California Housing Price Prediction1

December 27, 2022

1 Import required libraries

[39]:
```
import numpy as np
import pandas as pd
from sklearn.preprocessing import LabelEncoder
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error,r2_score
from math import sqrt
import matplotlib.pyplot as plt
from sklearn.tree import DecisionTreeRegressor
from sklearn.ensemble import RandomForestRegressor
```

2 Load The Data

[2]:
```
housing = pd.read_excel("housing.xlsx")
```

3 Print first few rows of this data

[3]:
```
housing.head(5)
```

[3]:

	longitude	latitude	housing_median_age	total_rooms	total_bedrooms	\
0	-122.23	37.88	41	880	129.0	
1	-122.22	37.86	21	7099	1106.0	
2	-122.24	37.85	52	1467	190.0	
3	-122.25	37.85	52	1274	235.0	
4	-122.25	37.85	52	1627	280.0	

	population	households	median_income	ocean_proximity	median_house_value
0	322	126	8.3252	NEAR BAY	452600
1	2401	1138	8.3014	NEAR BAY	358500
2	496	177	7.2574	NEAR BAY	352100
3	558	219	5.6431	NEAR BAY	341300

```
4          565           259          3.8462        NEAR BAY              342200
```

4 Fill the missing values with the mean of the respective column

[4]:
```
housing.isnull().sum()
```

[4]:
```
longitude               0
latitude                0
housing_median_age      0
total_rooms             0
total_bedrooms        207
population              0
households              0
median_income           0
ocean_proximity         0
median_house_value      0
dtype: int64
```

[5]:
```
housing.total_bedrooms = housing.total_bedrooms.fillna(housing.total_bedrooms.
↪mean())
housing.isnull().sum()
```

[5]:
```
longitude             0
latitude              0
housing_median_age    0
total_rooms           0
total_bedrooms        0
population            0
households            0
median_income         0
ocean_proximity       0
median_house_value    0
dtype: int64
```

5 Convert categorical column in the dataset to numerical data

[6]:
```
le = LabelEncoder()
```

[7]:
```
housing['ocean_proximity']=le.fit_transform(housing['ocean_proximity'])
```

6 Standardize training and test datasets

[8]:
```
names = housing.columns
scaler = StandardScaler()
```

[9]:
```
scaled_df = scaler.fit_transform(housing)
scaled_df = pd.DataFrame(scaled_df, columns=names)
scaled_df.head()
```

[9]:

	longitude	latitude	housing_median_age	total_rooms	total_bedrooms	population	households	median_income	ocean_proximity	median_house_value
0	-1.327835	1.052548	0.982143	-0.804819	-0.975228	-0.974429	-0.977033	2.344766	1.291089	2.129631
1	-1.322844	1.043185	-0.607019	2.045890	1.355088	0.861439	1.669961	2.332238	1.291089	1.314156
2	-1.332827	1.038503	1.856182	-0.535746	-0.829732	-0.820777	-0.843637	1.782699	1.291089	1.258693
3	-1.337818	1.038503	1.856182	-0.624215	-0.722399	-0.766028	-0.733781	0.932968	1.291089	1.165100
4	-1.337818	1.038503	1.856182	-0.462404	-0.615066	-0.759847	-0.629157	-0.012881	1.291089	1.172900

7 Extract input (X) and output (Y) data from the dataset

[10]:
```
X_features =␣
↪['longitude','latitude','housing_median_age','total_rooms','total_bedrooms','population','h
                'median_income','ocean_proximity','median_house_value']
X = scaled_df[X_features]
Y = scaled_df['median_house_value']
```

[11]:
```
print(type(X))
```

```
<class 'pandas.core.frame.DataFrame'>
```

[12]:
```
print(type(Y))
```

```
<class 'pandas.core.series.Series'>
```

[13]:
```
print(X.shape)
```

```
(20640, 10)
```

[14]:
```
print(Y.shape)
```

```
(20640,)
```

8 Split the data into 80% training dataset and 20% test dataset

[15]:
```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(X,Y,test_size=0.2,random_state=1)
```

[16]:
```
print (x_train.shape, y_train.shape)
```

```
(16512, 10) (16512,)
```

[17]:
```
print (x_test.shape, y_test.shape)
```

```
(4128, 10) (4128,)
```

9 Perform Linear Regression

[18]:
```
linreg=LinearRegression()
linreg.fit(x_train,y_train)
```

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

[19]:
```
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None, normalize=False)
```

[19]:
```
LinearRegression(normalize=False)
```

[20]:
```
y_predict = linreg.predict(x_test)
```

[21]:
```
print(sqrt(mean_squared_error(y_test,y_predict)))
print((r2_score(y_test,y_predict)))
```

```
2.451652034014511e-15
1.0
```

10 Perform Decision Tree Regression

[31]:
```
dtreg=DecisionTreeRegressor()
dtreg.fit(x_train,y_train)
```

[31]:
```
DecisionTreeRegressor()
```

[36]:
```
DecisionTreeRegressor(criterion='mse', max_depth=None, max_features=None,␣
↪max_leaf_nodes=None, min_impurity_decrease=0.0,
                      min_samples_leaf=1,min_samples_split=2,␣
↪min_weight_fraction_leaf=0.0, random_state=None, splitter='best')
```

[36]:
```
DecisionTreeRegressor(criterion='mse')
```

[37]:
```
y_predict = dtreg.predict(x_test)
print(sqrt(mean_squared_error(y_test,y_predict)))
print((r2_score(y_test,y_predict)))
```

```
0.0008269657636350467
0.9999993057735597
```

11 Perform Random Forest Regression

[40]:
```
rfreg=RandomForestRegressor()
rfreg.fit(x_train,y_train)
```

[40]:
```
RandomForestRegressor()
```

[44]:
```
RandomForestRegressor(bootstrap=True, criterion='mse', max_depth=None,
                      max_features='auto', max_leaf_nodes=None,␣
↪min_samples_leaf=1, min_samples_split=2,
                      min_weight_fraction_leaf=0.0, n_estimators=10,␣
↪n_jobs=None, oob_score=False, random_state=None,
                      verbose=0, warm_start=False)
```

[44]:
```
RandomForestRegressor(criterion='mse', n_estimators=10)
```

[45]:
```
y_predict = rfreg.predict(x_test)
print(sqrt(mean_squared_error(y_test,y_predict)))
print((r2_score(y_test,y_predict)))
```

```
0.0005130424176834727
0.9999997328023483
```

12 Extract just the median_income column from the independent variables

[22]:
```
x_train_Income=x_train[['median_income']]
x_test_Income=x_test[['median_income']]
```

[23]:
```
print(x_train_Income.shape)
print(y_train.shape)
```

```
(16512, 1)
(16512,)
```

13 Perform Linear Regression to predict housing values based on median_income

[24]:
```
linreg=LinearRegression()
linreg.fit(x_train_Income,y_train)
y_predict = linreg.predict(x_test_Income)
```

14 Predict output for test dataset using the fitted model

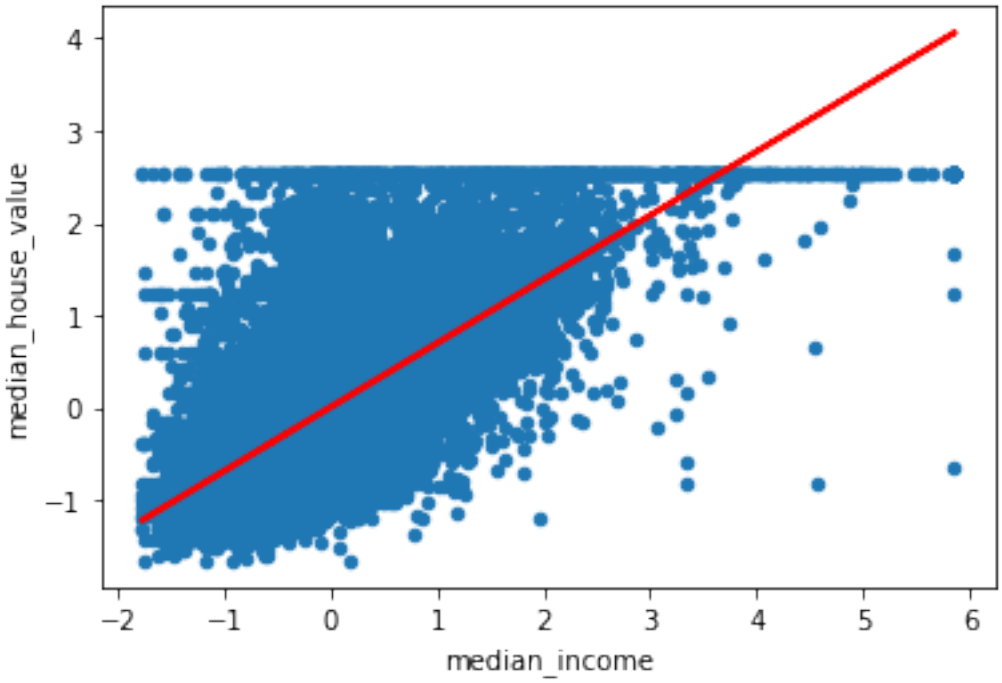
[25]:
```
print(linreg.intercept_, linreg.coef_)
print(sqrt(mean_squared_error(y_test,y_predict)))
print((r2_score(y_test,y_predict)))
```

```
0.005623019866893164 [0.69238221]
0.7212595914243148
0.47190835934467734
```

15 Plot the fitted model for training data as well as for test data to check if the fitted model satisfies the test data

[28]:
```
scaled_df.plot(kind='scatter',x='median_income',y='median_house_value')
plt.plot(x_test_Income,y_predict,c='red',linewidth=2)
```

[28]:
```
[<matplotlib.lines.Line2D at 0x7f63ae7ab190>]
```


median_house_value
median_income
4
3
2
1
0
−1
−2
−1
0
1
2
3
4
5
6

[ ]: