regression1

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Write a program to perform regression tasks over given data using direct functions and evaluate its performance.

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Dataset url "https://www.kaggle.com/code/gantalaswetha/usa-housing-dataset-linear-regression/input?select=USA_Housing.csv"

[ ]:
```
#importing necessary libraries for data manipulation and visualization
import pandas as pd
import numpy as np
import tensorflow as tf
import matplotlib.pyplot as plt
import seaborn as sns
from tensorflow import keras
from sklearn.model_selection import train_test_split
from sklearn import preprocessing
from sklearn.linear_model import LinearRegression
from math import sqrt
from sklearn.metrics import mean_squared_error, r2_score
```

[ ]:
```
#importing the dataset
file ='USA_Housing.csv'
data=pd.read_csv(file)
```

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

[ ]:
```
   Avg. Area Income  Avg. Area House Age  Avg. Area Number of Rooms  \
0      79545.458574             5.682861                   7.009188
1      79248.642455             6.002900                   6.730821
2      61287.067179             5.865890                   8.512727
3      63345.240046             7.188236                   5.586729
4      59982.197226             5.040555                   7.839388

   Avg. Area Number of Bedrooms  Area Population         Price  \
0                          4.09     23086.800503  1.059034e+06
1                          3.09     40173.072174  1.505891e+06
2                          5.13     36882.159400  1.058988e+06
3                          3.26     34310.242831  1.260617e+06
```

```
4                          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
```

[ ]:
```
#checking errors/null values/wrong values
data.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
```

[ ]:
```
#summary of the data
data.describe()
```

[ ]:
```
       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
```

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

[ ]:
```
   Avg. Area Income  Avg. Area House Age  Avg. Area Number of Rooms  \
0      79545.458574             5.682861                  7.009188
1      79248.642455             6.002900                  6.730821
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                                             Address
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3                         USS Barnett\nFPO AP 44820
4                        USNS Raymond\nFPO AE 09386
```

[ ]:
```
# Putting feature variable to X
X = data[['Avg. Area Income','Avg. Area House Age','Avg. Area Number of␣
 ↪Rooms','Avg. Area Number of Bedrooms','Area Population']]

# Putting response variable to y
y = data['Price']
```

[ ]:
```
pre_process = preprocessing.StandardScaler()
X = pd.DataFrame(pre_process.fit_transform(X))
```

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

[ ]:
```
          0         1         2         3         4
0  1.028660 -0.296927  0.021274  0.088062 -1.317599
1  1.000808  0.025902 -0.255506 -0.722301  0.403999
2 -0.684629 -0.112303  1.516243  0.930840  0.072410
3 -0.491499  1.221572 -1.393077 -0.584540 -0.186734
4 -0.807073 -0.944834  0.846742  0.201513 -0.988387
```

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

[ ]:
```
0    1.059034e+06
1    1.505891e+06
2    1.058988e+06
3    1.260617e+06
4    6.309435e+05
Name: Price, dtype: float64
```

[ ]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, train_size=0.7␣
 ↪,test_size = 0.3, random_state=2)
```

[ ]:
```
print(X_train.shape)
print(X_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(3500, 5)
(1500, 5)
(3500,)
(1500,)
```

[ ]:
```
lm=LinearRegression()
```

[ ]:
```
# fit the model to the training data
lm.fit(X_train, y_train)
```

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

[ ]:
```
# print the intercept
print(lm.intercept_)
```

```
1231006.3190642651
```

[ ]:
```
#Let's see the coefficient
coeff_df = pd.DataFrame(lm.coef_,X_test.columns,columns=['Coefficient'])
coeff_df
```

[ ]:
```
     Coefficient
0  229275.224032
1  163592.487140
2  120113.253351
3    3015.847572
4  150556.340296
```

[ ]:
```
# Making predictions using the model
y_pred = lm.predict(X_test)
```

[ ]:
```
mse = mean_squared_error(y_test, y_pred)
r_squared = r2_score(y_test, y_pred)
print('Mean_Squared_Error :' ,mse)
print('r_square_value :',r_squared)
```

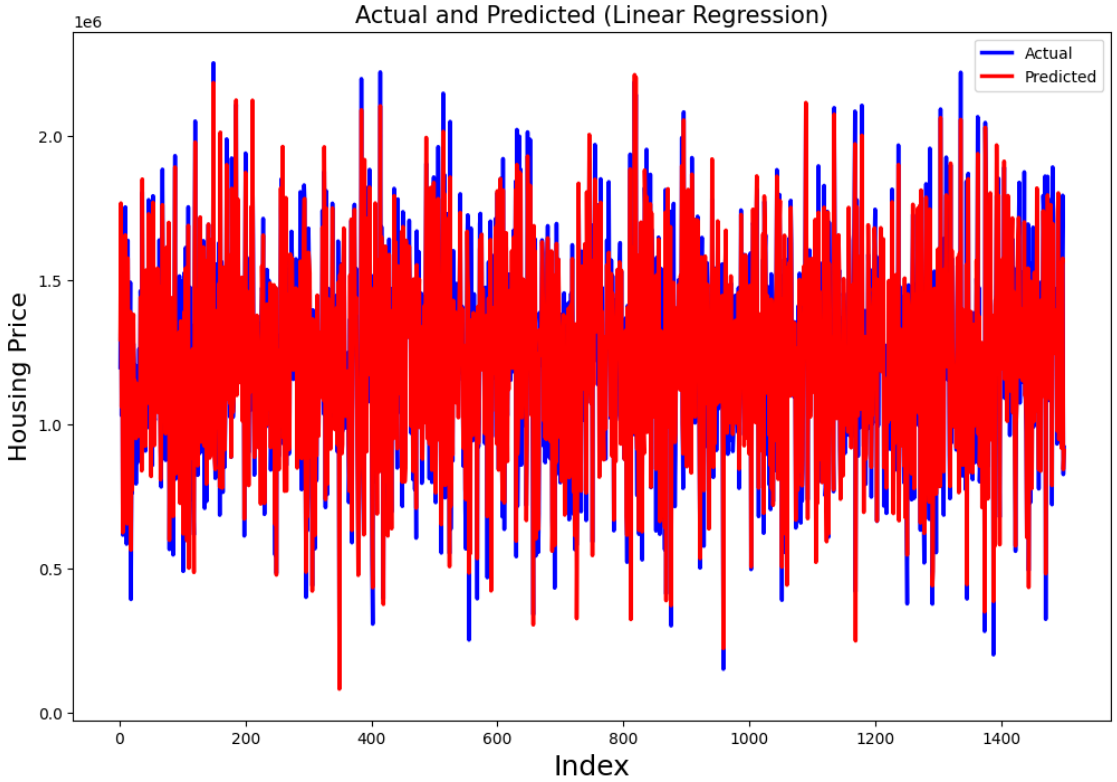
```
Mean_Squared_Error : 9831074697.740438
r_square_value : 0.9199287959786013
```

[ ]:
```
c = [i for i in range(1, 1501, 1)]  # Generating index

plt.figure(figsize=(12, 8))
plt.plot(c, y_test, color="blue", linewidth=2.5, linestyle="-", label="Actual")␣
 ↪ # Plotting Actual
plt.plot(c, y_pred, color="red", linewidth=2.5, linestyle="-",␣
 ↪label="Predicted")  # Plotting predicted

plt.title('Actual and Predicted (Linear Regression)', fontsize=15)  # Plot␣
 ↪heading
plt.xlabel('Index', fontsize=18)  # X-label
plt.ylabel('Housing Price', fontsize=16)
plt.legend(loc="upper right")  # Add a legend

plt.show()
```



[ ]: