In [12]:

```
from sklearn.datasets import fetch_california_housing
import pandas as pd

california_dataset = fetch_california_housing()

df = pd.DataFrame(california_dataset.data, columns=california_dataset.feature_names)
df['MEDV'] = california_dataset.target

df.head(n=10)
```

Out[12]:

	MedInc	HouseAge	AveRooms	AveBedrms	Population	AveOccup	Latitude	Longitude	MEDV
0	8.3252	41.0	6.984127	1.023810	322.0	2.555556	37.88	-122.23	4.526
1	8.3014	21.0	6.238137	0.971880	2401.0	2.109842	37.86	-122.22	3.585
2	7.2574	52.0	8.288136	1.073446	496.0	2.802260	37.85	-122.24	3.521
3	5.6431	52.0	5.817352	1.073059	558.0	2.547945	37.85	-122.25	3.413
4	3.8462	52.0	6.281853	1.081081	565.0	2.181467	37.85	-122.25	3.422
5	4.0368	52.0	4.761658	1.103627	413.0	2.139896	37.85	-122.25	2.697
6	3.6591	52.0	4.931907	0.951362	1094.0	2.128405	37.84	-122.25	2.992
7	3.1200	52.0	4.797527	1.061824	1157.0	1.788253	37.84	-122.25	2.414
8	2.0804	42.0	4.294118	1.117647	1206.0	2.026891	37.84	-122.26	2.267
9	3.6912	52.0	4.970588	0.990196	1551.0	2.172269	37.84	-122.25	2.611

In [13]:

```
from sklearn.model_selection import train_test_split

X = df.loc[:, df.columns != 'MEDV']
y = df.loc[:, df.columns == 'MEDV']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=12
3)
```

In [16]:

```
from keras.models import Sequential
from keras.layers import Dense

model = Sequential()

model.add(Dense(128, input_shape=(8, ), activation='relu', name='dense_1'))
model.add(Dense(64, activation='relu', name='dense_2'))
model.add(Dense(1, activation='linear', name='dense_output'))

model.compile(optimizer='adam', loss='mse', metrics=['mae'])
model.summary()
```

```
Model: "sequential_2"
_________________________________________________________________
 Layer (type)                 Output Shape              Param #
=================================================================
 dense_1 (Dense)              (None, 128)               1152

 dense_2 (Dense)              (None, 64)                8256

 dense_output (Dense)         (None, 1)                 65

=================================================================
Total params: 9,473
Trainable params: 9,473
```

```
Non-trainable params: 0
_________________________________________________________________
```

In [17]:

```
history = model.fit(X_train, y_train, epochs=200, validation_split=0.05, verbose = 1)
```

```
Epoch 1/200
429/429 [==============================] - 3s 3ms/step - loss: 108.4796 - mae: 3.1362 - v
al_loss: 3.6336 - val_mae: 1.0747
Epoch 2/200
429/429 [==============================] - 1s 3ms/step - loss: 2.1033 - mae: 1.0972 - val
_loss: 2.1447 - val_mae: 1.1562
Epoch 3/200
429/429 [==============================] - 2s 4ms/step - loss: 24.3507 - mae: 2.6630 - va
l_loss: 5.5047 - val_mae: 1.4988
Epoch 4/200
429/429 [==============================] - 1s 3ms/step - loss: 10.0135 - mae: 1.2712 - va
l_loss: 272.4287 - val_mae: 10.0643
Epoch 5/200
429/429 [==============================] - 1s 3ms/step - loss: 216.6668 - mae: 4.1999 - v
al_loss: 1.0633 - val_mae: 0.7675
Epoch 6/200
429/429 [==============================] - 1s 2ms/step - loss: 0.9901 - mae: 0.7834 - val
_loss: 1.1112 - val_mae: 0.7506
Epoch 7/200
429/429 [==============================] - 1s 2ms/step - loss: 1.0028 - mae: 0.7735 - val
_loss: 0.8950 - val_mae: 0.7865
Epoch 8/200
429/429 [==============================] - 1s 2ms/step - loss: 0.9189 - mae: 0.7327 - val
_loss: 0.7706 - val_mae: 0.6281
Epoch 9/200
429/429 [==============================] - 1s 2ms/step - loss: 1.0272 - mae: 0.7625 - val
_loss: 1.9868 - val_mae: 0.9981
Epoch 10/200
429/429 [==============================] - 1s 2ms/step - loss: 1.6072 - mae: 0.8944 - val
_loss: 1.2546 - val_mae: 0.9147
Epoch 11/200
429/429 [==============================] - 1s 2ms/step - loss: 1.3392 - mae: 0.8346 - val
_loss: 2.1335 - val_mae: 1.0505
Epoch 12/200
429/429 [==============================] - 1s 2ms/step - loss: 60.3223 - mae: 3.4018 - va
l_loss: 60.2671 - val_mae: 5.7113
Epoch 13/200
429/429 [==============================] - 1s 2ms/step - loss: 4.1071 - mae: 1.1129 - val
_loss: 1.1230 - val_mae: 0.7010
Epoch 14/200
429/429 [==============================] - 1s 2ms/step - loss: 0.7697 - mae: 0.6747 - val
_loss: 0.8549 - val_mae: 0.6264
Epoch 15/200
429/429 [==============================] - 1s 2ms/step - loss: 1.1181 - mae: 0.7691 - val
_loss: 1.0464 - val_mae: 0.6562
Epoch 16/200
429/429 [==============================] - 1s 2ms/step - loss: 0.7233 - mae: 0.6468 - val
_loss: 1.2330 - val_mae: 0.8025
Epoch 17/200
429/429 [==============================] - 1s 2ms/step - loss: 0.9201 - mae: 0.7199 - val
_loss: 1.8198 - val_mae: 0.9859
Epoch 18/200
429/429 [==============================] - 1s 3ms/step - loss: 7.4571 - mae: 1.7344 - val
_loss: 0.9826 - val_mae: 0.7114
Epoch 19/200
429/429 [==============================] - 1s 3ms/step - loss: 1.0486 - mae: 0.7627 - val
_loss: 0.6033 - val_mae: 0.5819
Epoch 20/200
429/429 [==============================] - 1s 2ms/step - loss: 3.4984 - mae: 1.0337 - val
_loss: 1.1465 - val_mae: 0.8297
Epoch 21/200
429/429 [==============================] - 1s 2ms/step - loss: 1.6262 - mae: 0.8801 - val
_loss: 0.7251 - val_mae: 0.6996
Epoch 22/200
429/429 [==============================] - 1s 2ms/step - loss: 1.2941 - mae: 0.8091 - val
```

```
_loss: 0.9730 - val_mae: 0.7315
Epoch 23/200
429/429 [==============================] - 1s 2ms/step - loss: 2.1472 - mae: 0.9992 - val
_loss: 64.6038 - val_mae: 6.0048
Epoch 24/200
429/429 [==============================] - 1s 2ms/step - loss: 2.9765 - mae: 1.1265 - val
_loss: 1.1295 - val_mae: 0.6116
Epoch 25/200
429/429 [==============================] - 1s 2ms/step - loss: 3.6593 - mae: 1.1021 - val
_loss: 5.5252 - val_mae: 1.5308
Epoch 26/200
429/429 [==============================] - 1s 2ms/step - loss: 1.1824 - mae: 0.8078 - val
_loss: 1.0677 - val_mae: 0.6192
Epoch 27/200
429/429 [==============================] - 1s 2ms/step - loss: 1.6315 - mae: 0.8675 - val
_loss: 4.3800 - val_mae: 1.5434
Epoch 28/200
429/429 [==============================] - 1s 2ms/step - loss: 2.1990 - mae: 0.9164 - val
_loss: 0.6606 - val_mae: 0.5842
Epoch 29/200
429/429 [==============================] - 1s 2ms/step - loss: 0.9335 - mae: 0.7081 - val
_loss: 1.3038 - val_mae: 0.8228
Epoch 30/200
429/429 [==============================] - 1s 2ms/step - loss: 0.8759 - mae: 0.6883 - val
_loss: 1.1061 - val_mae: 0.7517
Epoch 31/200
429/429 [==============================] - 1s 2ms/step - loss: 1.7201 - mae: 0.8828 - val
_loss: 2.5993 - val_mae: 1.1612
Epoch 32/200
429/429 [==============================] - 1s 3ms/step - loss: 1.2487 - mae: 0.7945 - val
_loss: 1.6532 - val_mae: 0.9182
Epoch 33/200
429/429 [==============================] - 1s 3ms/step - loss: 2.6600 - mae: 0.9954 - val
_loss: 0.9641 - val_mae: 0.6833
Epoch 34/200
429/429 [==============================] - 1s 2ms/step - loss: 0.6959 - mae: 0.6305 - val
_loss: 1.5209 - val_mae: 0.8640
Epoch 35/200
429/429 [==============================] - 1s 2ms/step - loss: 0.8021 - mae: 0.6718 - val
_loss: 0.7368 - val_mae: 0.6081
Epoch 36/200
429/429 [==============================] - 1s 2ms/step - loss: 0.6467 - mae: 0.6067 - val
_loss: 0.8186 - val_mae: 0.5578
Epoch 37/200
429/429 [==============================] - 1s 2ms/step - loss: 0.9464 - mae: 0.7152 - val
_loss: 1.0016 - val_mae: 0.6852
Epoch 38/200
429/429 [==============================] - 1s 2ms/step - loss: 0.9534 - mae: 0.7052 - val
_loss: 2.5829 - val_mae: 1.3008
Epoch 39/200
429/429 [==============================] - 1s 2ms/step - loss: 0.8767 - mae: 0.6870 - val
_loss: 0.8783 - val_mae: 0.5828
Epoch 40/200
429/429 [==============================] - 1s 2ms/step - loss: 0.6908 - mae: 0.6283 - val
_loss: 0.8254 - val_mae: 0.5824
Epoch 41/200
429/429 [==============================] - 1s 2ms/step - loss: 0.7507 - mae: 0.6452 - val
_loss: 0.6828 - val_mae: 0.5636
Epoch 42/200
429/429 [==============================] - 1s 2ms/step - loss: 0.8021 - mae: 0.6730 - val
_loss: 1.3696 - val_mae: 0.6318
Epoch 43/200
429/429 [==============================] - 1s 2ms/step - loss: 0.8055 - mae: 0.6590 - val
_loss: 0.8475 - val_mae: 0.7552
Epoch 44/200
429/429 [==============================] - 1s 2ms/step - loss: 0.8380 - mae: 0.6820 - val
_loss: 1.3371 - val_mae: 0.6481
Epoch 45/200
429/429 [==============================] - 1s 2ms/step - loss: 0.6839 - mae: 0.6188 - val
_loss: 1.1540 - val_mae: 0.5374
Epoch 46/200
429/429 [==============================] - 1s 2ms/step - loss: 1.0392 - mae: 0.7140 - val
```

```
_loss: 0.9004 - val_mae: 0.6784
Epoch 47/200
429/429 [==============================] - 1s 3ms/step - loss: 0.6394 - mae: 0.5989 - val
_loss: 0.7388 - val_mae: 0.6529
Epoch 48/200
429/429 [==============================] - 1s 3ms/step - loss: 0.6538 - mae: 0.6055 - val
_loss: 0.7166 - val_mae: 0.5741
Epoch 49/200
429/429 [==============================] - 1s 2ms/step - loss: 0.6251 - mae: 0.5915 - val
_loss: 0.6016 - val_mae: 0.5350
Epoch 50/200
429/429 [==============================] - 1s 2ms/step - loss: 0.6595 - mae: 0.6061 - val
_loss: 1.1316 - val_mae: 0.5446
Epoch 51/200
429/429 [==============================] - 1s 2ms/step - loss: 0.6975 - mae: 0.6248 - val
_loss: 0.7251 - val_mae: 0.6085
Epoch 52/200
429/429 [==============================] - 1s 2ms/step - loss: 0.7130 - mae: 0.6221 - val
_loss: 1.0409 - val_mae: 0.6128
Epoch 53/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5736 - mae: 0.5633 - val
_loss: 0.7529 - val_mae: 0.6181
Epoch 54/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5761 - mae: 0.5667 - val
_loss: 1.4176 - val_mae: 0.7583
Epoch 55/200
429/429 [==============================] - 1s 2ms/step - loss: 0.6913 - mae: 0.6016 - val
_loss: 0.5892 - val_mae: 0.5430
Epoch 56/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5453 - mae: 0.5526 - val
_loss: 0.6795 - val_mae: 0.5586
Epoch 57/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5701 - mae: 0.5638 - val
_loss: 0.7089 - val_mae: 0.5783
Epoch 58/200
429/429 [==============================] - 1s 2ms/step - loss: 0.6200 - mae: 0.5786 - val
_loss: 0.6386 - val_mae: 0.5165
Epoch 59/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5214 - mae: 0.5356 - val
_loss: 0.5429 - val_mae: 0.5822
Epoch 60/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5176 - mae: 0.5335 - val
_loss: 0.5690 - val_mae: 0.5634
Epoch 61/200
429/429 [==============================] - 1s 3ms/step - loss: 0.5516 - mae: 0.5538 - val
_loss: 1.1495 - val_mae: 0.5725
Epoch 62/200
429/429 [==============================] - 1s 3ms/step - loss: 0.5435 - mae: 0.5502 - val
_loss: 0.9347 - val_mae: 0.5776
Epoch 63/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5208 - mae: 0.5366 - val
_loss: 0.6300 - val_mae: 0.5075
Epoch 64/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5192 - mae: 0.5365 - val
_loss: 0.6742 - val_mae: 0.5108
Epoch 65/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5229 - mae: 0.5383 - val
_loss: 0.5569 - val_mae: 0.5233
Epoch 66/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5107 - mae: 0.5308 - val
_loss: 0.7217 - val_mae: 0.5194
Epoch 67/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5063 - mae: 0.5277 - val
_loss: 0.8204 - val_mae: 0.6789
Epoch 68/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5021 - mae: 0.5273 - val
_loss: 0.9442 - val_mae: 0.5347
Epoch 69/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5114 - mae: 0.5313 - val
_loss: 0.6028 - val_mae: 0.5271
Epoch 70/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5046 - mae: 0.5276 - val
```

```
_loss: 0.6872 - val_mae: 0.5398
Epoch 71/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5015 - mae: 0.5256 - val
_loss: 0.5774 - val_mae: 0.5118
Epoch 72/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5101 - mae: 0.5304 - val
_loss: 0.5529 - val_mae: 0.4969
Epoch 73/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5132 - mae: 0.5321 - val
_loss: 0.6069 - val_mae: 0.5348
Epoch 74/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5097 - mae: 0.5326 - val
_loss: 0.7981 - val_mae: 0.5367
Epoch 75/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5096 - mae: 0.5262 - val
_loss: 0.5283 - val_mae: 0.5017
Epoch 76/200
429/429 [==============================] - 1s 3ms/step - loss: 0.5004 - mae: 0.5258 - val
_loss: 0.5632 - val_mae: 0.5310
Epoch 77/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4857 - mae: 0.5162 - val
_loss: 0.5870 - val_mae: 0.4977
Epoch 78/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4933 - mae: 0.5202 - val
_loss: 0.6282 - val_mae: 0.5119
Epoch 79/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5030 - mae: 0.5289 - val
_loss: 0.6481 - val_mae: 0.5020
Epoch 80/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4906 - mae: 0.5207 - val
_loss: 0.5961 - val_mae: 0.5201
Epoch 81/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4877 - mae: 0.5175 - val
_loss: 0.5197 - val_mae: 0.5326
Epoch 82/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4892 - mae: 0.5204 - val
_loss: 0.6088 - val_mae: 0.5023
Epoch 83/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4882 - mae: 0.5186 - val
_loss: 0.7235 - val_mae: 0.5125
Epoch 84/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4833 - mae: 0.5153 - val
_loss: 0.6529 - val_mae: 0.5115
Epoch 85/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4877 - mae: 0.5199 - val
_loss: 0.6999 - val_mae: 0.6015
Epoch 86/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4887 - mae: 0.5180 - val
_loss: 0.5940 - val_mae: 0.5047
Epoch 87/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4927 - mae: 0.5196 - val
_loss: 0.5760 - val_mae: 0.5182
Epoch 88/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5213 - mae: 0.5394 - val
_loss: 0.5776 - val_mae: 0.5006
Epoch 89/200
429/429 [==============================] - 1s 2ms/step - loss: 0.5023 - mae: 0.5277 - val
_loss: 0.5701 - val_mae: 0.4956
Epoch 90/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4773 - mae: 0.5112 - val
_loss: 0.6034 - val_mae: 0.4917
Epoch 91/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4791 - mae: 0.5122 - val
_loss: 0.6698 - val_mae: 0.5076
Epoch 92/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4791 - mae: 0.5121 - val
_loss: 0.5545 - val_mae: 0.5464
Epoch 93/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4913 - mae: 0.5202 - val
_loss: 0.5625 - val_mae: 0.5092
Epoch 94/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4766 - mae: 0.5114 - val
```

```
_loss: 0.5987 - val_mae: 0.5104
Epoch 95/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4831 - mae: 0.5148 - val
_loss: 0.5772 - val_mae: 0.5117
Epoch 96/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4792 - mae: 0.5122 - val
_loss: 0.6347 - val_mae: 0.5831
Epoch 97/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4811 - mae: 0.5127 - val
_loss: 0.5627 - val_mae: 0.4984
Epoch 98/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4777 - mae: 0.5112 - val
_loss: 0.6080 - val_mae: 0.5309
Epoch 99/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4778 - mae: 0.5108 - val
_loss: 0.5727 - val_mae: 0.5252
Epoch 100/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4723 - mae: 0.5070 - val
_loss: 0.5122 - val_mae: 0.4914
Epoch 101/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4826 - mae: 0.5132 - val
_loss: 0.4818 - val_mae: 0.4876
Epoch 102/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4701 - mae: 0.5063 - val
_loss: 0.5751 - val_mae: 0.5089
Epoch 103/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4797 - mae: 0.5118 - val
_loss: 0.5145 - val_mae: 0.4894
Epoch 104/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4704 - mae: 0.5078 - val
_loss: 0.5177 - val_mae: 0.5497
Epoch 105/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4733 - mae: 0.5096 - val
_loss: 0.5110 - val_mae: 0.5028
Epoch 106/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4666 - mae: 0.5045 - val
_loss: 0.5998 - val_mae: 0.5352
Epoch 107/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4764 - mae: 0.5104 - val
_loss: 0.4690 - val_mae: 0.5009
Epoch 108/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4730 - mae: 0.5086 - val
_loss: 0.4883 - val_mae: 0.4966
Epoch 109/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4639 - mae: 0.5033 - val
_loss: 0.4850 - val_mae: 0.4852
Epoch 110/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4649 - mae: 0.5014 - val
_loss: 0.5226 - val_mae: 0.5069
Epoch 111/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4681 - mae: 0.5042 - val
_loss: 0.5317 - val_mae: 0.5223
Epoch 112/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4713 - mae: 0.5066 - val
_loss: 0.4696 - val_mae: 0.4864
Epoch 113/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4678 - mae: 0.5054 - val
_loss: 0.4428 - val_mae: 0.4875
Epoch 114/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4663 - mae: 0.5041 - val
_loss: 0.5001 - val_mae: 0.4989
Epoch 115/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4679 - mae: 0.5028 - val
_loss: 0.5296 - val_mae: 0.5085
Epoch 116/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4689 - mae: 0.5065 - val
_loss: 0.5251 - val_mae: 0.5437
Epoch 117/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4865 - mae: 0.5160 - val
_loss: 0.5100 - val_mae: 0.5071
Epoch 118/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4678 - mae: 0.5069 - val
```

```
_loss: 0.4888 - val_mae: 0.4859
Epoch 119/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4678 - mae: 0.5039 - val
_loss: 0.4461 - val_mae: 0.4995
Epoch 120/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4666 - mae: 0.5019 - val
_loss: 0.4407 - val_mae: 0.4935
Epoch 121/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4582 - mae: 0.4996 - val
_loss: 0.4782 - val_mae: 0.5171
Epoch 122/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4649 - mae: 0.5023 - val
_loss: 0.4941 - val_mae: 0.4939
Epoch 123/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4721 - mae: 0.5082 - val
_loss: 0.4820 - val_mae: 0.4840
Epoch 124/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4623 - mae: 0.5021 - val
_loss: 0.5170 - val_mae: 0.5504
Epoch 125/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4588 - mae: 0.4991 - val
_loss: 0.5128 - val_mae: 0.5095
Epoch 126/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4632 - mae: 0.5024 - val
_loss: 0.4426 - val_mae: 0.4717
Epoch 127/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4575 - mae: 0.4976 - val
_loss: 0.4471 - val_mae: 0.4790
Epoch 128/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4537 - mae: 0.4952 - val
_loss: 0.5179 - val_mae: 0.5175
Epoch 129/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4646 - mae: 0.5030 - val
_loss: 0.4705 - val_mae: 0.4930
Epoch 130/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4604 - mae: 0.5004 - val
_loss: 0.5333 - val_mae: 0.5134
Epoch 131/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4662 - mae: 0.5034 - val
_loss: 0.4668 - val_mae: 0.4743
Epoch 132/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4657 - mae: 0.5029 - val
_loss: 0.4846 - val_mae: 0.5301
Epoch 133/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4592 - mae: 0.4992 - val
_loss: 0.4450 - val_mae: 0.4858
Epoch 134/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4624 - mae: 0.5023 - val
_loss: 0.4834 - val_mae: 0.4879
Epoch 135/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4650 - mae: 0.5037 - val
_loss: 0.4714 - val_mae: 0.4916
Epoch 136/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4478 - mae: 0.4916 - val
_loss: 0.4942 - val_mae: 0.5043
Epoch 137/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4610 - mae: 0.5003 - val
_loss: 0.5654 - val_mae: 0.5833
Epoch 138/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4538 - mae: 0.4956 - val
_loss: 0.4257 - val_mae: 0.4817
Epoch 139/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4510 - mae: 0.4931 - val
_loss: 0.4943 - val_mae: 0.4950
Epoch 140/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4615 - mae: 0.4990 - val
_loss: 0.4349 - val_mae: 0.4781
Epoch 141/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4605 - mae: 0.4999 - val
_loss: 0.5183 - val_mae: 0.5054
Epoch 142/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4519 - mae: 0.4925 - val
```

```
_loss: 0.4797 - val_mae: 0.4857
Epoch 143/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4614 - mae: 0.5001 - val
_loss: 0.5472 - val_mae: 0.5813
Epoch 144/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4611 - mae: 0.5002 - val
_loss: 0.4496 - val_mae: 0.5084
Epoch 145/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4538 - mae: 0.4960 - val
_loss: 0.4634 - val_mae: 0.4895
Epoch 146/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4522 - mae: 0.4921 - val
_loss: 0.4406 - val_mae: 0.4820
Epoch 147/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4520 - mae: 0.4933 - val
_loss: 0.4364 - val_mae: 0.4948
Epoch 148/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4567 - mae: 0.4965 - val
_loss: 0.4475 - val_mae: 0.4913
Epoch 149/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4454 - mae: 0.4896 - val
_loss: 0.4820 - val_mae: 0.4886
Epoch 150/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4591 - mae: 0.4985 - val
_loss: 0.5600 - val_mae: 0.5205
Epoch 151/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4596 - mae: 0.4983 - val
_loss: 0.4479 - val_mae: 0.4990
Epoch 152/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4503 - mae: 0.4910 - val
_loss: 0.4795 - val_mae: 0.5069
Epoch 153/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4505 - mae: 0.4921 - val
_loss: 0.4755 - val_mae: 0.4820
Epoch 154/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4477 - mae: 0.4917 - val
_loss: 0.4231 - val_mae: 0.4786
Epoch 155/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4485 - mae: 0.4907 - val
_loss: 0.4497 - val_mae: 0.4859
Epoch 156/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4556 - mae: 0.4952 - val
_loss: 0.5193 - val_mae: 0.4873
Epoch 157/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4462 - mae: 0.4895 - val
_loss: 0.5529 - val_mae: 0.5029
Epoch 158/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4517 - mae: 0.4938 - val
_loss: 0.4932 - val_mae: 0.4988
Epoch 159/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4441 - mae: 0.4906 - val
_loss: 0.5491 - val_mae: 0.5951
Epoch 160/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4499 - mae: 0.4959 - val
_loss: 0.4851 - val_mae: 0.4788
Epoch 161/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4453 - mae: 0.4887 - val
_loss: 0.4349 - val_mae: 0.4738
Epoch 162/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4433 - mae: 0.4877 - val
_loss: 0.4665 - val_mae: 0.4787
Epoch 163/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4438 - mae: 0.4890 - val
_loss: 0.5585 - val_mae: 0.5911
Epoch 164/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4503 - mae: 0.4925 - val
_loss: 0.4405 - val_mae: 0.5014
Epoch 165/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4490 - mae: 0.4914 - val
_loss: 0.4315 - val_mae: 0.4763
Epoch 166/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4430 - mae: 0.4879 - val
```

```
_loss: 0.5141 - val_mae: 0.5025
Epoch 167/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4437 - mae: 0.4877 - val
_loss: 0.4409 - val_mae: 0.4958
Epoch 168/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4504 - mae: 0.4929 - val
_loss: 0.4711 - val_mae: 0.4814
Epoch 169/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4472 - mae: 0.4892 - val
_loss: 0.4455 - val_mae: 0.5061
Epoch 170/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4476 - mae: 0.4902 - val
_loss: 0.4797 - val_mae: 0.4964
Epoch 171/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4423 - mae: 0.4869 - val
_loss: 0.4408 - val_mae: 0.4790
Epoch 172/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4470 - mae: 0.4915 - val
_loss: 0.4410 - val_mae: 0.4775
Epoch 173/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4493 - mae: 0.4913 - val
_loss: 0.4422 - val_mae: 0.4975
Epoch 174/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4380 - mae: 0.4849 - val
_loss: 0.4422 - val_mae: 0.4673
Epoch 175/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4410 - mae: 0.4868 - val
_loss: 0.5323 - val_mae: 0.5796
Epoch 176/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4375 - mae: 0.4841 - val
_loss: 0.4342 - val_mae: 0.4654
Epoch 177/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4361 - mae: 0.4838 - val
_loss: 0.4298 - val_mae: 0.4735
Epoch 178/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4577 - mae: 0.4959 - val
_loss: 0.4330 - val_mae: 0.4895
Epoch 179/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4369 - mae: 0.4856 - val
_loss: 0.4210 - val_mae: 0.4691
Epoch 180/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4466 - mae: 0.4908 - val
_loss: 0.5119 - val_mae: 0.5350
Epoch 181/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4396 - mae: 0.4847 - val
_loss: 0.4809 - val_mae: 0.4832
Epoch 182/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4419 - mae: 0.4867 - val
_loss: 0.4566 - val_mae: 0.4754
Epoch 183/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4389 - mae: 0.4832 - val
_loss: 0.4307 - val_mae: 0.4670
Epoch 184/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4354 - mae: 0.4832 - val
_loss: 0.4376 - val_mae: 0.4981
Epoch 185/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4473 - mae: 0.4908 - val
_loss: 0.4654 - val_mae: 0.4693
Epoch 186/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4447 - mae: 0.4867 - val
_loss: 0.5317 - val_mae: 0.4654
Epoch 187/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4317 - mae: 0.4820 - val
_loss: 0.4786 - val_mae: 0.5117
Epoch 188/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4380 - mae: 0.4843 - val
_loss: 0.6209 - val_mae: 0.4692
Epoch 189/200
429/429 [==============================] - 1s 3ms/step - loss: 0.4412 - mae: 0.4865 - val
_loss: 0.5805 - val_mae: 0.5130
Epoch 190/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4416 - mae: 0.4853 - val
```

```
_loss: 0.5307 - val_mae: 0.4697
Epoch 191/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4357 - mae: 0.4801 - val
_loss: 0.6056 - val_mae: 0.5026
Epoch 192/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4321 - mae: 0.4811 - val
_loss: 0.5964 - val_mae: 0.4815
Epoch 193/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4323 - mae: 0.4797 - val
_loss: 0.5342 - val_mae: 0.4750
Epoch 194/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4330 - mae: 0.4818 - val
_loss: 0.5950 - val_mae: 0.4731
Epoch 195/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4328 - mae: 0.4812 - val
_loss: 0.7073 - val_mae: 0.5552
Epoch 196/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4385 - mae: 0.4837 - val
_loss: 0.6635 - val_mae: 0.4834
Epoch 197/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4400 - mae: 0.4859 - val
_loss: 0.5831 - val_mae: 0.4846
Epoch 198/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4345 - mae: 0.4823 - val
_loss: 0.7164 - val_mae: 0.5204
Epoch 199/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4376 - mae: 0.4835 - val
_loss: 0.6445 - val_mae: 0.5513
Epoch 200/200
429/429 [==============================] - 1s 2ms/step - loss: 0.4378 - mae: 0.4861 - val
_loss: 0.6271 - val_mae: 0.4747
```

In [18]:

```
mse_nn, mae_nn = model.evaluate(X_test, y_test)

print('Mean squared error on test data is: ', mse_nn)
print('Mean absolute error on test data is: ', mae_nn)
```

```
194/194 [==============================] - 0s 2ms/step - loss: 0.4118 - mae: 0.4550
Mean squared error on test data is:  0.4117625951766968
Mean absolute error on test data is:  0.4550313353538513
```