1.6854
Epoch 37/50
 670/2484 [=======>......................] - ETA: 2s - loss: 1.5619

C:\ProgramData\Anaconda3\lib\site-packages\keras\callbacks\
callbacks.py:95: RuntimeWarning: Method (on_train_batch_end) is slow 
compared to the batch update (0.449026). Check your callbacks.
  % (hook_name, delta_t_median), RuntimeWarning)
C:\ProgramData\Anaconda3\lib\site-packages\keras\callbacks\
callbacks.py:95: RuntimeWarning: Method (on_train_batch_end) is slow 
compared to the batch update (0.225013). Check your callbacks.
  % (hook_name, delta_t_median), RuntimeWarning)

2484/2484 [==============================] - 1s 577us/step - loss: 
1.6852
Epoch 38/50
2484/2484 [==============================] - 1s 223us/step - loss: 
1.6852
Epoch 39/50
2484/2484 [==============================] - 1s 222us/step - loss: 
1.6852
Epoch 40/50
2484/2484 [==============================] - 1s 226us/step - loss: 
1.6852
Epoch 41/50
2484/2484 [==============================] - 1s 227us/step - loss: 
1.6851
Epoch 42/50
2484/2484 [==============================] - 1s 226us/step - loss: 
1.6852
Epoch 43/50
2484/2484 [==============================] - 1s 226us/step - loss: 
1.6852
Epoch 44/50
2484/2484 [==============================] - 1s 239us/step - loss: 
```

```
1.6852
Epoch 45/50
2484/2484 [==============================] - 1s 232us/step - loss:
1.6851
Epoch 46/50
2484/2484 [==============================] - 1s 229us/step - loss:
1.6851
Epoch 47/50
2484/2484 [==============================] - 1s 232us/step - loss:
1.6851
Epoch 48/50
2484/2484 [==============================] - 1s 227us/step - loss:
1.6851
Epoch 49/50
2484/2484 [==============================] - 1s 252us/step - loss:
1.6852
Epoch 50/50
2484/2484 [==============================] - 1s 270us/step - loss:
1.6852
276/276 [==============================] - 0s 152us/step
Epoch 1/50
2484/2484 [==============================] - 1s 338us/step - loss:
25.3121
Epoch 2/50
2484/2484 [==============================] - 1s 276us/step - loss:
15.5666
Epoch 3/50
2484/2484 [==============================] - 1s 371us/step - loss:
11.3659
Epoch 4/50
2484/2484 [==============================] - 1s 357us/step - loss:
8.9442
Epoch 5/50
2484/2484 [==============================] - 1s 276us/step - loss:
7.3193
Epoch 6/50
2484/2484 [==============================] - 1s 240us/step - loss:
6.1381
Epoch 7/50
2484/2484 [==============================] - 1s 248us/step - loss:
5.2320
Epoch 8/50
2484/2484 [==============================] - 1s 246us/step - loss:
4.5167
Epoch 9/50
2484/2484 [==============================] - 1s 245us/step - loss:
3.9421
Epoch 10/50
2484/2484 [==============================] - 1s 242us/step - loss:
3.4758
```

```
Epoch 11/50
2484/2484 [==============================] - 1s 251us/step - loss:
3.0942
Epoch 12/50
2484/2484 [==============================] - 1s 239us/step - loss:
2.7823
Epoch 13/50
2484/2484 [==============================] - 1s 239us/step - loss:
2.5288
Epoch 14/50
2484/2484 [==============================] - 1s 239us/step - loss:
2.3247
Epoch 15/50
2484/2484 [==============================] - 1s 240us/step - loss:
2.1610
Epoch 16/50
2484/2484 [==============================] - 1s 240us/step - loss:
2.0319
Epoch 17/50
2484/2484 [==============================] - 1s 250us/step - loss:
1.9317
Epoch 18/50
2484/2484 [==============================] - 1s 247us/step - loss:
1.8550
Epoch 19/50
2484/2484 [==============================] - 1s 249us/step - loss:
1.7986
Epoch 20/50
2484/2484 [==============================] - 1s 247us/step - loss:
1.7586
Epoch 21/50
2484/2484 [==============================] - 1s 247us/step - loss:
1.7307
Epoch 22/50
2484/2484 [==============================] - 1s 254us/step - loss:
1.7113
Epoch 23/50
2484/2484 [==============================] - 1s 244us/step - loss:
1.6983
Epoch 24/50
2484/2484 [==============================] - 1s 246us/step - loss:
1.6900
Epoch 25/50
2484/2484 [==============================] - 1s 247us/step - loss:
1.6850
Epoch 26/50
2484/2484 [==============================] - 1s 252us/step - loss:
1.6818
Epoch 27/50
2484/2484 [==============================] - 1s 246us/step - loss:
```

