```
# Importing Libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt

# Importing Data
from sklearn.datasets import load_boston
boston = load_boston()
```

```
boston.data.shape
```

```
(506, 13)
```

```
boston.feature_names
```

```
array(['CRIM', 'ZN', 'INDUS', 'CHAS', 'NOX', 'RM', 'AGE', 'DIS', 'RAD',
       'TAX', 'PTRATIO', 'B', 'LSTAT'], dtype='<U7')
```

```
print("\nConverting data from nd-array to data frame and adding feature names to the data\
data = pd.DataFrame(boston.data)
data.columns = boston.feature_names

data.head(10)
```

```
Converting data from nd-array to data frame and adding feature names to the data
```

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B
0	0.00632	18.0	2.31	0.0	0.538	6.575	65.2	4.0900	1.0	296.0	15.3	396.90
1	0.02731	0.0	7.07	0.0	0.469	6.421	78.9	4.9671	2.0	242.0	17.8	396.90
2	0.02729	0.0	7.07	0.0	0.469	7.185	61.1	4.9671	2.0	242.0	17.8	392.83
3	0.03237	0.0	2.18	0.0	0.458	6.998	45.8	6.0622	3.0	222.0	18.7	394.63
4	0.06905	0.0	2.18	0.0	0.458	7.147	54.2	6.0622	3.0	222.0	18.7	396.90
5	0.02985	0.0	2.18	0.0	0.458	6.430	58.7	6.0622	3.0	222.0	18.7	394.12
6	0.08829	12.5	7.87	0.0	0.524	6.012	66.6	5.5605	5.0	311.0	15.2	395.60
7	0.14455	12.5	7.87	0.0	0.524	6.172	96.1	5.9505	5.0	311.0	15.2	396.90
8	0.21124	12.5	7.87	0.0	0.524	5.631	100.0	6.0821	5.0	311.0	15.2	386.63
9	0.17004	12.5	7.87	0.0	0.524	6.004	85.9	6.5921	5.0	311.0	15.2	386.71

```
print("\n\nAdding 'Price' (target) column to the data\n ")
boston.target.shape
data['Price'] = boston.target
data.head()
```

Adding 'Price' (target) column to the data

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B	I
0	0.00632	18.0	2.31	0.0	0.538	6.575	65.2	4.0900	1.0	296.0	15.3	396.90	
1	0.02731	0.0	7.07	0.0	0.469	6.421	78.9	4.9671	2.0	242.0	17.8	396.90	
2	0.02729	0.0	7.07	0.0	0.469	7.185	61.1	4.9671	2.0	242.0	17.8	392.83	
3	0.03237	0.0	2.18	0.0	0.458	6.998	45.8	6.0622	3.0	222.0	18.7	394.63	
4	0.06905	0.0	2.18	0.0	0.458	7.147	54.2	6.0622	3.0	222.0	18.7	396.90	

```
print("\n\nDescription of Boston dataset \n ")
data.describe()
```

Description of Boston dataset

	CRIM	ZN	INDUS	CHAS	NOX	RM	AG
count	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000	506.0000
mean	3.613524	11.363636	11.136779	0.069170	0.554695	6.284634	68.5749
std	8.601545	23.322453	6.860353	0.253994	0.115878	0.702617	28.1488
min	0.006320	0.000000	0.460000	0.000000	0.385000	3.561000	2.9000
25%	0.082045	0.000000	5.190000	0.000000	0.449000	5.885500	45.0250
50%	0.256510	0.000000	9.690000	0.000000	0.538000	6.208500	77.5000
75%	3.677083	12.500000	18.100000	0.000000	0.624000	6.623500	94.0750
max	88.976200	100.000000	27.740000	1.000000	0.871000	8.780000	100.0000

```
print("\n\nInfo of Boston Dataset \n ")
data.info()
```

Info of Boston Dataset

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 506 entries, 0 to 505
Data columns (total 14 columns):
 #   Column   Non-Null Count  Dtype
---  ------   --------------  -----
 0   CRIM     506 non-null    float64
 1   ZN       506 non-null    float64
```

```
 2   INDUS    506 non-null    float64
 3   CHAS     506 non-null    float64
 4   NOX      506 non-null    float64
 5   RM       506 non-null    float64
 6   AGE      506 non-null    float64
 7   DIS      506 non-null    float64
 8   RAD      506 non-null    float64
 9   TAX      506 non-null    float64
 10  PTRATIO  506 non-null    float64
 11  B        506 non-null    float64
 12  LSTAT    506 non-null    float64
 13  Price    506 non-null    float64
dtypes: float64(14)
memory usage: 55.5 KB
```

```
print("\n\nGetting input and output data and further splitting data to training and testin
# Input Data
x = boston.data
# Output Data
y = boston.target

