Linear Regression Model for House Price Prediction

Mini Project Report submitted to

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY

In fulfillment of requirement for the award of degree of

BACHELOR OF TECHNOLOGY

Under the

Faculty of Engineering and Technology

In the discipline

Computer Engineering

By

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T.Y. COMPUTER

Guide

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GODAVARI COLLEGE OF ENGINEERING, JALGAON

(NAAC Accredited)

(An affiliated to Dr. Babasaheb Ambedkar Technological University)

YEAR 2020-2021

Godavari Foundation's
GODAVARI COLLEGE OF ENGINEERING, JALGAON
(NAAC Accredited)
(An affiliated to Dr. Babasaheb Ambedkar Technological University)

CERTIFICATE

This is to certify that the T.Y.Computer Internship on "Linear Regression Model for House Price Prediction" submitted by SHWETA RAVINDRA PATIL In fulfillment of the degree of BACHELOR OF TECHNOLOGY in the Department of COMPUTER ENGINEERING, Godavari College of Engineering, Dr. Babasaheb Ambedkar Technological University, Lonere is a bonafide record of work carried out by her in the Department of Computer Engineering, Dr. Babasaheb Ambedkar Technological University, Lonere under my guidance and supervision. In my opinion this work has attained the standard fulfilling the requirements of the regulations of the University.

Date:
Place:Jalgaon

Prof. Ganesh Chavan — **GUIDE** — Assistant Prof.

Prof. Pramod B. Gosavi — **H.O.D.** — Associate Prof.

Dr. V. H. PATIL
PRINCIPAL
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DECLARATION

I hereby declare that the work presented in this Internship Report "Linear Regression Model for House Price Prediction" was carried out by me under the supervision of PROF. GANESH CHAVAN Sir from Auguest-2020 to December-2020.
This work or any part of this work is based on original research and has not been submitted by me to any University/Institution for the award of any degree.

Date:
Place: Jalgaon

SHWETA RAVINDRA PATIL(Roll No. 34)

ACKNOWLEDGEMENT

I would like to acknowledge all the people who have been of the help and assisted me throughout my curriculum work.

First of all I would like to thank our respected guide PROF. GANESH CHAVAN Sir, in department of computer engineering for introducing me throughout features needed. The time to time guidance, encouragement,and valuable suggestions recived from her. This work would not have been possible without the enthusiastic response, insight and new ideas form her.

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I gladly take this apportunity to thanks Dr.V.H.Patil,Principal Sir, GF's Godavari College of Engineering ,jalgaon for providing all the facility during the progress of learning.

The acknowledgement would be incomplete without mention of the blessing of the Almighty, which helped me in keeping high moral during most difficult period.

SHWETA RAVINDRA PATIL (Roll No. 34)

Mini Project Linear Regression Model

December 9, 2020

1 Linear Regression Machine Learning Project for House Price Prediction

1.0.1 Import Libraries

[1]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn import datasets, linear_model
from sklearn.metrics import mean_squared_error, r2_score

%matplotlib inline
```

1.0.2 Importing Data and Checking out.

[2]:
```
HouseDF = pd.read_csv('USA_Housing.csv')
```

[3]:
```
HouseDF.head()
```

[3]:

	Avg. Area Income	Avg. Area House Age	Avg. Area Number of Rooms	Avg. Area Number of Bedrooms	Area Population	Price
0	79545.458574	5.682861	7.009188	4.09	23086.800503	1.059034e+06
1	79248.642455	6.002900	6.730821	3.09	40173.072174	1.505891e+06
2	61287.067179	5.865890	8.512727	5.13	36882.159400	1.058988e+06
3	63345.240046	7.188236	5.586729	3.26	34310.242831	1.260617e+06
4	59982.197226	5.040555	7.839388	4.23	26354.109472	6.309435e+05

```
                                                 Address
0  208 Michael Ferry Apt. 674\nLaurabury, NE 3701...
1  188 Johnson Views Suite 079\nLake Kathleen, CA...
2  9127 Elizabeth Stravenue\nDanieltown, WI 06482...
3                          USS Barnett\nFPO AP 44820
4                         USNS Raymond\nFPO AE 09386
```

[4]:
```
HouseDF.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5000 entries, 0 to 4999
Data columns (total 7 columns):
 #   Column                       Non-Null Count  Dtype  
---  ------                       --------------  -----  
 0   Avg. Area Income             5000 non-null   float64
 1   Avg. Area House Age          5000 non-null   float64
 2   Avg. Area Number of Rooms    5000 non-null   float64
 3   Avg. Area Number of Bedrooms  5000 non-null   float64
 4   Area Population              5000 non-null   float64
 5   Price                        5000 non-null   float64
 6   Address                      5000 non-null   object 
dtypes: float64(6), object(1)
memory usage: 273.6+ KB
```

[5]:
```
HouseDF.describe()
```

[5]:
```
       Avg. Area Income  Avg. Area House Age  Avg. Area Number of Rooms  \
count       5000.000000          5000.000000                5000.000000   
mean       68583.108984             5.977222                   6.987792   
std        10657.991214             0.991456                   1.005833   
min        17796.631190             2.644304                   3.236194   
25%        61480.562388             5.322283                   6.299250   
50%        68804.286404             5.970429                   7.002902   
75%        75783.338666             6.650808                   7.665871   
max       107701.748378             9.519088                  10.759588   

       Avg. Area Number of Bedrooms  Area Population         Price  
count                   5000.000000      5000.000000  5.000000e+03  
mean                       3.981330     36163.516039  1.232073e+06  
std                        1.234137      9925.650114  3.531176e+05  
min                        2.000000       172.610686  1.593866e+04  
25%                        3.140000     29403.928702  9.975771e+05  
50%                        4.050000     36199.406689  1.232669e+06  
75%                        4.490000     42861.290769  1.471210e+06  
max                        6.500000     69621.713378  2.469066e+06  
```

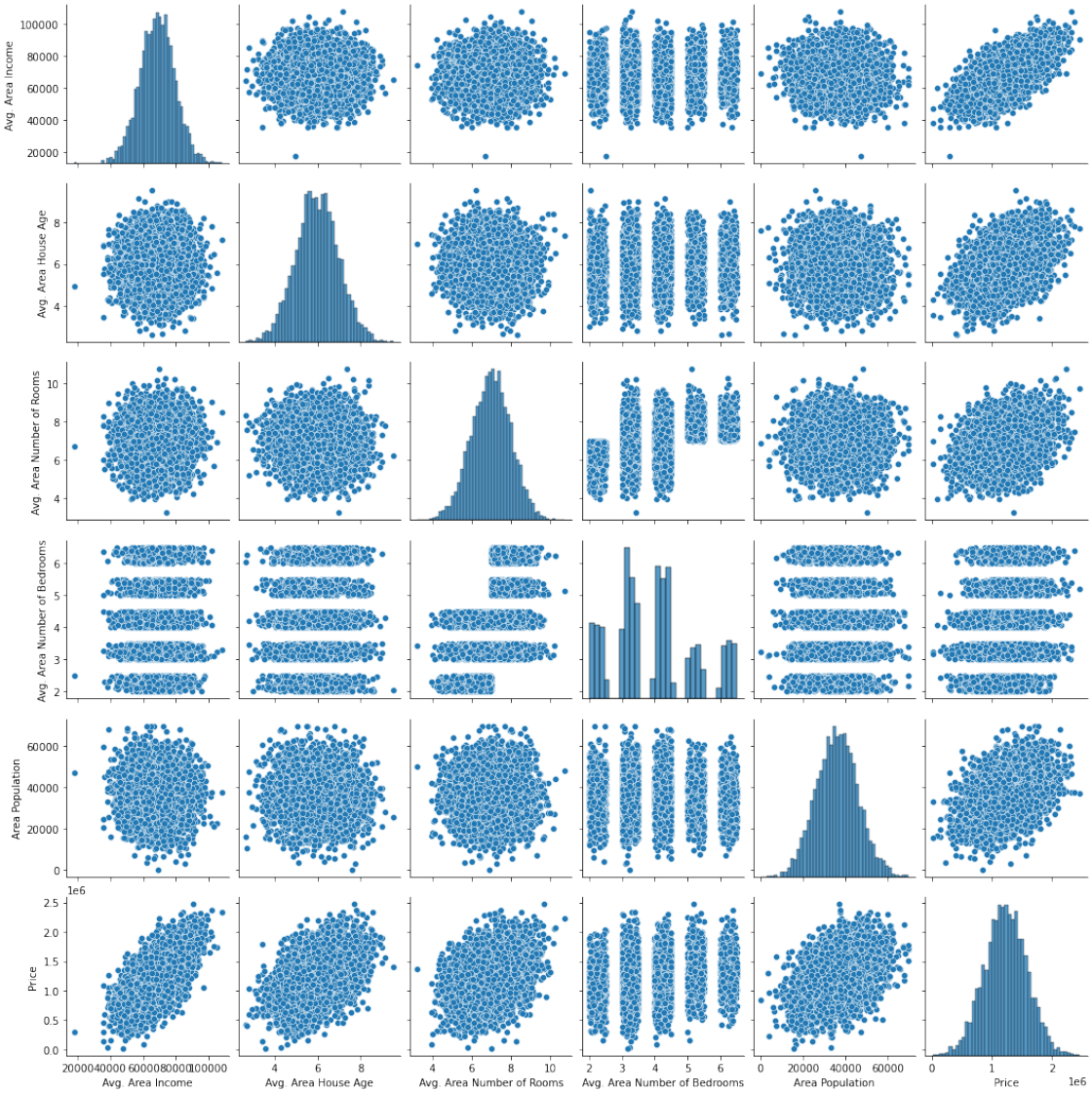
[6]:
```
HouseDF.columns
```

[6]:
```
Index(['Avg. Area Income', 'Avg. Area House Age', 'Avg. Area Number of Rooms',
       'Avg. Area Number of Bedrooms', 'Area Population', 'Price', 'Address'],
      dtype='object')
```

1.1 Exploratory Data Analysis for House Price Prediction

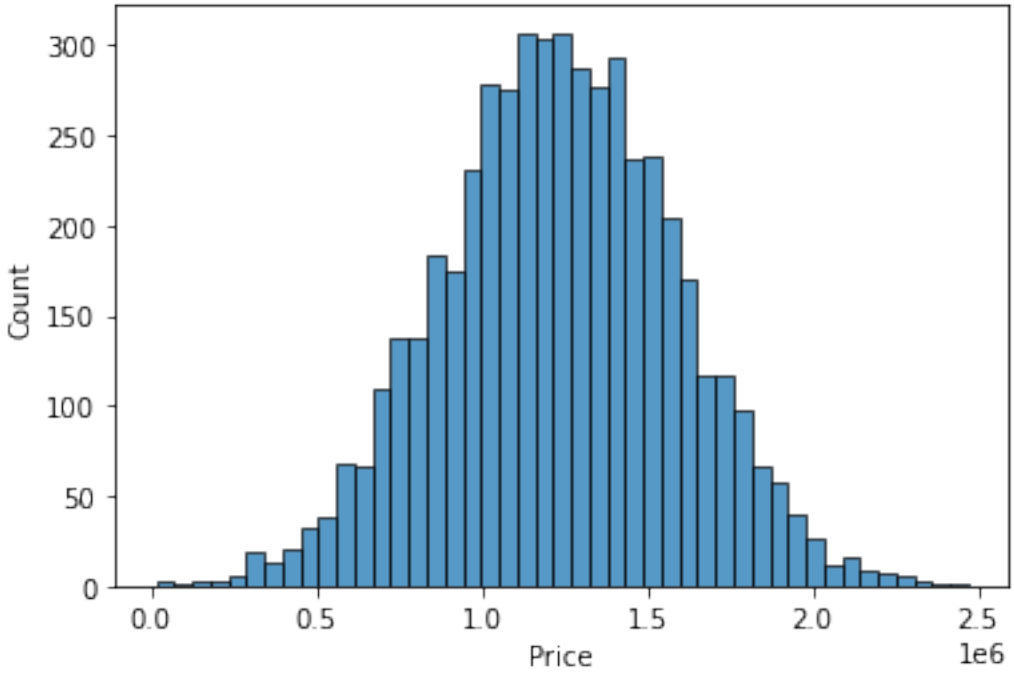
[7]:
```
sns.pairplot(HouseDF)
```

[7]:
```
<seaborn.axisgrid.PairGrid at 0x7efcd86a5880>
```



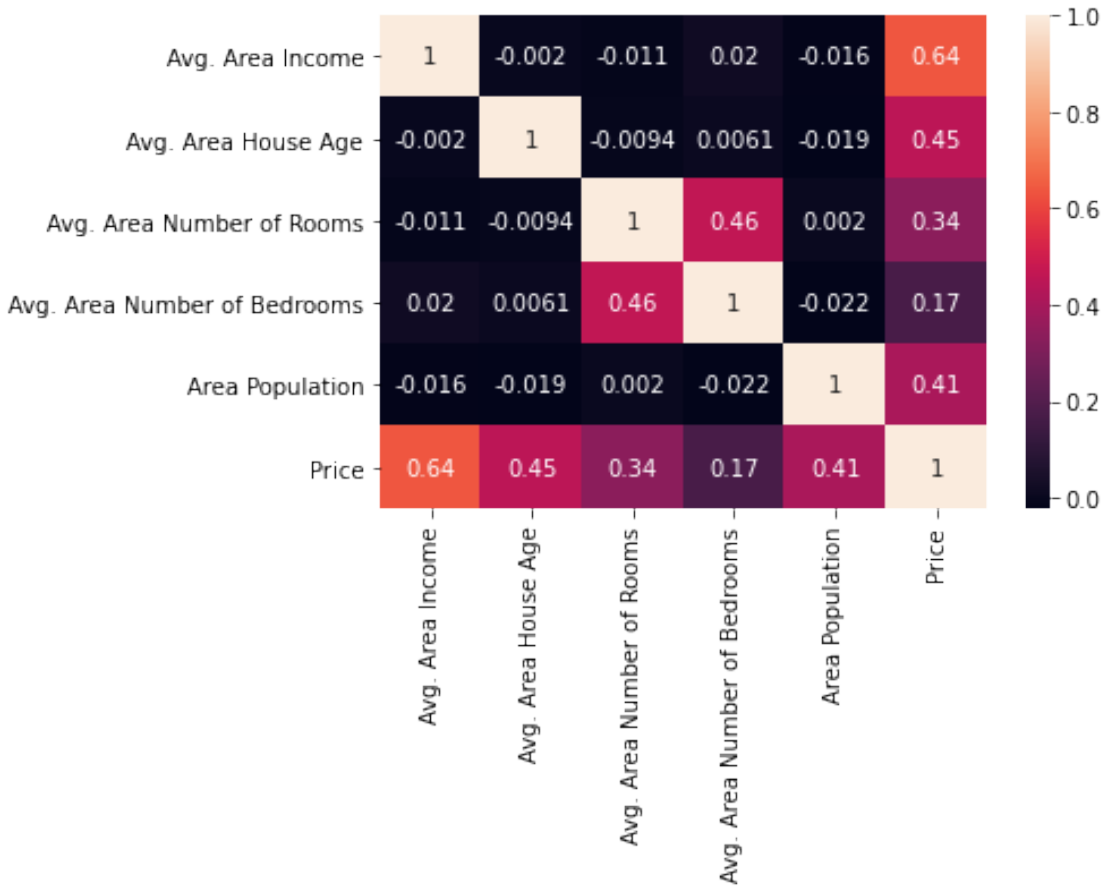
[8]:
```
sns.histplot(HouseDF['Price'])
```

[8]: <AxesSubplot:xlabel='Price', ylabel='Count'>



[12]:
```
sns.heatmap(HouseDF.corr() , annot=True)
```

[12]: <AxesSubplot:>



1.2 Training a Linear Regression Model

1.2.1 X and y List

[13]:
```
X = HouseDF[['Avg. Area Income', 'Avg. Area House Age', 'Avg. Area Number of␣
↪Rooms',
               'Avg. Area Number of Bedrooms', 'Area Population']]

y = HouseDF['Price']
```

1.2.2 Split Data into Train, Test

[14]:
```
from sklearn.model_selection import train_test_split
```

[15]:
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.40,)#␣
↪random_state=101)
```

1.3 Creating and Training the LinearRegression Model

[16]:
```
from sklearn.linear_model import LinearRegression
```

[17]:
```
lm =  linear_model.LinearRegression()
```

[18]:
```
lm.fit(X_train,y_train)
```

[18]:
```
LinearRegression()
```

1.4 LinearRegression Model Evaluation

[19]:
```
print(lm.intercept_)
```

```
-2637599.1421310618
```

[20]:
```
coeff_df = pd.DataFrame(lm.coef_,X.columns,columns=['Coefficient'])
coeff_df
```

[20]:

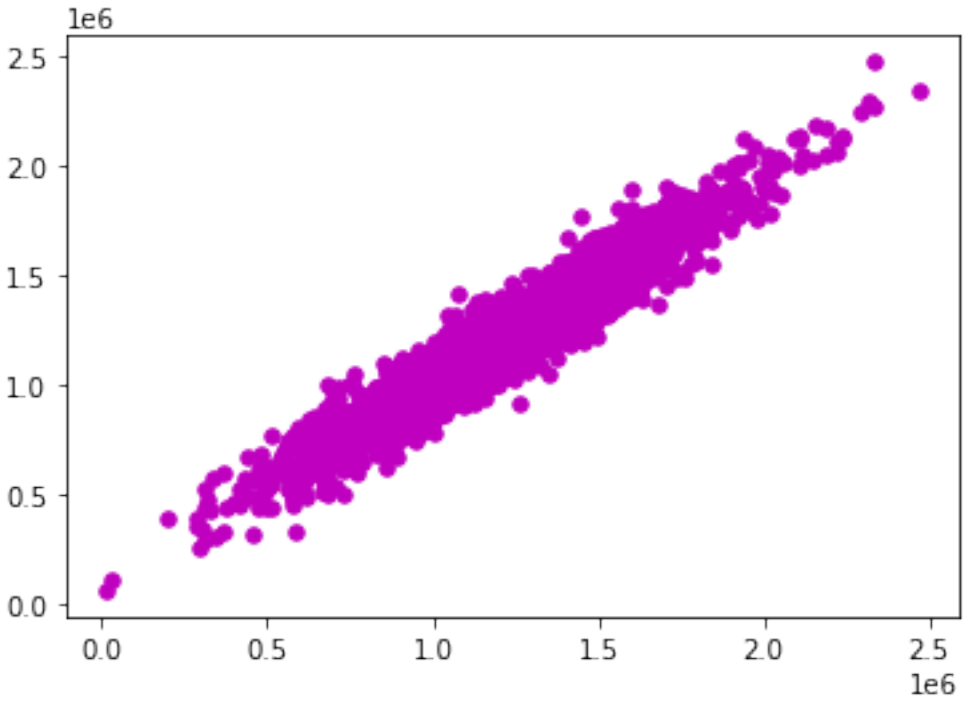
	Coefficient
Avg. Area Income	21.543966
Avg. Area House Age	165690.511404
Avg. Area Number of Rooms	120212.512681
Avg. Area Number of Bedrooms	1737.769687
Area Population	15.318771

1.5 Predictions from our Linear Regression Model

[21]:
```
y_pred = lm.predict(X_test)
```

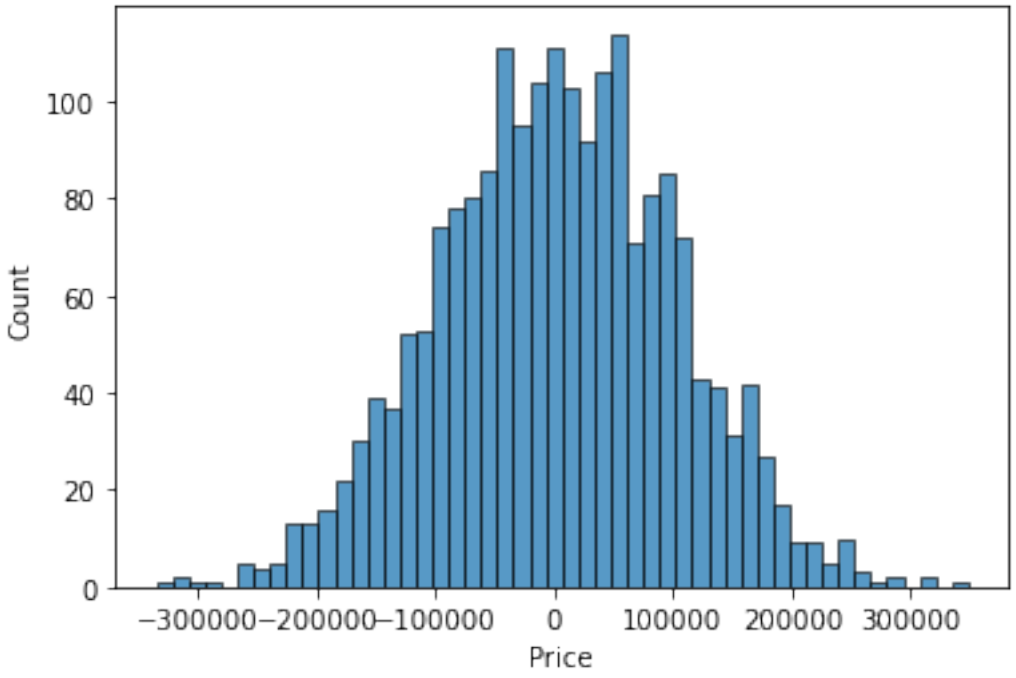
[22]:
```
#plt.scatter(y_test,predictions) plt.plot(X_test, y_pred, color='blue')
plt.scatter(y_test, y_pred, color = "m", marker = "o", s = 30)
```

[22]:
```
<matplotlib.collections.PathCollection at 0x7efca8db9310>
```



In the above scatter plot, we see data is in line shape, which means our model has done good predictions.

[23]:
```
sns.histplot((y_test-y_pred),bins=50);
```



In the above histogram plot, we see data is in bell shape (Normally Distributed), which means our model has done good predictions.

1.6 Regression Evaluation Metrics

[24]:
```
from sklearn import metrics
```

[25]:
```
print('MAE (Mean Absolute Error is ):', metrics.mean_absolute_error(y_test,␣
 ↪y_pred))
print('MSE (Mean Square Error is ):', mean_squared_error(y_test, y_pred))
print('RMSE( Root Mean Square Error is ):', np.sqrt(metrics.
 ↪mean_squared_error(y_test, y_pred)))
print('Coefficient of determination (Regression score ): %.2f' %␣
 ↪r2_score(y_test, y_pred))
```

```
MAE (Mean Absolute Error is ): 80301.66530852049
MSE (Mean Square Error is ): 9991562818.77865
RMSE( Root Mean Square Error is ): 99957.8051918841
Coefficient of determination (Regression score ): 0.92
```

[ ]:
```

```