```
1.6795
Epoch 28/50
2484/2484 [==============================] - 1s 361us/step - loss:
1.6783
Epoch 29/50
2484/2484 [==============================] - 1s 360us/step - loss:
1.6773
Epoch 30/50
2484/2484 [==============================] - 1s 288us/step - loss:
1.6766
Epoch 31/50
2484/2484 [==============================] - 1s 259us/step - loss:
1.6763
Epoch 32/50
2484/2484 [==============================] - 1s 281us/step - loss:
1.6760
Epoch 33/50
2484/2484 [==============================] - 1s 267us/step - loss:
1.6756
Epoch 34/50
2484/2484 [==============================] - 1s 261us/step - loss:
1.6756
Epoch 35/50
2484/2484 [==============================] - 1s 261us/step - loss:
1.6753
Epoch 36/50
2484/2484 [==============================] - 1s 259us/step - loss:
1.6752
Epoch 37/50
2484/2484 [==============================] - 1s 259us/step - loss:
1.6750
Epoch 38/50
2484/2484 [==============================] - 1s 256us/step - loss:
1.6749
Epoch 39/50
2484/2484 [==============================] - 1s 260us/step - loss:
1.6747
Epoch 40/50
2484/2484 [==============================] - 1s 262us/step - loss:
1.6747
Epoch 41/50
2484/2484 [==============================] - 1s 251us/step - loss:
1.6746
Epoch 42/50
2484/2484 [==============================] - 1s 261us/step - loss:
1.6746
Epoch 43/50
2484/2484 [==============================] - 1s 254us/step - loss:
1.6746
Epoch 44/50
```

```
2484/2484 [==============================] - 1s 252us/step - loss:
1.6745
Epoch 45/50
2484/2484 [==============================] - 1s 258us/step - loss:
1.6743
Epoch 46/50
2484/2484 [==============================] - 1s 254us/step - loss:
1.6743
Epoch 47/50
2484/2484 [==============================] - 1s 265us/step - loss:
1.6742
Epoch 48/50
2484/2484 [==============================] - 1s 259us/step - loss:
1.6741
Epoch 49/50
2484/2484 [==============================] - 1s 254us/step - loss:
1.6740
Epoch 50/50
2484/2484 [==============================] - 1s 255us/step - loss:
1.6739
276/276 [==============================] - 0s 145us/step
Epoch 1/50
2484/2484 [==============================] - 1s 370us/step - loss:
25.6786
Epoch 2/50
2484/2484 [==============================] - 1s 343us/step - loss:
15.1120
Epoch 3/50
2484/2484 [==============================] - 1s 297us/step - loss:
10.8615
Epoch 4/50
2484/2484 [==============================] - 1s 258us/step - loss:
8.4868
Epoch 5/50
2484/2484 [==============================] - 1s 273us/step - loss:
6.9140
Epoch 6/50
2484/2484 [==============================] - 1s 265us/step - loss:
5.7725
Epoch 7/50
2484/2484 [==============================] - 1s 261us/step - loss:
4.9055
Epoch 8/50
2484/2484 [==============================] - 1s 259us/step - loss:
4.2277
Epoch 9/50
2484/2484 [==============================] - 1s 255us/step - loss:
3.6853
Epoch 10/50
2484/2484 [==============================] - 1s 239us/step - loss:
```