# splitting data to training and testing dataset.
#from sklearn.cross_validation import train_test_split
#the submodule cross_validation is renamed and reprecated to model_selection
from sklearn.model_selection import train_test_split

xtrain, xtest, ytrain, ytest = train_test_split(x, y, test_size =0.2, random_state = 0)

print("xtrain shape : ", xtrain.shape)
print("xtest shape : ", xtest.shape)
print("ytrain shape : ", ytrain.shape)
print("ytest shape : ", ytest.shape)
```

```
Getting input and output data and further splitting data to training and testing data

xtrain shape :  (404, 13)
xtest shape :  (102, 13)
ytrain shape :  (404,)
ytest shape :  (102,)
```

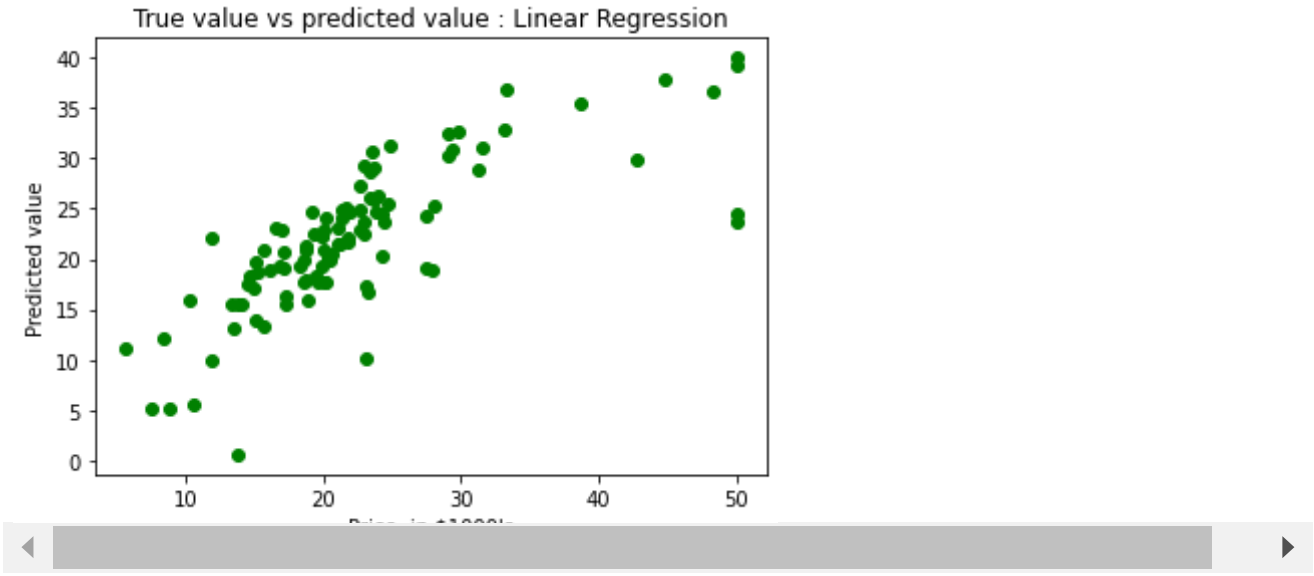
```
#Applying Linear Regression Model to the dataset and predicting the prices
# Fitting Multi Linear regression model to training model
from sklearn.linear_model import LinearRegression
regressor = LinearRegression()
regressor.fit(xtrain, ytrain)

# predicting the test set results
y_pred = regressor.predict(xtest)


print("\n\nPlotting Scatter graph to show the prediction results – 'ytrue' value vs 'y_pre
# Plotting Scatter graph to show the prediction
# results - 'ytrue' value vs 'y_pred' value
```

```
plt.scatter(ytest, y_pred, c = 'green')
plt.xlabel("Price: in $1000's")
plt.ylabel("Predicted value")
plt.title("True value vs predicted value : Linear Regression")
plt.show()
```

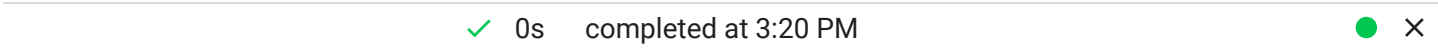
Plotting Scatter graph to show the prediction results – ‘ytrue’ value vs ‘y_pred’ val




```
print("\n\nResults of Linear Regression i.e. Mean Squared Error. \n ")
# Results of Linear Regression.
from sklearn.metrics import mean_squared_error
mse = mean_squared_error(ytest, y_pred)
print("Mean Square Error : ", mse)
```

Results of Linear Regression i.e. Mean Squared Error.

Mean Square Error : 33.448979997676496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