```
3.2470
Epoch 11/50
2484/2484 [==============================] - 1s 267us/step - loss:
2.8921
Epoch 12/50
2484/2484 [==============================] - 1s 240us/step - loss:
2.6043
Epoch 13/50
2484/2484 [==============================] - 1s 238us/step - loss:
2.3724
Epoch 14/50
2484/2484 [==============================] - 1s 236us/step - loss:
2.1864
Epoch 15/50
2484/2484 [==============================] - 1s 240us/step - loss:
2.0396
Epoch 16/50
2484/2484 [==============================] - 1s 237us/step - loss:
1.9253
Epoch 17/50
2484/2484 [==============================] - 1s 239us/step - loss:
1.8387
Epoch 18/50
2484/2484 [==============================] - 1s 236us/step - loss:
1.7746
Epoch 19/50
2484/2484 [==============================] - 1s 238us/step - loss:
1.7286
Epoch 20/50
2484/2484 [==============================] - 1s 237us/step - loss:
1.6961
Epoch 21/50
2484/2484 [==============================] - 1s 238us/step - loss:
1.6739
Epoch 22/50
2484/2484 [==============================] - 1s 238us/step - loss:
1.6595
Epoch 23/50
2484/2484 [==============================] - 1s 238us/step - loss:
1.6501
Epoch 24/50
2484/2484 [==============================] - 1s 238us/step - loss:
1.6443
Epoch 25/50
2484/2484 [==============================] - 1s 238us/step - loss:
1.6407
Epoch 26/50
2484/2484 [==============================] - 1s 291us/step - loss:
1.6384
Epoch 27/50
```

```
2484/2484 [==============================] - 1s 329us/step - loss:
1.6369
Epoch 28/50
2484/2484 [==============================] - 1s 281us/step - loss:
1.6361
Epoch 29/50
2484/2484 [==============================] - 1s 236us/step - loss:
1.6356
Epoch 30/50
2484/2484 [==============================] - 1s 244us/step - loss:
1.6350
Epoch 31/50
2484/2484 [==============================] - 1s 247us/step - loss:
1.6347
Epoch 32/50
2484/2484 [==============================] - 1s 238us/step - loss:
1.6346
Epoch 33/50
2484/2484 [==============================] - 1s 241us/step - loss:
1.6343
Epoch 34/50
2484/2484 [==============================] - 1s 234us/step - loss:
1.6343
Epoch 35/50
2484/2484 [==============================] - 1s 239us/step - loss:
1.6342
Epoch 36/50
2484/2484 [==============================] - 1s 224us/step - loss:
1.6342
Epoch 37/50
2484/2484 [==============================] - 1s 234us/step - loss:
1.6342
Epoch 38/50
2484/2484 [==============================] - 1s 237us/step - loss:
1.6341
Epoch 39/50
2484/2484 [==============================] - 1s 226us/step - loss:
1.6341
Epoch 40/50
2484/2484 [==============================] - 1s 223us/step - loss:
1.6340
Epoch 41/50
2484/2484 [==============================] - 1s 226us/step - loss:
1.6340
Epoch 42/50
2484/2484 [==============================] - 1s 225us/step - loss:
1.6340
Epoch 43/50
2484/2484 [==============================] - 1s 238us/step - loss:
1.6340
```

```
Epoch 44/50
2484/2484 [==============================] - 1s 231us/step - loss:
1.6339
Epoch 45/50
2484/2484 [==============================] - 1s 256us/step - loss:
1.6341
Epoch 46/50
2484/2484 [==============================] - 1s 230us/step - loss:
1.6340
Epoch 47/50
2484/2484 [==============================] - 1s 262us/step - loss:
1.6339
Epoch 48/50
2484/2484 [==============================] - 1s 233us/step - loss:
1.6339
Epoch 49/50
2484/2484 [==============================] - 1s 242us/step - loss:
1.6339
Epoch 50/50
2484/2484 [==============================] - 1s 261us/step - loss:
1.6339
276/276 [==============================] - 0s 163us/step
Standardized: 0.23 (0.11) MSE
```